DOCUMENT RESUME

ED 229 374 SP 022 268

AUTHOR Houtkooper, Linda; And Others
TITLE Sports Nutrition.
INSTITUTION Arizona State Dept. of Education, Phoenix.; Arizona Univ., Tucson. Dept. of Nutrition and Food Service.
SPONS AGENCY Department of Agriculture, Washington, D.C.
PUB DATE Nov 82
NOTE 264p.; Some appendices may not reproduce well due to the type size.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC11 Plus Postage.
DESCRIPTORS Athletes; Athletic Coaches; *Athletics; Eating Habits; Elementary Secondary Education; Exercise Physiology; Foods Instruction; Health Education; *Health Needs; Human Body; *Needs Assessment; *Nutrition Instruction; Physical Education; *Physical Fitness

ABSTRACT

This kit provides coaches, physical education teachers, and health professionals with current nutrition information and guidelines for applying that information in classes and athletic training programs. The kit contains four components. A "Key Terms" section provides an index to nutrition-fitness terminology and concepts. The instructional materials section contains information on: (1) sports-nutrition essentials; (2) fitness assessment and conditioning; (3) nutrition and athletic performance; and (4) nutrition-fitness assessment skills training. A directory provides information on how to obtain nutrition and fitness education materials, audiovisual aids, and nutrition-fitness assessment tools. The reference section lists resources used to develop the kit. Additional reference information is appended, including suggestions for classroom activities; sample high-carbohydrate daily food game-plans; a chart of recommended dietary allowances (RDA) for adolescents; a Cooperative Extension Service (Arizona University, College of Agriculture) publication on nutrition and fitness; tables containing the nutritive value of foods; and a sports-nutrition posttest, with answer key.

SPORTS NUTRITION

Developed By
Department of Nutrition & Food Science
University of Arizona
Tucson, Arizona

Arizona Department of Education, November 1982
Carolyn Warner, Superintendent
Dr. Jim Hartgraves, Deputy Superintendent
Dr. Ray Ryan, Deputy Superintendent

ARIZONA DEPARTMENT OF EDUCATION

Carolyn Warner, Superintendent

Dr. Jim Hartgraves — Deputy Superintendents — Dr. Ray Ryan

Education Services	General Operations	Vocational Education
Dr. Thomas R. Reno	James J. Brunstein	Dr. Ray D. Ryan
Associate Superintendent	Associate Superintendent	Deputy Superintendent

STATE BOARD OF EDUCATION

STATE BOARD OF VOCATIONAL EDUCATION

ARIZONA STATE BOARD OF EDUCATION

Dr. George N. Smith	President
Julieta Bencomo	Vice-President
Honorable Carolyn Warner	Executive Officer
Eddie Basha	Member
George Evans	Member
Geraldine Hernbrode	Member
Dr. Eugene M. Hughes	Member
Dr. Don McIntyre	Member
Honorable David Silva	Member

The contents of this publication were developed under a grant from the U. S. Department of Agriculture. However, these contents do not necessarily represent the policy of that agency, and you should not assume endorsement by the Federal Government.
[20 U.S.C. 1221e-3(a)(1)]

Printed by the
Arizona Department of Education
Phoenix, Arizona
Total Copies Printed · 300
Total Printing Cost · $2,226.00
Unit Printing Cost · $7.42
Date of Printing · 11/82

INTRODUCTION

Athletes and fitness buffs make special demands of their bodies. The starting point for meeting those demands is sound nutrition knowledge and practices combined with optimal physical training programs and adequate rest.

The Sports-Nutrition Kit provides coaches, physical education teachers and health professionals with current nutrition information and guidelines for applying that information in classes and athlete training programs.

The Sports-Nutrition Kit contains four components:

KEY TERMS

INSTRUCTIONAL MATERIALS

- A - Sports-Nutrition Essentials
- B - Fitness Assessment and Conditioning
- C - Nutrition and Athletic Performance
- D - Nutrition-Fitness Assessment Skills Training
- Eater's Guide Poster
- Fitness Guide Poster

REFERENCES

APPENDIX

- Instructional Aids Directory
- Suggested Class Activities
- High Carbohydrate Daily Food Game Plans
- Recommended Dietary Allowances (RDA)
- Nutrition-Fitness: A Winning Combination
- Alcohol - Ups and Downs
- Vegetarianism
- Nutritive Value of Food - Handbook 72
- Sports-Nutrition Test and Answer Key

The Key Terms section is an index to nutrition-fitness terminology and concepts in the kit. Instructional Materials includes two posters and information on the four topic areas listed above. The Instructional Aids Directory provides information on how to obtain nutrition and fitness education materials, audio-visual aids, and nutrition-fitness assessment tools. The Reference section lists the resources used to develop the kit. The Appendix includes additional reference information listed above.

ACKNOWLEDGEMENTS

This Sports-Nutrition training packet development was funded by a grant from the Arizona Department of Education - Food and Nutrition Division - Nutrition Education and Training Program.

This curriculum development, field test, and evaluation was conducted by the Department of Nutrition and Food Science - College of Agriculture - University of Arizona, Tucson, 85721.

This Sports-Nutrition Curriculum Kit is the culmination of ideas, hard work, and dedication of the entire Sports-Nutrition Project Staff.

Developed by

PROJECT DIRECTOR
Linda Houtkooper, M.S., R.D.

SPORTS-NUTRITION PROJECT STAFF

Sally Bitzinger - Secretary II
Ellen Champagne - Artist
Molly Engle, M.S., R.N. - Evaluation Consultant
Jon Rudy - Research Assistant

PRINCIPAL INVESTIGATORS

Ann Tinsley, Ph.D., R.D., Assistant Professor
Department of Nutrition and Food Science
University of Arizona

June C. Gibbs, M.A., Extension Specialist
Food and Nutrition
Cooperative Extension Service
University of Arizona

SPORTS NUTRITION

Table of Contents

SPORTS NUTRITION

KEY TERMS

The Sports-Nutrition packet contains descriptions and definitions for each of the following words or terms. You will be a winner in the Sports-Nutrition game if you know this key information. Fill in the definition or description next to each word. *(Definitions are on pages listed next to each term.)*

SECTION A - SPORTS-NUTRITION ESSENTIALS

Adenosine triphosphate (ATP) *p. 30-31*

Aerobic energy release *p. 36-37*

Aerobic exercise *p. 34, 36*

Alcohol *p. 167-172*

Amino acid *p. 3, 36, 38*

Anaerobic energy release *p. 34, 36*

Anaerobic exercise *p. 34, 36*

Basal metabolic rate *p. 39*

Body composition *p. 42-43*

Calorie *p. 28*

AAHPERD 4 fitness components measured by the AAHPERD Fitness Tests are listed below. List the name of the test used to measure each component:

Musculo skeletal function/strength - *p. 55-60*

Musculo skeletal function/flexibility - *p. 55-61*

Body composition - *p. 55-62*

SECTION D - NUTRITION-FITNESS ASSESSMENT SKILLS TRAINING

None

A - SPORTS-NUTRITION ESSENTIALS

NUTRIENT ESSENTIALS

To date, research nas shown that there are 40 essential human nutrients. The chart below lists these nutrients. The chart also shows that several other nutrients are currently being studied to find out if they too are essential to our health. The 40 nutrients are classified into six major nutrient groups: WATER, PROTEIN, FATS, CARBOHYDRATE, VITAMINS, MINERALS. Within each major nutrient group, there are subgroups to identify the various forms of each major nutrient.

1 water

1 carbohydrate (sugar, starches, cellulose or fiber)

9 protein / 9 essential amino acids

histidine	lysine	threonine
isoleucine	methionine	tryptophan
leucine	phenylalanine	valine

1 fat / 1 essential fatty acid:

linoleic acid

13 vitamins / 4 fat-soluble

A--D--E--K

9 water-soluble

B_1 (thiamin)	B_6 (pyridoxine)	biotin
B_2 (riboflavin)	B_{12}	pantothenic acid
B_3 (niacin)	folacin	C (ascorbic acid)

15 minerals / 6 major

calcium	sodium	} electrolytes
phosphorus	potassium	
magnesium	chloride	

9 trace

iron	copper	chromium
zinc	manganese	selenium
iodine	fluoride	molybdenum

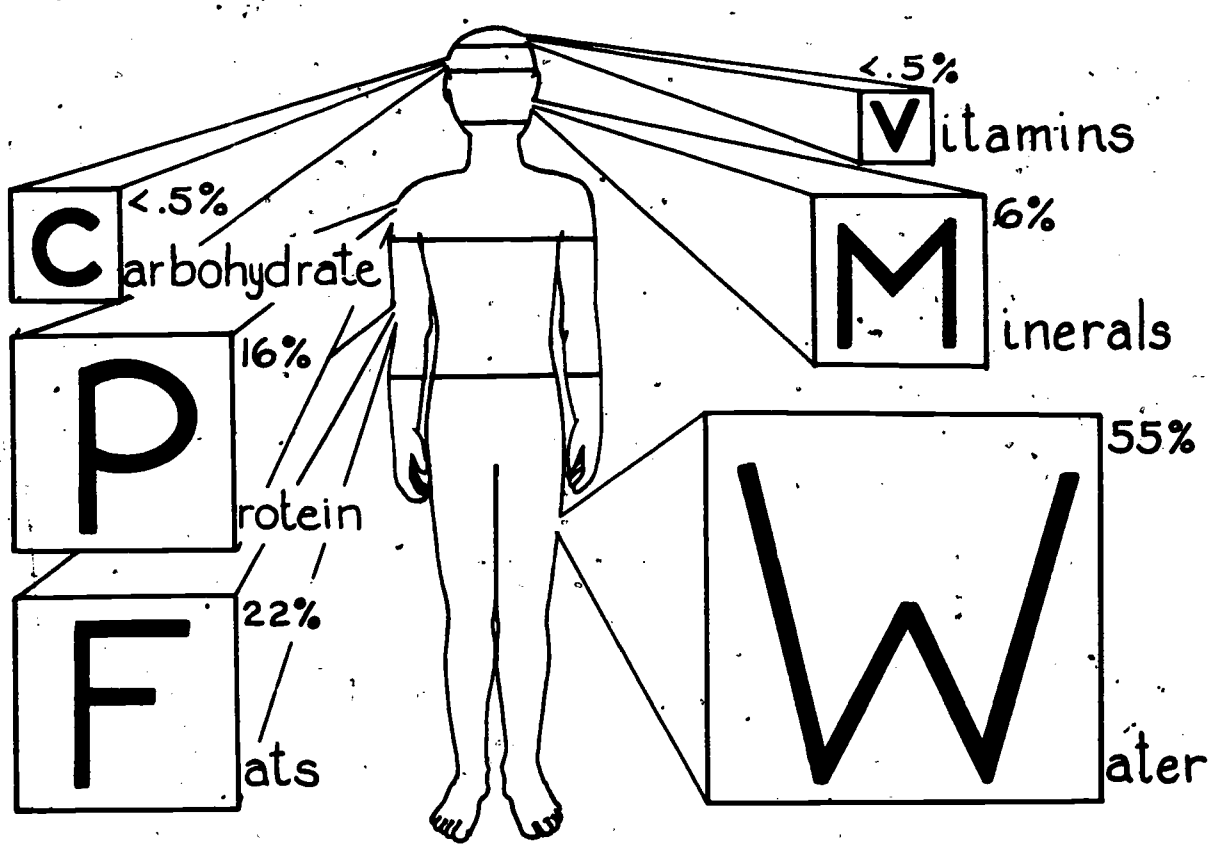
40 TOTAL

other substances which are presently being studied to determine possible human requirements are:

aluminum	choline	strontium
arsenic	cobalt	sulfur
boron	nickel	titanium
cadmium	silicon	tin
		vanadium

By eating a variety of foods within the "4-4-3-2-?" food plan, you will get the essential nutrients required by the body to maintain good health.

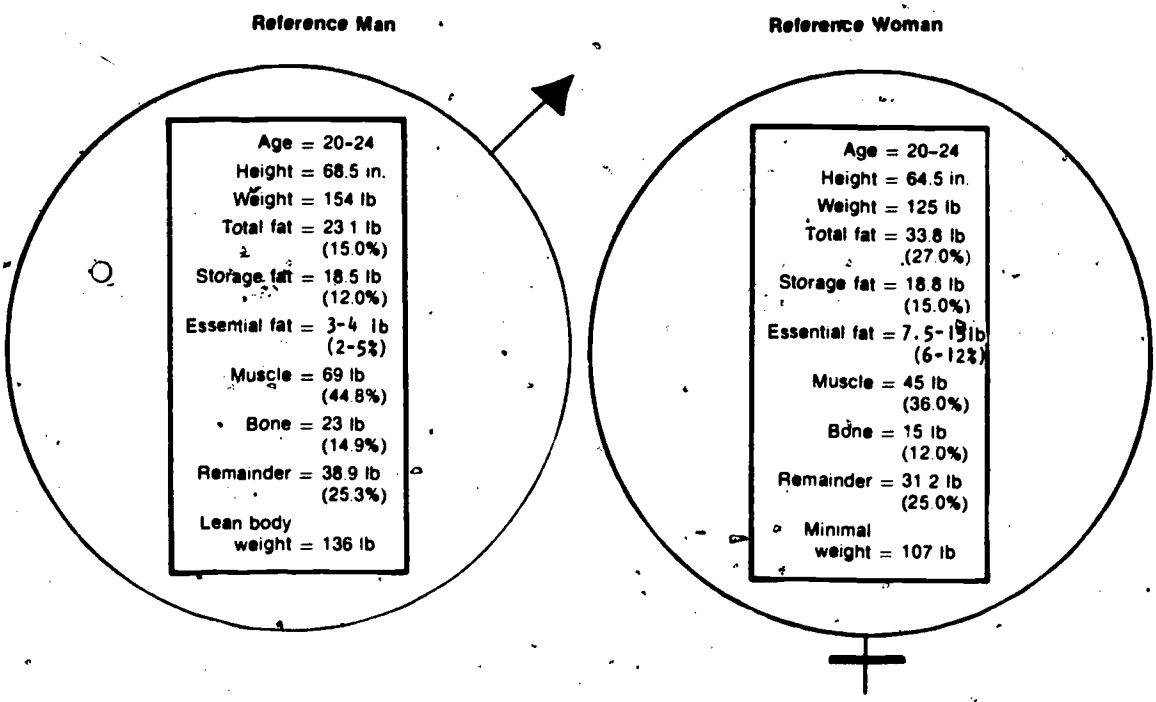
BODY COMPOSITION



The body is made of six major nutrient groups: *Fats, Carbohydrates, Protein, Minerals, Vitamins* and *Water*. Since all bodies are made of the same things, why are they shaped so differently? Body composition, that is the percent of body weight that is formed by each nutrient, is affected by genetics, nutritional status, age, sex, and physical fitness level. The drawing above shows the average percentage of body weight formed by each nutrient group in a typical human.

With increasing age, the percent body fat typically increases and body water decreases. Males usually have lower percent body fat than females. The percent body fat of athletes also varies among sports. Physically fit people usually have a lower percent body fat than unfit folks. What people eat and their exercise level can affect their nutritional status, body composition, fitness level and athletic performance. Many methods are used to estimate body composition. These methods include measuring height, weight, skinfolds, body parts circumferences and hydrostatic weighing.

BEHNKE'S THEORETICAL MODEL FOR A REFERENCE MAN AND WOMAN.



Behnke's theoretical model for a reference man and woman. The mean values for 13 circumference measures and 8 skeletal diameters, including proportionality constants for the reference man and woman and comparisons with various groups, are presented in the Behnke and Wilmore monograph.

Source: McArdle, W.D. and Katch, F. I., Katch, V.L. Exercise Physiology, Lea and Febiger, Philadelphia, 1981.

The above illustration shows the body composition differences in percentage body weight made from fat, muscle, bone and other tissues for a reference man and woman. Water, protein, fat, minerals and vitamins form parts of every body cell. Fat is also stored in the adipose or fat tissue. Carbohydrate is stored in the muscles or liver in a form called *glycogen*.

The idea body composition means the right balance of all nutrients in the body. Inadequate or excessive amounts of any nutrient can lead to malnutrition.

The following chart summarizes the typical ranges of percent body fat for males and females.

BODY FAT	MALE	FEMALE
Essential	2-5%	6-12%
Average	12-17%	19-25%
Borderline Obese	18-24%	26-30%
Obese	25%+	30%+
Athletes	4-18%	6-30%

Malnutrition means *bad nutrition* due to either a deficiency or excesses of essential body nutrients. For example, excessive consumption of energy nutrients can lead to obesity. Obesity is defined as being overfat. Overweight is defined as exceeding the maximum weight for sex, height, and frame size listed in standard tables. However, standard tables represent only average data for the population as a whole and don't consider body composition. There are many people who are overweight on the basis of comparison to standard height-weight tables, yet they have a normal or lower than normal amount of body fat. Thus, they are *overweight*, but *not obese* (over fat). Many athletes tend to fall into this group as a result of their heavy bones and large muscle mass. Others who are not physically fit fall within the standard range of weights for their sex, height, and frame size, yet have more than a normal amount of body fat. These people are obese, yet of *normal* weight. Thus it is important to be aware of individual body composition and not be overly concerned with whether a person is overweight, underweight, or normal weight.

The following is a standard height-weight table.

STANDARD HEIGHT-WEIGHT TABLE DERIVED FROM LIFE INSURANCE STATISTICS

Desirable weights for women aged 25 and over

Height with Shoes 2-inch Heels Feet	Inches	Small Frame	Medium Frame	Large Frame
4	10	92- 98	96-107	104-119
4	11	94-101	98-110	106-122
5	0	96-104	101-113	109-125
5	1	99-107	104-116	112-128
5	2	102-110	107-119	115-131
5	3	105-113	110-122	118-134
5	4	108-116	113-126	121-138
5	5	111-119	116-130	125-142
5	6	114-123	120-134	129-146
5	7	118-127	124-138	133-150
5	8	122-131	128-143	137-154
5	9	126-135	132-147	141-158
5	10	130-140	136-151	145-163
5	11	134-144	140-155	149-168
6	0	138-148	144-159	153-173

For nude weight, deduct 2 to 4 lbs.
Prepared by Metropolitan Life Insurance Company. Derived primarily from data of the Build and Blood Pressure Study, 1959, Society of Actuaries.

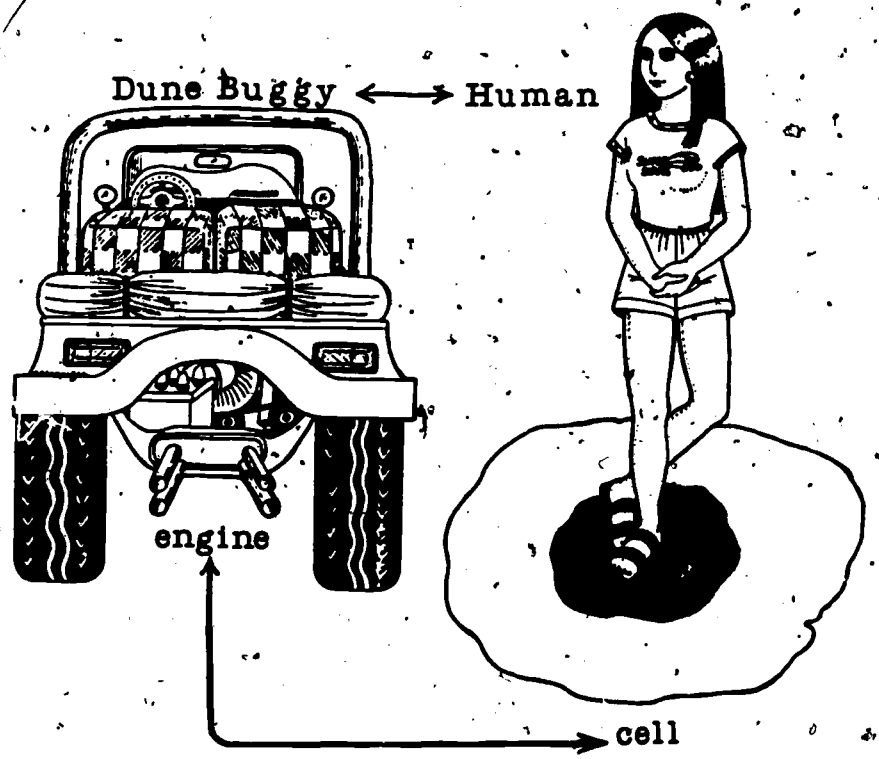
Desirable weights for men aged 25 and over

Height with Shoes 1-inch Heels Feet	Inches	Small Frame	Medium Frame	Large Frame
5	2	112-120	118-129	126-141
5	3	115-123	121-133	129-144
5	4	118-126	124-136	132-148
5	5	121-129	127-139	135-152
5	6	124-133	130-143	138-156
5	7	128-137	134-147	142-161
5	8	132-141	138-152	147-166
5	9	136-145	142-156	151-170
5	10	140-150	146-160	155-174
5	11	144-154	150-165	159-179
6	0	148-158	154-170	164-184
6	1	152-162	158-175	168-189
6	2	156-167	162-180	173-194
6	3	160-171	167-185	178-199
6	4	164-175	172-190	182-204

For nude weight, deduct 5 to 7 lbs.
Prepared by Metropolitan Life Insurance Company. Derived primarily from data of the Build and Blood Pressure Study, 1959, Society of Actuaries.

Although the tables give ideal weights for three different frame sizes, at the time they were published no means of estimating frame size was supplied. A simple rule is to compare the wristbones of several women or several men and to make an arbitrary judgment as to which are small, medium, or large.

FUEL BURNERS

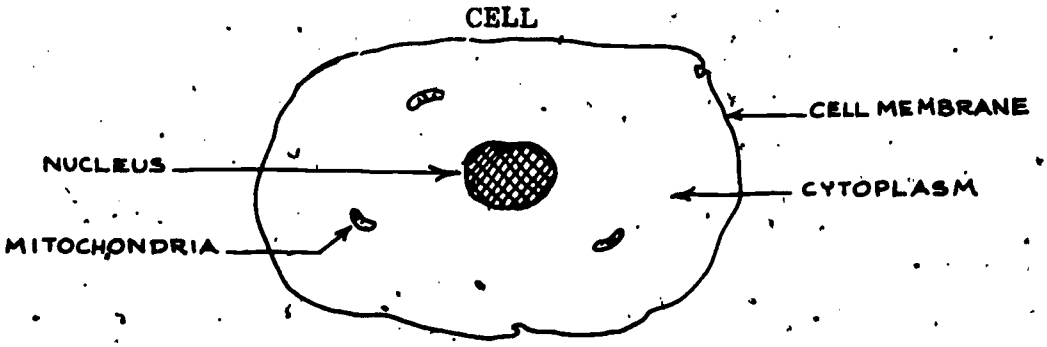


Nutrients form *cells* which in turn form our body composition. Cells are the basic living unit in our body. Just as the engine makes the car run, our cells are tiny engines that keep our body moving. Cells in different parts of the body look different and perform different jobs. Some cells form our skin, bones, nerves, teeth, heart, and other organs just like metal, plastic, and rubber form the parts of an engine in a car.

All cells have some basic parts listed below. The *nucleus* directs the activities of the cell. When a cell divides or uses food, the nucleus controls what happens. The *cell membrane* lets in nutrients from food and helps keep out harmful substances. The cell membrane is made from protein and fat.

Carbohydrate, fat, and protein are the three nutrients that supply body energy. Alcohol also contains energy. This energy is measured in calories. The energy nutrients must be transported in the blood to the cell and through the cell membrane in order for the energy they contain to be released.

The *cytoplasm* is the area where *anerobic* energy release takes place. The *mitochondria* is where *aerobic* energy release takes place.



NUTRIENT SOURCES

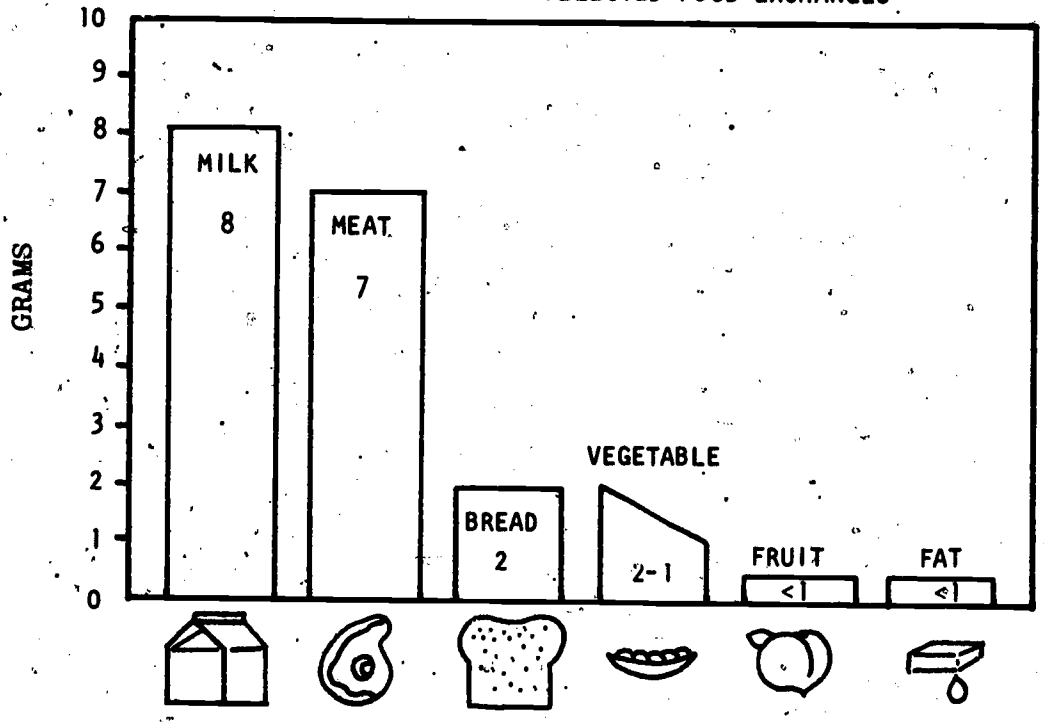
Athletes need increased calories to meet the high-energy demands of conditioning and competition. Athletes can meet the high-energy challenge of sports by increasing food intake. The U.S. Dietary Guidelines provide the latest advice on selecting foods for nourishing, healthy snacks and meals.

The dietary guidelines for athletes' food selection are:

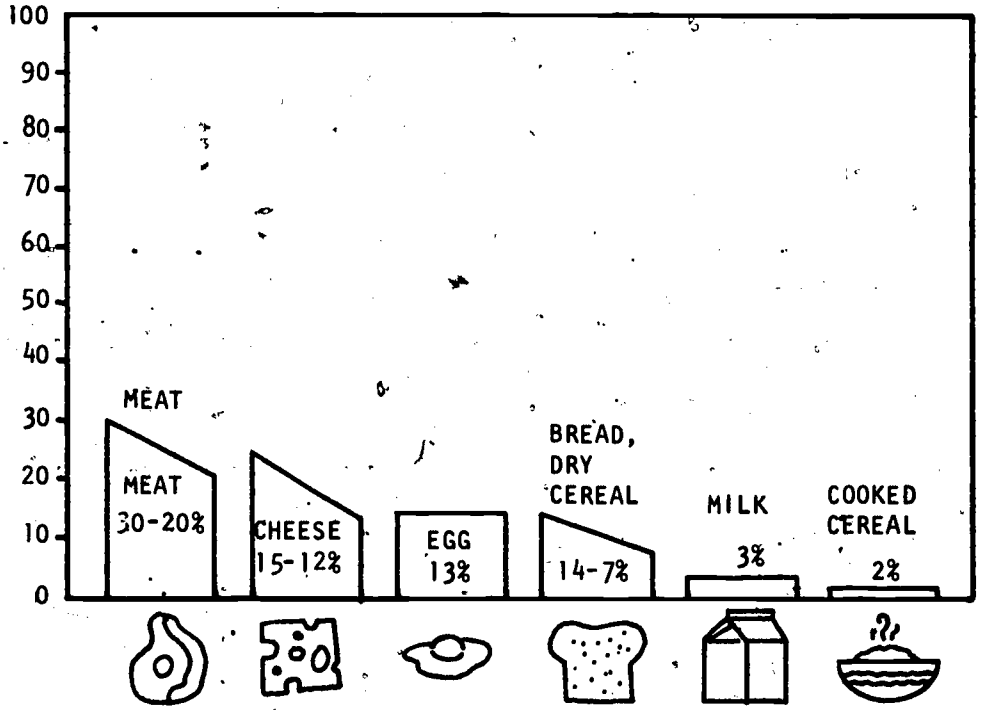
- Eat a variety of foods
- Eat foods with adequate complex carbohydrate (starch and fiber)
- Avoid too much simple carbohydrate (sugars)
- Avoid too much sodium
- Avoid too much fat, saturated fat, and cholesterol

The nutrient content in the foods listed in the charts below illustrates that foods vary greatly in the percentage of major nutrients they contain. Food preparation may change nutrient content. For example, cooked cereals contains a lower percentage of carbohydrate than bread because cooked cereals have a higher water content. Other nutrients are added to or removed from foods during processing and preparation. See page 114 for portion size for each food exchange category.

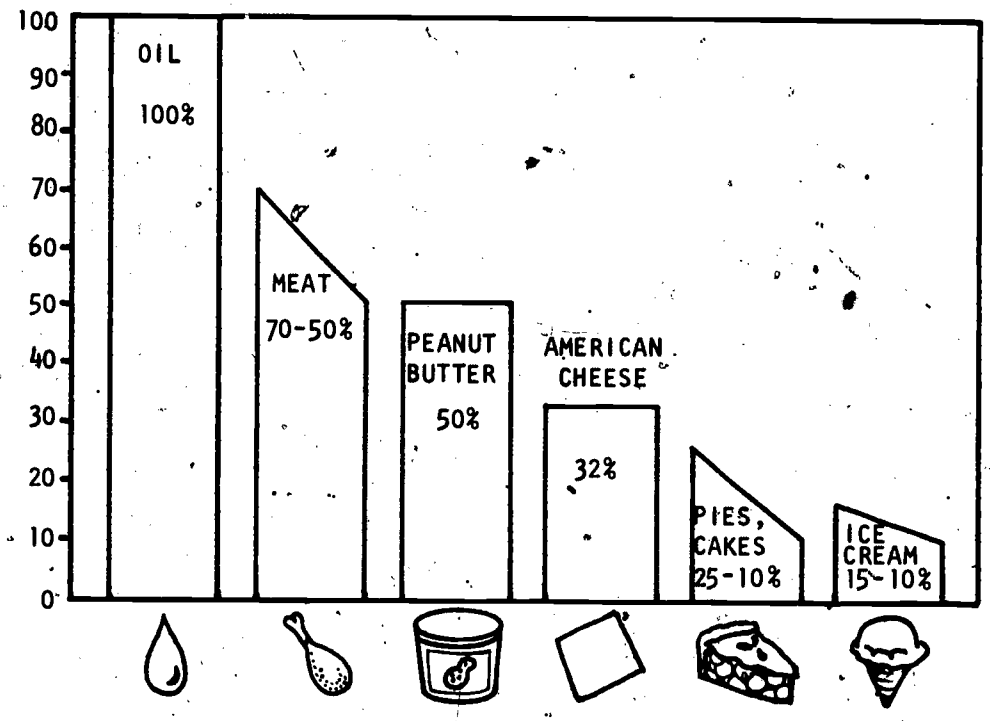
PROTEIN CONTENT OF SELECTED FOOD EXCHANGES



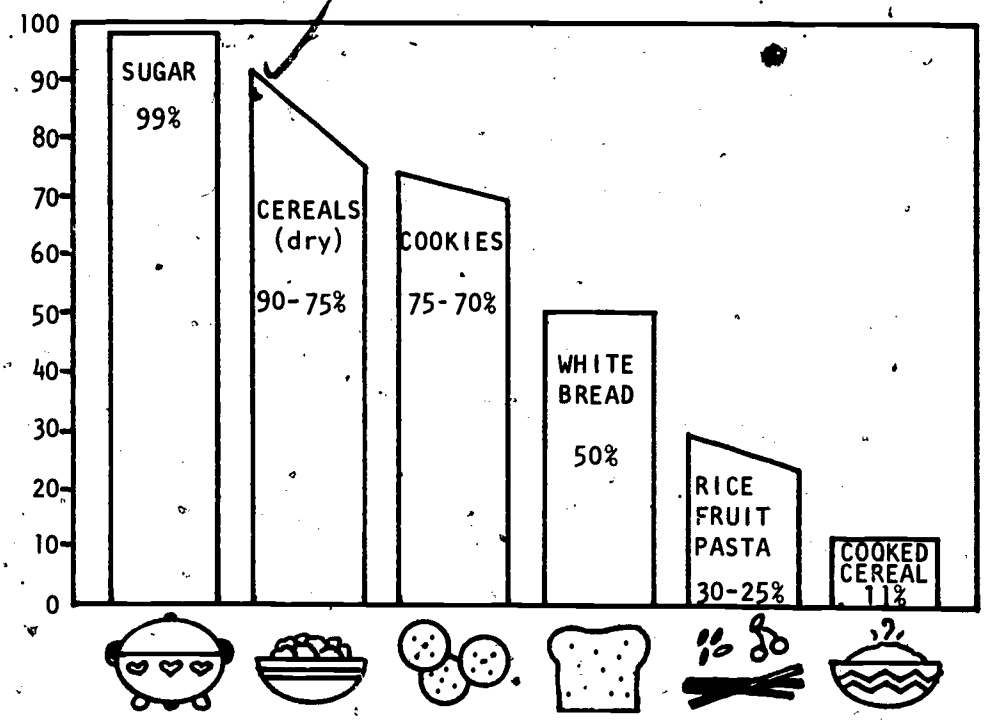
PERCENT PROTEIN CONTENT OF SELECTED FOODS



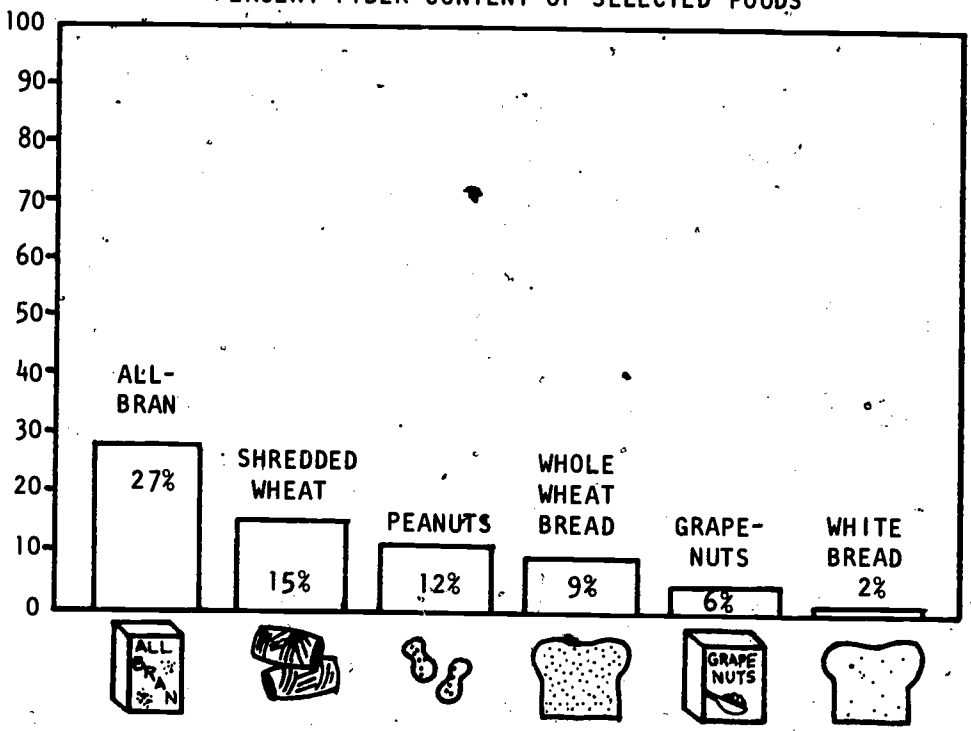
PERCENT FAT CONTENT OF SELECTED FOODS



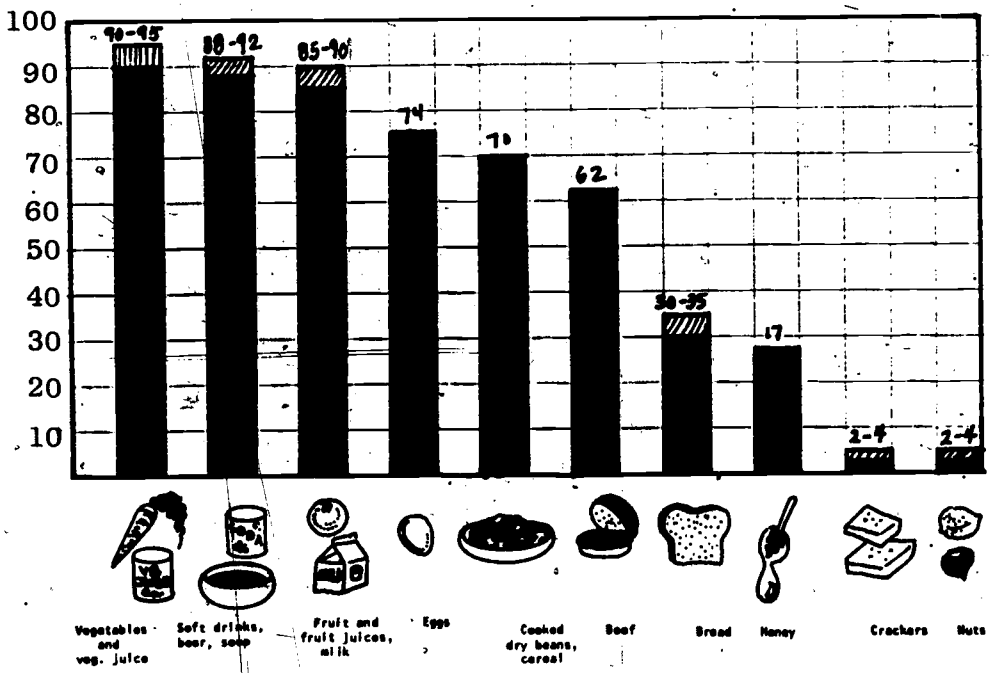
PERCENT TOTAL CARBOHYDRATE CONTENT OF SELECTED FOODS



PERCENT FIBER CONTENT OF SELECTED FOODS



Percent Water Content of Selected Foods



Many foods contain "hidden" nutrients. Cheese, an excellent source of protein, also has a high fat content. Many foods contain "hidden" fat. Two major types of fat are *saturated* and *unsaturated* fat. Unsaturated fats come from plants and are liquid at room temperature. Vegetable oils such as corn, safflower, sunflower, and soybean are examples of unsaturated fats. Saturated fats come from animal sources such as meat, eggs, and dairy products like butter, milk, and cheese. Saturated fats are usually solid at room temperature. Palm oil and coconut oil are saturated fats that are liquid rather than solid.

SODIUM

Sodium is also "hidden" in foods. The Sports-Nutrition Eaters Guide Poster contains a list of high and low sodium foods. The following chart lists sodium content in salt, water, and some medications.

FOOD AND NUTRITION BOARD OF NATIONAL ACADEMY OF SCIENCES	RECOMMENDED DIETARY ALLOWANCE 1100-3300 mg. sodium (½ to 1½ tsp salt)

Salt = sodium (40%) + chloride (60%)

	mg. sodium
1 tsp. salt*	2200.0
1 tsp. Lite Salt*	1100.0
1 tsp. salt substitute*	0.5
1 tsp. baking soda*	1232.0
1 tsp. baking powder*	408.0
1 cup Tucson Water**	10.0
1 tablet Alka-Seltzer***	532.0
1 tsp. Bromo-Seltzer***	480.0
1 tablet Rolaids***	53.0

References:

*Morton Salt, Division of Morton-Nowich Products, Inc. 110 N. Wacker Drive, Chicago, Illinois 60606

**Water & Sewers Department, P.O. Box 27210, 111 E. Pennington Street, Tucson, Arizona 85726

***Water Quality Association. Richard Weickart, Technical Director. Easy-to-Use Guide to Sodium in Food, Medicine, and Water, p. 15

SUGARS

Sugar is also "hidden" in food. Many athletes avoid sucrose or table sugar but use other sweeteners. Sweeteners all contain simple carbohydrates or sugar. Sweeteners or sugars are called many names that include: white sugar, brown sugar, raw sugar, honey, fructose, syrup, glucose, dextrose, lactose, and galactose. All these types of sugars contain calories and some contain very small traces of vitamins and minerals needed to metabolize those calories. For example, an adult would have to eat four cups of brown sugar to meet their RDA for calcium and anyone under 18 would need 6¼ cups to meet their RDA.

SUGAR-HONEY-FRUCTOSE: What's the Difference?

Honey compared to white or brown sugar has only a slightly higher vitamin and mineral content. White sugar and honey both contain simple sugars called glucose and fructose. Fructose must be converted into glucose in the liver before it is used by the body or stored as glycogen. The chart on the next page shows a nutrient comparison of sugars. The chart below lists the "hidden" sugar content of some foods.

Hidden Sugar in Foods

Food	Teaspoons Sugar
Chocolate Bar (average size)	7
Chocolate Fudge (1 1/2" square)	4
Marshmallow (1 average)	1 1/2
Chewing Gum (1 stick)	1/2
Chocolate Cake (1 1/2" square)	15
Doughnut (plain, 3" diameter)	4
Molasses Cookie (3 1/2" diameter)	2
Ice Cream (1/2 cup)	5-6
Apple Pie (1/6 medium pie)	12
Pumpkin Pie (1/6 medium pie)	10
Orange Juice (1/2 cup)	2
Tomato Catsup (1 tablespoon)	1
Sweet Carbonated Beverage (6 ounce)	4 1/3
Chocolate Milk (1 cup)	6
Jelly (1 tablespoon)	3
Maple Syrup (1 tablespoon)	2 1/2
Honey (1 tablespoon)	2 1/2
Peaches (canned, 2 halves, 1 tablespoon syrup)	3 1/2
Prunes (stewed, 4-5 medium, sweetened-2 tablespoons juice)	8
Apricots (dried, 4-6 halves)	4
Raisins (1/4 cup)	4

Source: Tucson General Hospital, Tucson, Arizona, 7/80

NUTRIENT ANALYSIS OF SUGAR

Type of Sugar	Cal	Pro	Fat	CHO	Na+	Calcium	Phosphorus	Iron	Potassium	Vit. A	Thiamin	Riboflavin	Niacin	Vit. C
Brown sugar 1 tbsp	52	0	0	14g	Tr	12mg	3mg	.47mg	47mg	0	.001mg	.004mg	.03mg	0
Fructose 1 tbsp	33	0	0	9g	Tr	Less than 2% of U.S.R.D.A. requirements for vitamins & minerals								
Honey 1 tbsp	65	Tr	0	17g	1mg	1mg	1mg	.1mg	11mg	0	Tr	.01mg	.1mg	0
Light Molasses 1 tbsp	50	-	-	13g	3mg	33mg	9mg	.9mg	183mg	-	.01mg	.01mg	Tr	-
Blackstrap 1 tbsp	43			11g	19mg	137mg	17mg	3.2mg	585mg		.02mg	.04mg	.4mg	-
White sugar 1 tbsp	45	0	0	12g	Tr	0	0	Tr	Tr	0	0	0	0	0

Cal = Calories // Pro = Protein // CHO = Carbohydrates // Na+ = Sodium

Tr = trace

g = gram

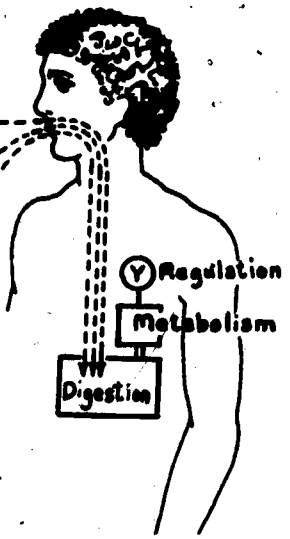
mg = milligram

Source: Nutritive Value of Foods, Home and Garden Bulletin #72 - USDA.

The *Nutritive Value of Foods* tables (p. 181-207) from U.S.D.A. and *Nutrient Analysis of Fast Foods* from Ross Laboratories can be used to check out the nutrient content of foods you like to eat.

FUNCTIONS OF NUTRIENTS

	CALORIES PER GRAM
BODY FUELS	
Carbohydrate	4
Fat	9
Protein	4
(Alcohol)	7
BUILDING MATERIALS	
Protein	4
Fat	9
Minerals	0
Water	0
REGULATORS	
Water	0
Vitamins	0
Minerals	0
(Fiber)	0



The three major functions of nutrients in the body are:

1. Fuel or energy sources
2. Building material
3. Regulate body cell activities.

These functions are essential for *metabolism.* Metabolism is a general term used to describe all the chemical changes that continually occur in the body tissues. For example, carbohydrate, fat and protein are the three nutrients that supply *energy* to *fuel* metabolism. Alcohol also contains energy the body can use for fuel. Water, vitamins and minerals help *regulate* the relase of energy from carbohydrate, fat, protein, or alcohol but they *do not* contain energy. This energy release is called oxidation.

The energy released is used to *build* new tissue cells using water, protein, fat and minerals. Energy can also be used to repair injuries, regulate cell activities, fuel muscle work and heat the body. Energy which is not used for metabolism is stored as fat or lost as heat.

ATHLETE NUTRIENT NEEDS

Exercise and sports place special demands on the body. An athlete may ask, "Is my diet adequate to meet the rigors of fitness training?". A prolonged deficiency or excess of any nutrient will be damaging to performance. Therefore, regular diet analysis may be a way to help keep athletes "eating on the right track" so they can reach their potential.

The Food and Nutrition Board of the National Academy of Sciences/ National Research Council has established Recommended Dietary Allowances (RDA) as a guideline for estimating adequate dietary intake of protein, energy, 10 vitamins, and six minerals. The RDAs are based on available scientific knowledge for adequate levels of essential nutrient intake that will meet the needs of practically all healthy people.

The nutrient requirements for individuals are unknown. Thus, the RDAs are recommendations for *population groups*, not individuals. Because of individual variability, the RDA for each nutrient has a built in margin of safety. The requirements are set high enough to meet the needs of those people with the highest demands. Even though the RDAs are designed for population group dietary nutrient analysis, they are good guides for evaluating the nutritional adequacy of an athlete's diet.

When using the RDA as a nutrient guideline, a coach or athlete should keep in mind that the body can:

1. Conserve essential nutrients when dietary supply is insufficient, and
2. Store some nutrients when daily intake exceeds immediate needs.

Therefore, if the RDA for a nutrient on a particular day is not met, surplus amounts consumed shortly thereafter will usually compensate for the inadequacy.

Special Consideration for Protein Needs

Except for energy, the nutrient requirements for protein, vitamins, and minerals are usually the same for athletes and non-athletes. There is little evidence that muscle activity increases the need for protein except for very small amounts required for muscle development during training. Since the turn of the century, nutritionists have known that protein in excess of the daily requirement does not enhance work performance.

The protein RDA is 0.8 gram of protein per kilogram (kg) body weight. Therefore, the protein RDA for a 70 kg man is 56 grams of protein and for a 55 kg woman is 44 grams of protein.

The adult athlete can easily meet protein needs by an intake of 1 gram of protein/kg of body weight, while the growing athlete may require 1.5 grams of protein/kg of body weight.

Because the American diet is rich in high quality protein and easily exceeds the protein RDA, protein supplementation is unnecessary. The use of protein supplementation can decrease performance by causing (1) dehydration when the body eliminates excess protein metabolic waste products and (2) body fat increases from conversion of protein to fat.

To increase muscle mass, the athlete must consume from a variety of foods an adequate number of calories beyond regular daily needs and increase muscle work. Guidelines for increasing muscle mass are included in the weight control body composition section of this packet.

Athletes who consume a variety of foods that supply the RDA, will receive all the nutrients required for a demanding training program. Eating wholesome, high-nutrient density foods will meet increased calorie needs while simultaneously providing increased amounts of protein, vitamins, and minerals. A high-nutrient density food is one that contains a high ratio of nutrients to calories. This means the food gives you lots of vitamins and minerals along with calories.

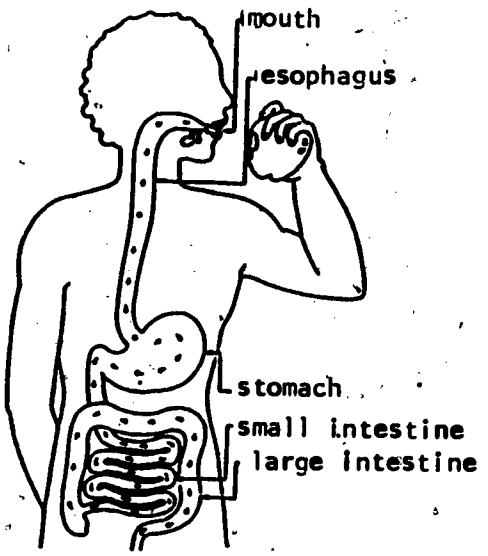
A multivitamin and mineral supplement supplying 100% of the RDA, generally, can be taken once a day, without any harmful effects, as a hedge against vitamin or mineral deficits incurred from frequently skipped meals.

NUTRIENT DELIVERY TO CELLS

Digestion

The digestive tract or *food tube* is where our body starts the conversion of food into nutrients that the body can use. The illustration below outlines the basic anatomy of our food tubes. An understanding of the anatomy will make it easier for you to understand the complex process of digestion.

Neither carrots nor beans nor cherries nor any other food can be used by the body in the form we eat it. Food must be broken down in the digestive tract and dissolved to a liquid state. Then the different nutrients can be absorbed into the blood and lymph and transported to the cells. This process is called *digestion.*



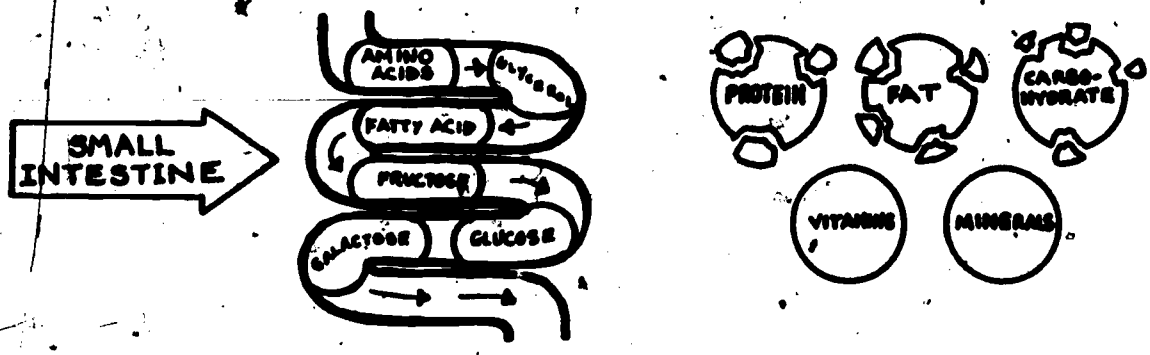
The digestive tract is a series of food processing organs which start at the mouth and ends at the rectum. In the mouth, digestion is primarily mechanical. Chewing grinds food into smaller pieces and moistens them with saliva. While we chew food, the saliva in the mouth begins to chemically change some of the complex carbohydrates (*such as starch*) into sugar. When starch is broken down into sugar, we can detect a sweet taste.

When food is swallowed, it passes along into a long tube or the esophagus. A series of ring-like muscles squeeze the food along until it reaches the stomach.

The stomach acts much like a cement mixer. It churns and mixes food with digestive juices (*saliva and acid*). The saliva which mixed with the food in your mouth, continues to work in your stomach to change more carbohydrate into simple sugar. The digestive juice breaks down protein into smaller units called amino acids.

Fats are not digested until they reach the small intestine. Because fats are digested very slowly; they are often called satisfying foods and delay that empty feeling in the stomach.

Meat, milk, and bread proteins are only partially digested as they move into the small intestine, so the small intestine must split the protein, fat, and carbohydrate into their smallest units.

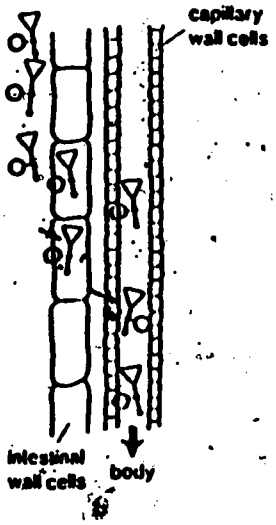


You would not recognize your food now! Your body has turned it into a liquid that contains *AMINO ACIDS* from the PROTEINS, *FATTY ACIDS*, and *GLYCEROL* from FATS, and *SIMPLE SUGARS, FRUCTOSE, GLUCOSE, AND GALACTOSE* from CARBOHYDRATE.

The nutrients from digested food must pass through the intestinal wall before they can be used by the body. Breakdown products of carbohydrate, protein, and fat travel through the wall into the blood or lymph system to all parts of the body.

What about vitamins and minerals? They do not have to be changed much by the body. As the other nutrients are broken down in the digestive tract, the vitamins

and minerals dissolve and also travel through the intestinal wall. The fat-soluble vitamins (*A, D, E, and K*) are usually absorbed with fat. The water-soluble vitamins (*the B-vitamins and Vitamin C*) and minerals are easily transported through the intestinal wall.



The small intestine is the area in the digestive tract where most nutrients are absorbed. Some nutrients simply pass through the intestinal wall cells into the blood or lymph system. Other nutrients must be carried through the intestinal wall cells by other substances. These two means of absorbtion are called simple diffusion and active transport.

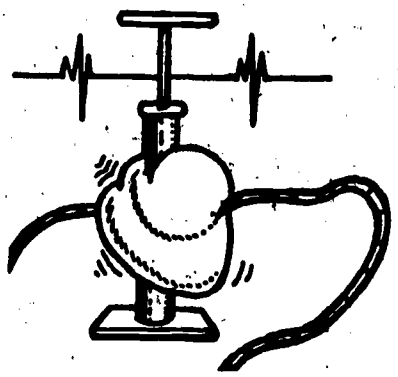
How long does digestion take? The time required for digestion depends on the amount of food you eat and the percentage of that amount which comes from each major nutrient. Carbohydrates are quickly absorbed, followed by protein and then fat. A typical meal composed of a variety of nutrients takes about 3-4 hours to be digested.

What a person thinks or feels can put the workings of the food tube into a real tizzy! Emotions can cause minor stomach problems -- *butterflies in the stomach* -- to burning ulcers. Here is how: fear or anxiety can shut off the flow of pancreatic juice to part of the small intestine and can increase peristalsis. Stomach acid is then dumped into the small intestine at a time when it is unprepared for the acid. The small intestine does not have a thick mucous coating to protect itself against the acid; consequently, the lining of the small intestine wears away leaving an ulcer or hole.

Digestion is a complex process that transforms the nutrients in food to forms which can be absorbed and metabolized by the body. How well the digestion process works is affected by our state of health, diet, and emotions.

Circulation

The oxygen from the air you breathe and the nutrients from the food you eat are transported in the blood to the different cells of your body. This is done by way of the *cardiovascular system*. The cardiovascular system is made up of a set of tubes called *blood vessels* and a pump known as the *heart*. The pumping action of the heart pushes the blood through the blood vessels to the cells. The cells take up the oxygen and nutrients from the blood to make energy needed for all body activities. See illustration on next page.



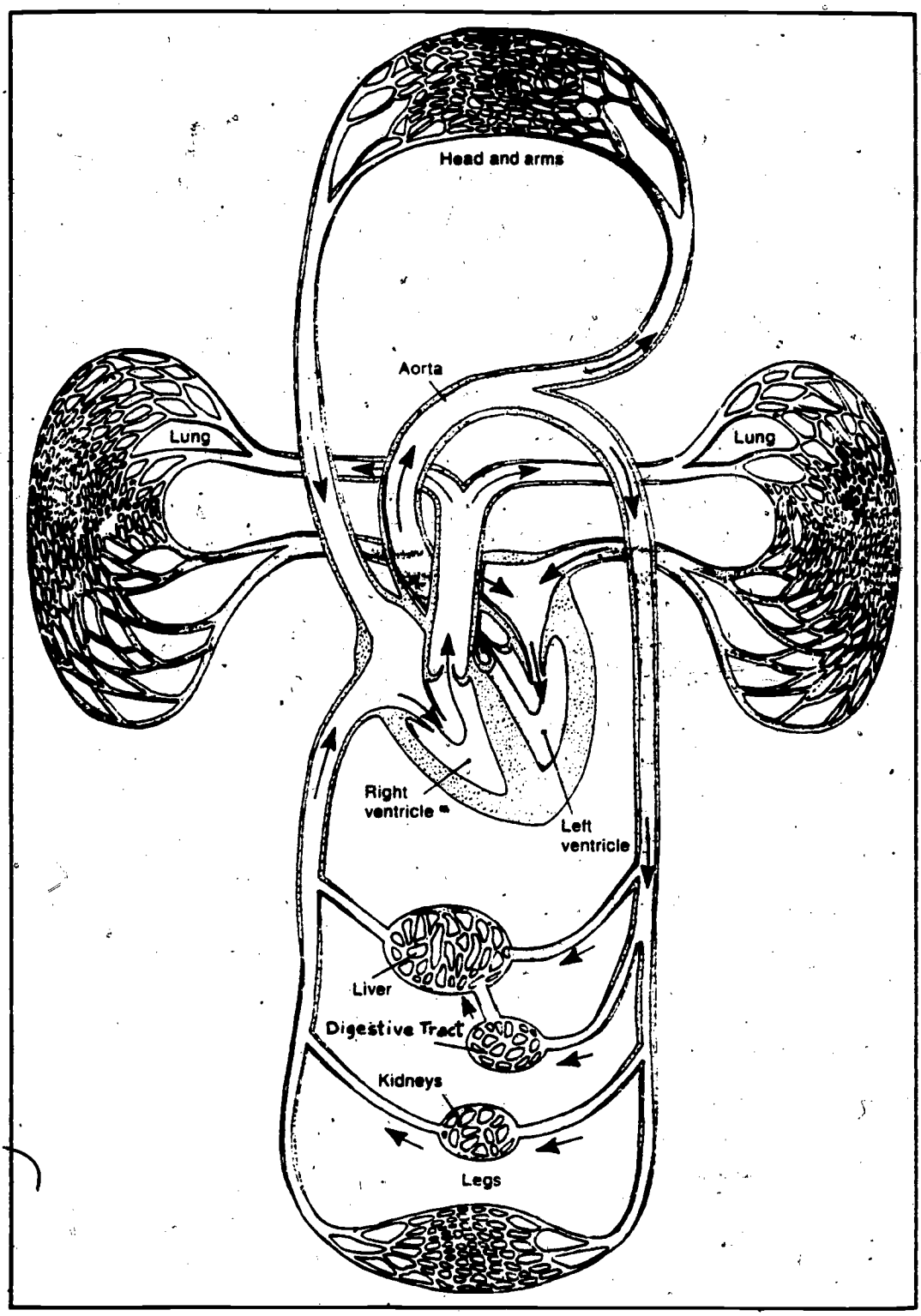
The lymph system is also made up of a set of tubes called lymph vessels. These vessels carry fluid from the digestive tract to the blood. Some of the nutrients from digested food are transported in the fluid and dumped in the blood to be carried to the cells.

The heart is a muscle made up of cells. These cells need energy to keep the heart pumping. Each time the heart pumps, it produces a sound called the heart beat.

The entire blood supply in an adult (*about 6 quarts*) is circulated in about 50 heartbeats, so all the blood of an adult passes through the heart in less than a minute.

Your heart beats several times a minute in order to supply blood to all your cells. When it beats, you can feel the artery in your wrist or neck jump. This is your pulse. By taking your pulse, you can determine how many times your heart beats per minute under a variety of situations. Average resting pulse rate varies with age, sex, and fitness level.

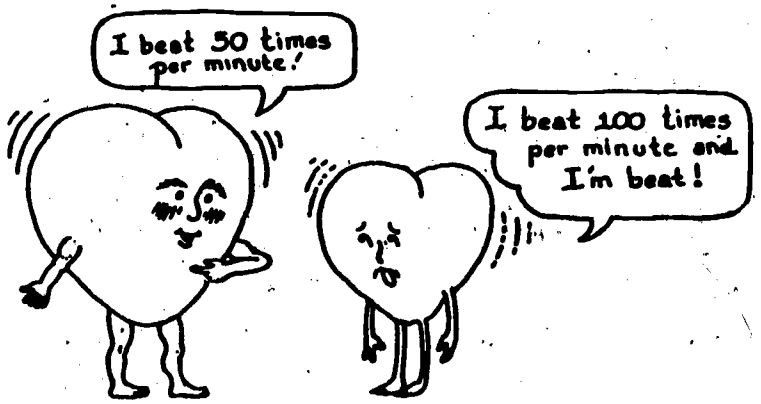
THE CARDIOVASCULAR SYSTEM



Reference: McArdle, W.D., Katch, F.I, and Katch, V.L.; Exercise Physiology, Philadelphia, Lea and Febiger, 1981.

Exercising causes the heart to pump faster in order to supply your cells with enough nutrients. As a result, your pulse rate increases during and shortly after exercising.

Individuals with cardiovascular disease or those physically unfit have weaker heart muscles. They may feel some discomfort (*shortness of breath, chest discomfort or dizziness*) when exercising. This discomfort is due to the stress on a weak heart muscle that has to beat harder and faster to supply enough blood to the working muscle cells. The pulse of people with weak hearts may stay elevated after exercising. They will also have difficulty returning to normal resting pulse rate within 2 minutes. It may take as long as 6 minutes for their pulse rate to return to its normal resting rate.

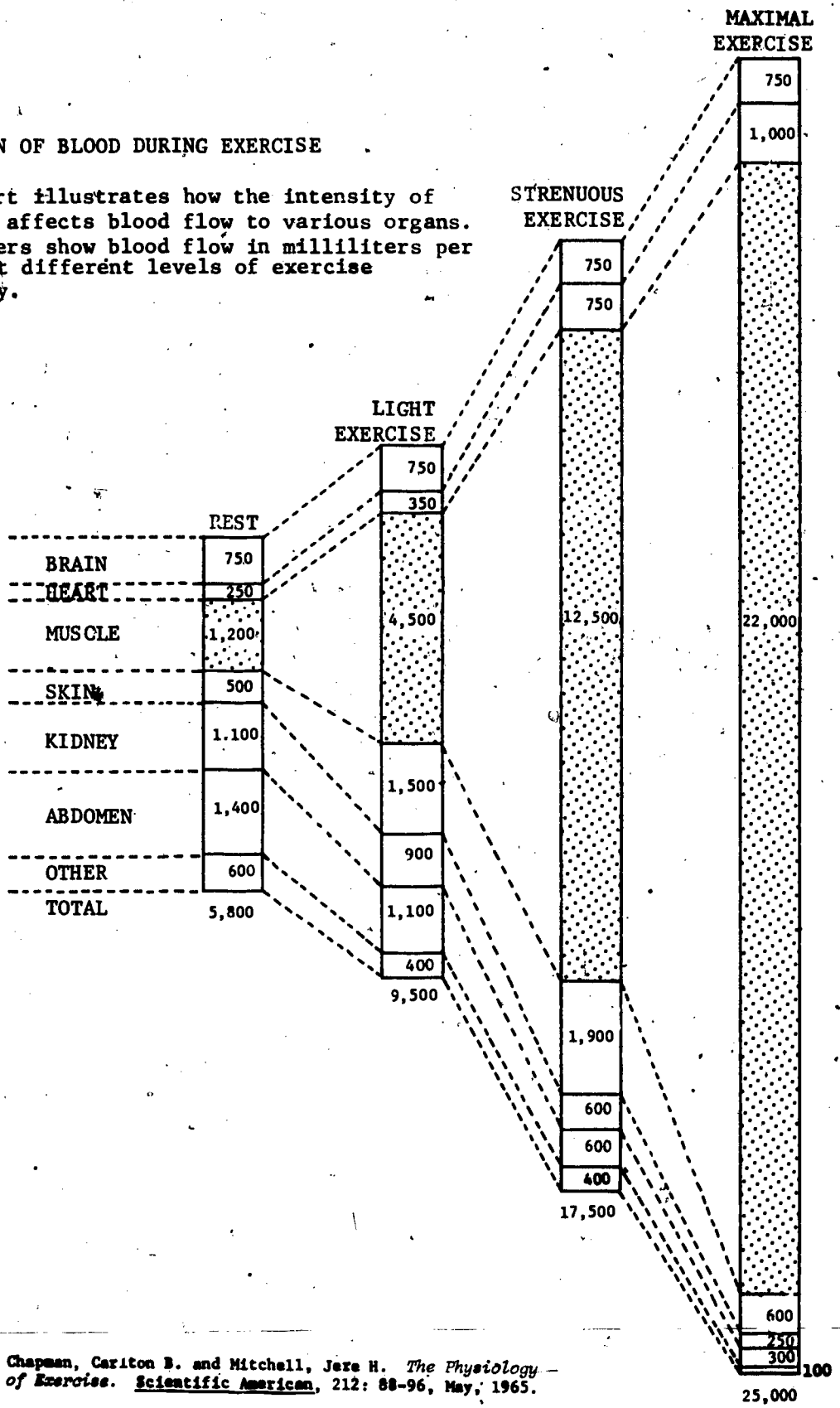


Physically fit individuals have very strong heart muscles and are able to pump more blood per beat. Strong hearts can therefore perform the same amount of work, either at rest or during exercise, with less beats per minute.

Just as the heart muscles require energy to perform work, the intestines contain muscles which require energy to help digest our food. In order to breathe, we need energy to run the muscles that help bring air in and out of the lungs. Energy is also needed to maintain body temperature, fuel the on-going activities of each cell, and send nerve impulses to direct all of the activities just mentioned. These activities are referred to as the basal metabolic processes. These processes maintain life. The rate at which calories are used to support these activities is called the basal metabolic rate (BMR).

DIVERSION OF BLOOD DURING EXERCISE

This chart illustrates how the intensity of exercise affects blood flow to various organs. The numbers show blood flow in milliliters per minute at different levels of exercise intensity.



Adapted from: Chapman, Carlton B. and Mitchell, Jere H. *The Physiology of Exercise.* Scientific American, 212: 88-96, May, 1965.

ENERGY RELEASE IN THE BODY

Energy Stores

The fuel nutrients in food -- carbohydrate, fat and protein -- are digested, absorbed into the body and transported to all body cells. The energy content of foods that contains these nutrients is measured in *calories*. The following chart summarizes the content for each fuel nutrient. Alcohol also contains calories. It's calorie content is also listed in the chart.

CALORIE CONTENT OF FUEL NUTRIENTS AND ALCOHOL

FUEL NUTRIENTS	Calories Per Gram	or	Calories Per Ounce
Fat	9		252
Carbohydrate	4		112
Protein	4		121
ALCOHOL	7		196

The energy nutrients are stored in the body in different ways. The chart below summarizes the storage forms and number of calories from each fuel nutrient in a typical male.

ENERGY STORES FOR AVERAGE 150 POUND MALE

	Calorie Content Per Gm of Nutrient	Stored Calories
FAT (15% of body weight)	9	91,900
CARBOHYDRATE	4	
Glycogen		
Muscle		1,400
Liver		320
Blood Glucose		80
		93,700

Source: McKardle, W.D. and Katch, F.I., Katch, V.L.: Exercise Physiology - Energy, Nutrition, and Human Performance. Lea & Febiger, Philadelphia, 1981.

Felig, P. and J. Wahren. Fuel Homeostasis in Exercise. New England Journal of Medicine, 293: 1079, 1975.

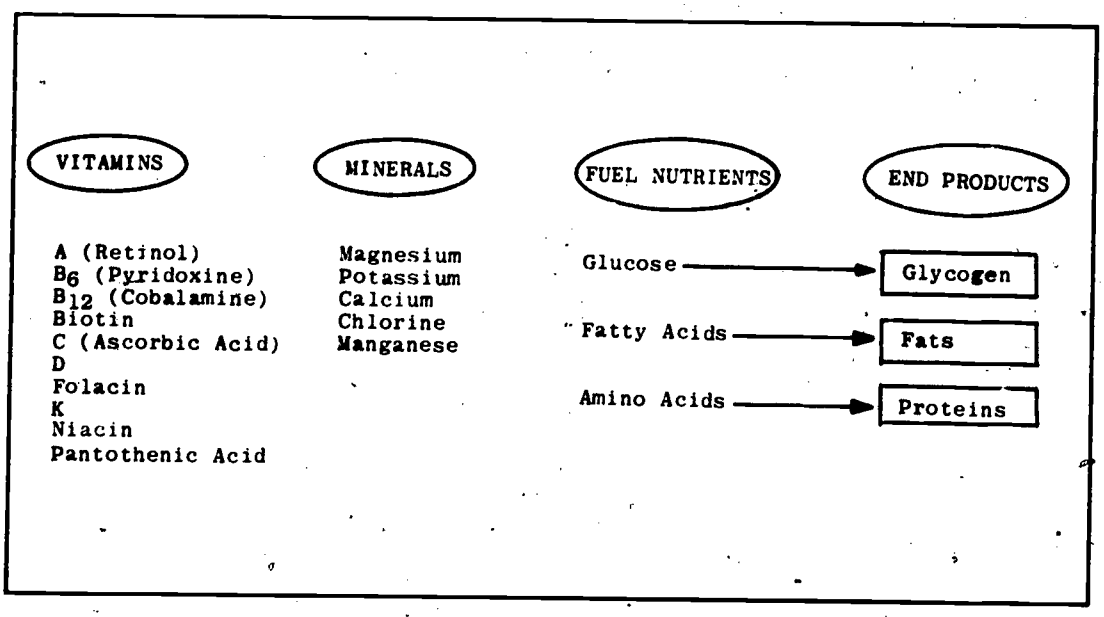
Energy Release Systems

In a car engine, gasoline mixed with oxygen is ignited or burned to provide the energy needed to drive the pistons. Then, gears and linkages harness this energy to turn the wheels. Increasing or decreasing the oxygen and fuel supply either speeds up or slows down the engine. Similarly, the human body takes its fuel supply from the energy nutrients -- fat, carbohydrate, and protein -- and releases the energy by using oxygen to burn the nutrients to release energy in each cell. The energy released is used to drive the body's metabolism. *Metabolism*, as you learned earlier, is a general term used to describe all the chemical changes that occur in the body as it continually performs its many complex functions including exercise.

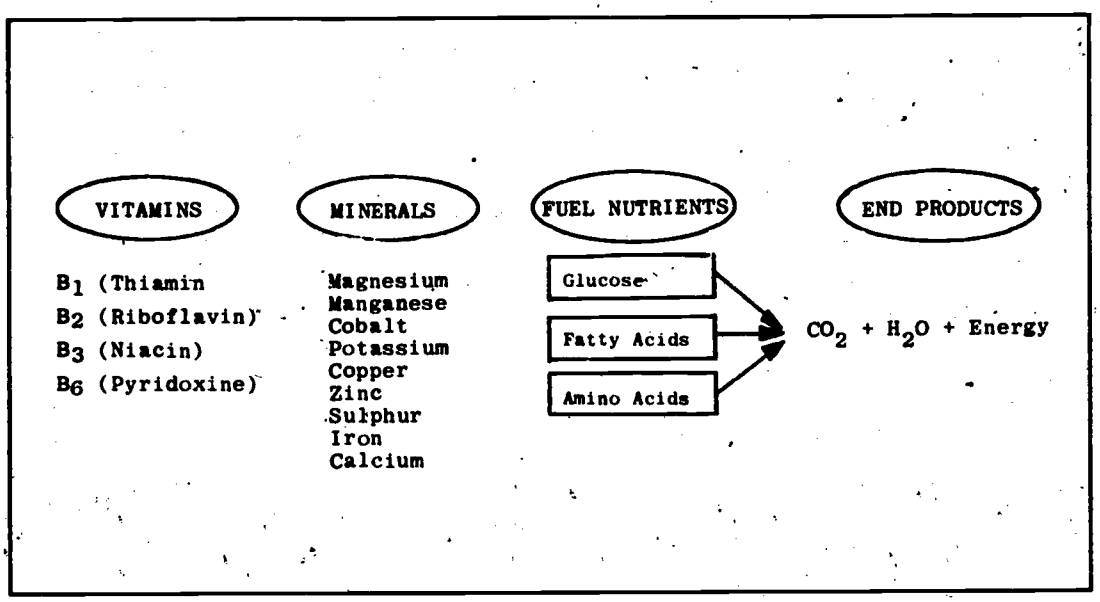
There are two components of metabolism -- anabolism and catabolism. *Anabolism* includes all the chemical changes by which absorbed nutrients are used to replace cell substances that are worn out or destroyed by injury and to build new cells for growth. *Catabolism* describes processes by which nutrients and body cell parts are broken down into chemically simplier substances with the release of energy. In catabolism the fuel nutrients and cell parts are oxidized or burned by a series of chemical reactions inside the cell ultimately releasing energy in the form of heat and ATP and at the same time forming carbon dioxide, water and some nitrogen-containing substances from protein catabolism.

The following charts summarize the fuel nutrients, mineral and vitamin requirements plus end products of anabolism and catabolism.

ANABOLISM
(build up)



CATABOLISM
(break down)



Adapted from: Katch, F.I. and McArdle, W.D. Nutrition, Weight Control and Exercise. Houghton Mifflin, Co., Boston, 1977.

Cells and Energy Release

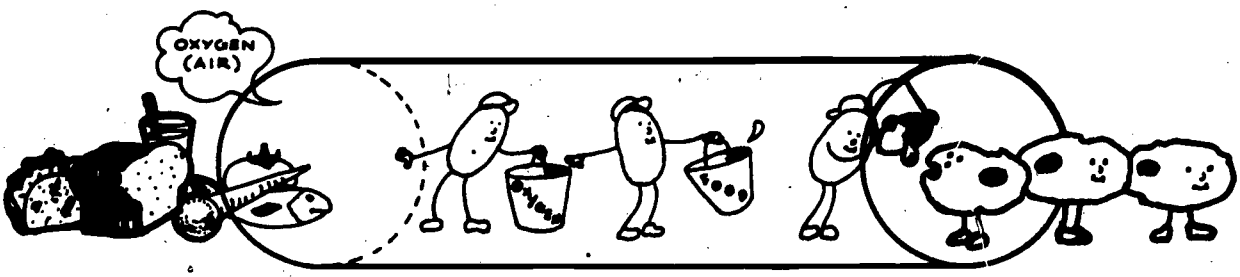
Cells do not directly use the nutrients from the food we eat or things we drink for their immediate supply of energy for metabolism. Instead, the energy from fat, carbohydrate, protein or alcohol must be transformed into an energy-rich substance called adenosine triphosphate, or simply ATP. ATP is directly used to fuel all the energy-requiring processes within the cell. The energy nutrients obtained from digested food are continually used in cells to produce ATP. ATP molecules contain potential chemical energy that is made as needed in the body cells. Creatine phosphate or CP is used to anaerobically rebuild small amounts of ATP. ATP is called the "energy currency" of the cell because the energy released from ATP is directly harnessed to power *all* forms of biological work or metabolism. Any fat, carbohydrate, protein, or alcohol energy not needed as a fuel for metabolism is stored as fat.

ATP Production

Glucose from carbohydrates, fatty acids from fats, and amino acids from proteins are "burned" inside muscle cells and in the process release energy which is used to make ATP to power muscle contractions.

This "burning" is also called oxidation because oxygen is required for the process.

You may be wondering how a muscle cell can "burn" anything? Burning or oxidation in a muscle cell doesn't fit the image most of us have of burning. However, what happens during the rapid burning of a board does have a lot in common with the slow controlled burning process in the body cells. For example, if you have a small wooden shed in your back yard that you want to remove, you could do the job two ways. You could carefully disassemble it and save each piece of wood. However, it would be much faster to burn it down but you would have no lumber that you could use for other projects. By burning the wood, you get the job done quickly but the energy is turned into only heat and all that is left is ashes. Cellular burning on the other hand, is like carefully taking the shed apart and ending up with materials for other work projects. Cellular oxidation is a controlled burning process that releases energy in the form of heat and ATP for fueling work. Cellular oxidation requires special tools called *enzymes* for each step of the process. During oxidation or burning, the energy in food is released with the aid of enzymes to form ATP, and at the same time, water, carbon dioxide and heat are produced.



Enzymes are catalysts. A catalyst is a substance that speeds up a chemical reaction without being used up in the process. For example, oil in a car engine lubricates the mechnical parts and allows them to move quickly so the fuel can be oxidized or burned in the carbureator. The oil is not an active part of the energy released but is essential for lubricating the engine parts which in turn allows the burned fuel to drive the wheels. Vitamins, like oil, are catalysts and are generally not used up in reactions they promote, so only small but vital amounts are needed.

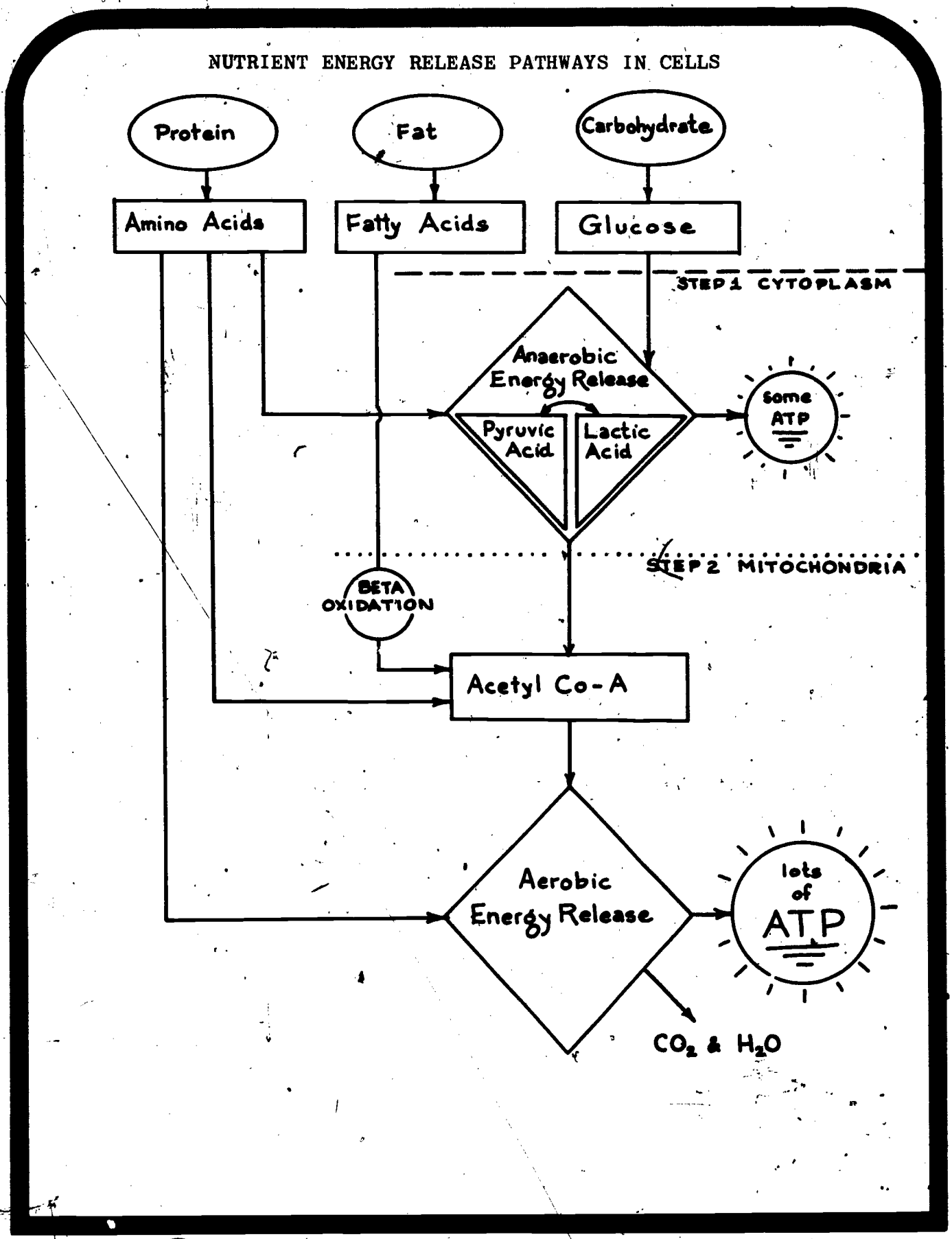
Literally hundreds of enzymes and coenzymes are needed in each cell and each one is quite different from the others. Each enzyme system contains protein and vitamins. Enzymes are large, complex molecules that cannot pass through the wall of a cell. Because an enzyme molecule is so large, it is impossible for oxidative enzymes added to the diet or injected into the blood-stream to end up in muscle cells. The only way enzymes increase in a muscle cell is when the cell nucleus makes more enzymes inside the cell. This is called enzyme biosynthesis and takes place only if what you eat is nutritionally adequate, if your cells aren't sick, and if you exercise to stimulate the cell nucleus to make enzymes.

All nutrients, protein, carbohydrate, fat, vitamins and minerals, are required for anabolism and for catabolic processes of oxidation or energy release that fuel metabolism. Oxygen is also a key ingredient in aerobic energy release from glucose, fatty acids, amino acids or alcohol.

GLUCOSE. FATTY ACID, AND AMINO ACID OXIDATION

Glucose Oxidation

The energy release in the body obtained from the controlled burning of energy nutrients is called oxidation. The oxidation of glucose in a muscle cell takes place in two steps. This process is outlined in the chart on the next page and described on the following pages.



During the first step, glucose obtained from carbohydrate is broken down until it becomes a substance called *pyruvic acid*. This process happens in the cell fluid area called the cytoplasm. In the second step, the pyruvic acid is completely disassembled in a process that requires lots of oxygen to form water and carbon dioxide. Enzymes used during the first step need very little oxygen to do their work. This step is called the *anaerobic* phase. Anaerobic means without oxygen. The enzymes required during the second step need lots of oxygen, so this is called the aerobic phase of energy release or oxidation. Lots of ATP is produced during the aerobic phase. A little ATP is produced during the anaerobic phase. The final direct release of energy from ATP is also an anaerobic process.

The ATP molecule releases its energy in the absence of oxygen. This is the final step in energy release from glucose, fatty acids, or amino acids and alcohol. ATP energy release occurs quickly and enables the cell to generate energy for immediate use. Anaerobic energy release from ATP can only last for a very short time. However, this anaerobic energy release is the reason you can sprint or lift heavy weights without taking a breath. ATP is constantly formed by Step 1 anaerobic energy release and Step 2 aerobic energy release. This way the body has plenty of ATP cash to pay for the energy needs of the body. The intensity and duration of activity determines the extent that each energy release system is used by the body.

AEROBIC EXERCISE is activity that uses the aerobic energy release system. This energy release system is used during exercise in which the heart rate falls within the training heart rate range or lower. That is, lower than 85% of maximum heart rate. Heart rate is measured by pulse rate. When pulse rate does not exceed 85% of the maximum, muscle cells are able to receive and use oxygen so that glucose can be disassembled through energy processing steps and can be completely burned. If the exercise forces the pulse rate to exceed 85% of maximum, then the oxygen supply to the cells cannot keep up with the oxygen demand in the muscles. That is, there is no longer a steady state. When this happens, glucose will only be partially broken down to form pyruvic acid. There will not be enough oxygen to continue through the second step. Exercise that *exceeds* 85% of maximum is called *anaerobic* exercise and is very high intensity activity. Since pyruvic acid *cannot* be burned during *anaerobic exercise*, it accumulates in the muscle and is converted into *lactic acid*. Excess lactic acid in the muscle is associated with pain. The pain is often so intense that a person can't continue the exercise. As you slow down activity intensity, "catch your breath", and recover, oxygen flows into the deprived muscle. During recovery part of the lactic acid turns back into pyruvic acid, to be burned aerobically. It has been estimated that the rest of the accumulated lactic acid is converted back into fatty acids.

Fatty Acid Oxidation

There appears to be completely different set of enzymes used for the oxidation or burning of fats. Fatty acids, either from our fat deposits or from a recent meal, are carried by the blood to muscle cells. Inside the cell, the enzymes are lined up ready to take the fatty acid apart and get the energy out of it. Each enzyme does its work in an orderly sequency that biochemists call a chemical pathway. If you look at the chart you will see that the first half of fat burning, called the Beta oxidation pathway, is unique to fats. The second half of fat burning uses the exact same enzymes as the second step or aerobic phase of glucose burning.

Unlike glucose burning, in which the enzymes require little oxygen in the first step, all the enzymes used in fat breakdown need a lot of oxygen. Anaerobic exercise, therefore, effectively shuts off all fat burning and forces the muscle to use glucose exclusively. Activity that keeps the pulse rate at 85% of maximum heart rate or lower not only allows you to burn fat while exercising, but also stimulates muscle cell formation of more of the enzymes required to burn fat. As the enzymes proliferate, your muscle cells are better equipped to grab oxygen from the blood and burn fats at higher and higher exercise intensities. That is, you will be able to run faster, yet still run aerobically and burn increasing amounts of fat while sparing glycogen stores.

Oxygen Consumption: Steady State - Low To Moderate Intensity Activity

The usage of oxygen by the cells is called oxygen consumption. Oxygen consumed by cells is used for energy release. During the first few minutes of low or moderate intensity activity, there is a sharp increase in oxygen consumption. As an activity like walking, jogging, swimming or bicycling settles into a constant pace, a balance between the energy required by the working muscles and the energy supply from the aerobic energy releasing reactions is reached. This balance is called the *steady state.*

Maximum Oxygen Consumption - High Intensity Activity

In terms of oxygen consumption, the amount of energy released from aerobic reactions will increase in proportion to the intensity of the exercise. Increases in exercise intensity require an increase in oxygen consumption by the cells up to a certain limit called the maximal oxygen consumption or VO_2 max. When a person's cells are using oxygen as fast as they possibly can to release energy aerobically, he or she has reached their VO_2 max. If the intensity of exercise increases above VO_2 max, then *anaerobic* energy release systems are used to supply the additional energy needed for work. The anaerobic energy release system kicks

in because the energy released by aerobic reactions is not producing enough ATP to meet the total energy demand of the exercise. Maximum oxygen consumption level or VO_2 max is one of the most important factors that determines a person's ability to sustain high-intensity exercise. Proper aerobic training increases VO_2 max.

Amino Acids Oxidation

Amino acids can also be burned in muscle cells by the oxidative enzymes. This means that proteins can be burned along with fats and carbohydrates. This occurs when people eat very low-calorie diets. The body will burn valuable protein instead of using it for tissue repair if it does not get enough fuel from carbohydrate or fat.

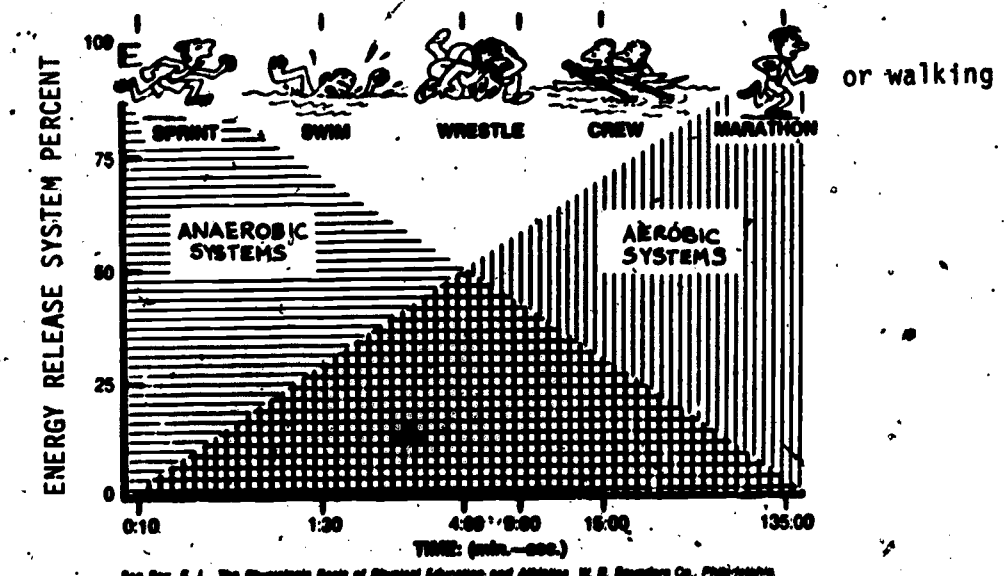
AEROBIC OR ANAEROBIC?

Heavy weight lifting is on the extreme end of anaerobic exercise, whereas walking is perhaps on the extreme end of aerobic exercise. It is hard to distinguish between aerobic and anaerobic exercises that are of moderate or variable intensity. For example; if a person jogs or runs slowly, which type of exercise is he or she doing? The answer depends on whether or not the person is running out of breath; whether they can continue on and on or have to stop.

A good way to tell if a person is exercising aerobically is to monitor heart rate. If heart rate is not above 85% of their maximum heart rate, the exercise is probably at an aerobic level.

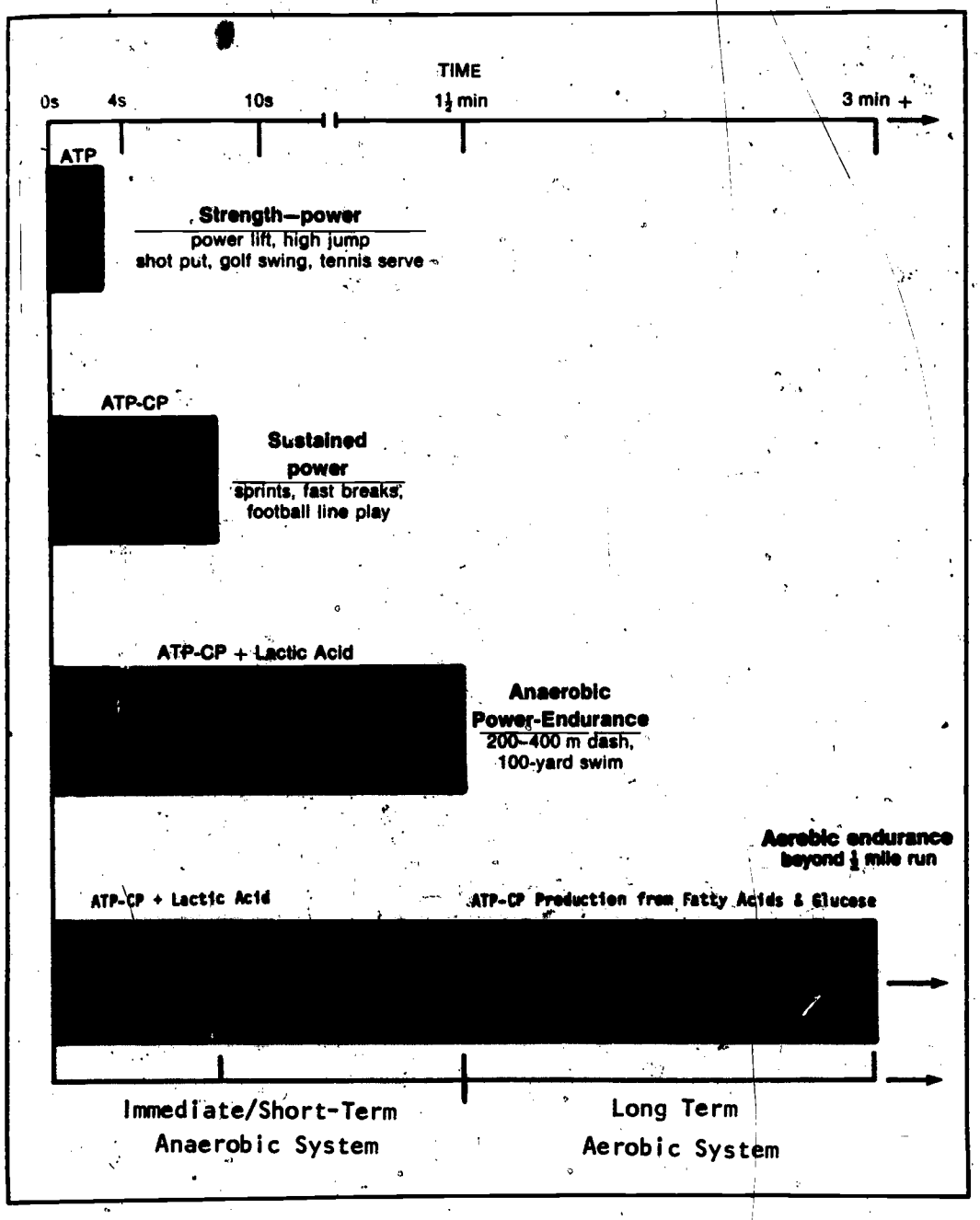
The following graphs summarize the major energy release pathways and fuel sources for various sports.

ENERGY RELEASE SYSTEMS for ACTIVITIES OF VARYING INTENSITY AND DURATION



See Fox, E. L. The Physiologic Basis of Physical Education and Athletics. W. B. Saunders Co., Philadelphia.

ENERGY SOURCES AND ENERGY RELEASE SYSTEMS FOR SELECTED ACTIVITIES



Source: McArdle, W.D., and Katch, F.I., Katch, V.L.: Energy, Nutrition, and Human Performance. Lea & Febiger, Philadelphia, 1981.

Summary

Food supplies energy nutrients called carbohydrate (4 calories per gram), fat (9 calories per gram), and protein (4 calories per gram). Alcohol, although not considered an essential nutrient, also contains energy (7 calories per gram). The body converts extra energy whether it comes from fat, carbohydrate, or protein into fat and stores it in the body. There is a large calorie reserve of fat in the body. The body stores a small amount of carbohydrate in a form called glycogen. There is no protein stored exclusively for use as fuel. The only protein available for use in energy release in the body is in the cells of organs and tissues such as muscles. The energy nutrients are broken down into simpler compounds -- fats to fatty acids, carbohydrate to glucose, protein to amino acids -- that are oxidized or burned, and release energy as heat, form ATP, plus produces carbon dioxide and water. ATP is the direct energy source for body cells. Energy release from glucose occurs in two steps. Step 1 produces a little ATP, occurs in the cells' cytoplasm, is used for high intensity activity that occurs when the heart rate for the activity is greater than 85% of maximum heart rate, does not require oxygen, and is called anaerobic energy release. Step 2 ultimately produces lots of ATP, occurs in the cell mitochondria, is used for moderate to low intensity activity that occurs when the heart rate is less than 85% of its maximum and requires a steady supply of oxygen. Fatty acids are oxidized only in Step 2. Amino acids can be oxidized in Step 1 or Step 2. Enzymes and coenzyme systems made from protein and vitamins are catalysts for oxidation. Minerals are also required for oxidation. Low and moderate intensity activity are fueled mainly by aerobic energy release systems. Therefore, for low and moderate intensity activity fat is the main fuel nutrient used to produce ATP. Glucose is also a fuel for ATP production in low and moderate intensity activity. When cell energy requirements are balanced by cell oxygen consumption, a steady state exists. As the intensity of activity increases, there is an increase in oxygen consumption by the cells and a shift from aerobic energy release for ATP production to anaerobic energy release for ATP production. Maximum oxygen consumption or VO_2 max is reached when cells cannot utilize anymore oxygen. This occurs in high intensity activity. High intensity activity which lasts more than a few seconds relies mainly on anaerobic energy release from glucose to produce ATP. High intensity activity lasting only a few seconds uses the minimal stored ATP and creatine phosphate or CP for energy.

ESTIMATING ENERGY NEEDS

Human energy is spent in three major ways:

1. Fueling basal metabolism
2. Processing food nutrients
3. Fueling voluntary activities

An individual's calorie needs depend on the amount of energy he or she spends on these three activities.

Basal Metabolism - At basal or rest conditions, the body uses energy for activities such as pumping blood, transmitting nerve impulse, and breathing. Basal metabolic rate is defined as the minimal rate of energy use required to maintain life of the body at complete rest. This value is calculated by measuring the amount of oxygen consumed during a period of time a person is relaxed, lying at complete rest, and without food for at least 12 hours.

The oxygen consumed by the body cells is used to help release the energy that is obtained from carbohydrate, fat, protein, or alcohol in food. Therefore, oxygen uptake is a clear indication of the amount of the energy the body utilizes. Most authorities set the basal oxygen requirement of the body at 3.5 milliliters per kilogram of body weight per minute. This is called 1 MET. For a man weighing 150 pounds or 70 kilograms (1 pound = 2.2 kg), this rate is equivalent to 245 milliliters of oxygen per minute, or a basal metabolic rate of 14.7 liters of oxygen per hour. If we multiply the basal metabolic rate by the resting energy equivalent of one liter of oxygen, 5 calories, we can calculate the total quantity of energy liberated from fat, carbohydrate, or protein within the body during an hour. That figure turns out to be about 74 calories. For 24 hours this works out as 1776 calories.

The BMR for men is estimated to be 1 calorie per hour for each kilogram (2.2 lb.) of body weight. Knowing body weight in kilograms, you can roughly estimate basal metabolic rate for 24 hours.

Weight in pounds ÷ 2.2 kilograms/pound = Weight in kilograms

[ ] lbs ÷ [2.2] kg/lb = [ ] kg

Weight in kg × 1 Calorie/kg hour × 24 hrs/day = BMR Calories/day

[ ] kg × [1] $\frac{\text{Calorie}}{\text{kg hr}}$ × [24] $\frac{\text{hrs}}{\text{day}}$ = [ ] $\frac{\text{Calories}}{\text{day}}$

Age, body composition and body shape affect metabolic rate. Basal metabolic rate decreases with age. Muscle tissue uses more energy than fat tissue. Women typically have a higher percentage of body weight that is fat than men. Therefore, a woman will typically have a slower metabolic rate than a man of the same age and weight. Body shape also affects metabolic rate. Tall thin people have greater uninsulated skin surface area from which to lose heat than short obese people. To keep their body temperature at about 99°F, tall thin people must generate more heat and therefore use more calories at a faster rate. Thus, their basal metabolic rate is higher.

Effect of Food

Basal metabolism is usually measured for people at rest after a 12 hour fast when there is no food in their stomachs. Basal metabolism includes the energy needed to maintain the digestive system at rest. When you eat, your digestive system becomes more active in order to process the incoming food, transport these digested nutrients to cells, and metabolize them. The amount of energy required for these internal activities depends on the amount and type of food you eat and is called specific *dynamic activity* or SDA.

Voluntary Activities

Activity -- thinking, sitting, exercise, sport performance -- all require energy to fuel the nerves and muscles. Nervous activity uses very little energy, while muscle activity requires energy in direct proportion to the amount of muscle moved. To lie and daydream requires 1/10th of a calorie of fuel per kilogram per hour. For a game of tennis or swimming, where all the muscles are active, four calories or more per kilogram per hour are required.

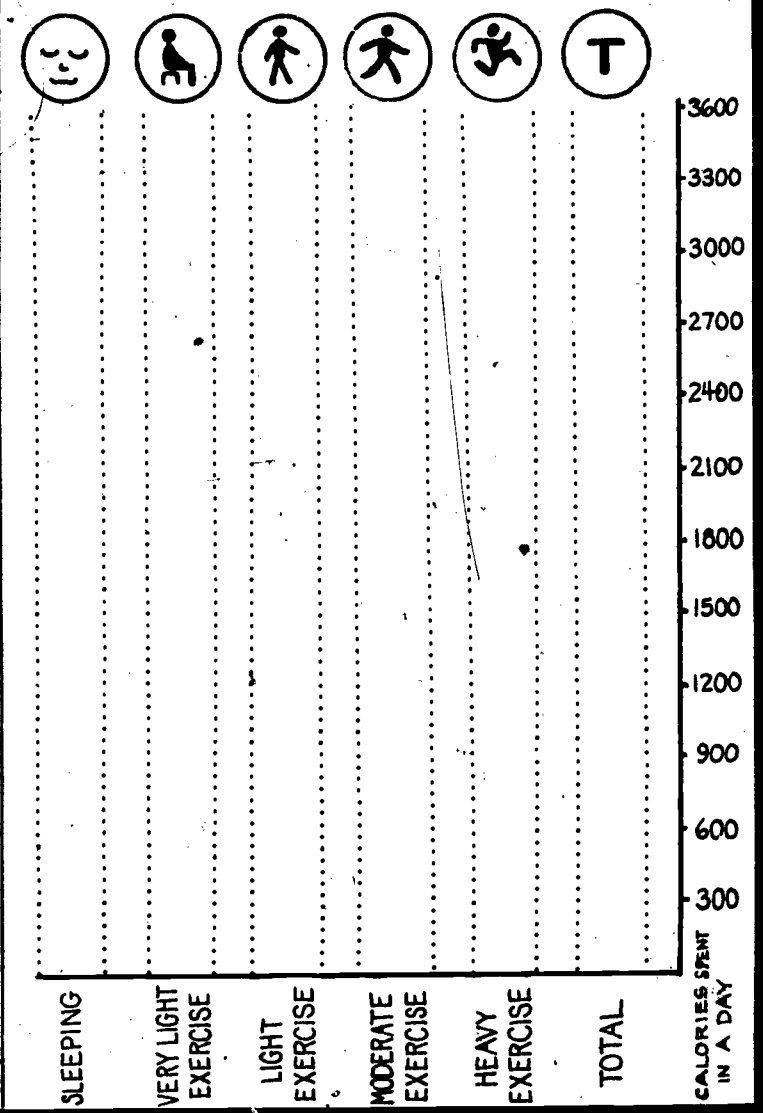
TOTAL ENERGY NEED - 3 ESTIMATION GUIDELINES

A rough estimate of the total amount of energy needed for basal metabolic rate, processing food, and voluntary activities can be made by three different methods. One method is to add up the amount of time you spend sleeping and doing activities in the four major exercise categories: very light, light, moderate, and heavy. The handout called Calorie Check Out can help you estimate calorie or energy needs.

CALORIE CHECK OUT

Check out how you spend your activity calories. Next to each activity group -- *sleeping, very light exercise, light exercise, moderate exercise, heavy exercise* -- record how many minutes you spend a day doing activities from that group. Multiply the minutes by the average number of calories it takes to do those activities. Record the calories for each group. This total will give you an estimate of how many calories you spend for a day. Graph the number of calories from each group. How many minutes and calories did you spend doing aerobic activities?

ACTIVITIES	Daily Amount of Time Spent on Each Activity MINUTES	CALORIES
SLEEPING 1 CALORIE BURNED/MINUTE		
VERY LIGHT EXERCISE 2 CALORIES/MINUTE Riding in a car, bus, truck, or motorcycle Singing Sitting--reading, eating watching TV, school, on the phone, typing, piano playing, card playing		
LIGHT EXERCISE 2-5 CALORIES/MINUTE AVERAGE = 4 CAL/MIN. Croquet, Fishing, Golf, Hammering, Horseback riding, Housework, Painting, Sewing, Shopping, Shuffleboard, Volleyball, Walking leisurely		
MODERATE EXERCISE 5-7 CALORIES/MINUTE AVERAGE = 6 CAL/MIN. Baseball, Bicycling, Bowling, Dancing, Gardening, Hiking, Ping Pong, Scrubbing, Swimming leisurely, Tennis, Walking		
HEAVY EXERCISE 7-12 CALORIES/MINUTE AVERAGE = 9 CAL/MIN. Bicycle racing, Boxing, Climbing, Country or folk dancing, Football, Horseback riding at gallop, Running, Skiing, Soccer, Squash, handball, Weight Lifting		
TOTAL :		



A second method for estimating energy needs can be found on the Sports-Nutrition Fitness Guide Poster. Recommended Dietary Allowances for Energy listed on the chart are average estimates of total energy requirements. Find the age range you are looking for and check the poster to find the range of calorie requirements.

A third method of estimating energy needs involves using a formula based on an estimate of ideal body weight. To determine your ideal weight, use the following formula if you are 25 years or older:

MEN	WOMEN
Take your height in inches, multiply by 4 and subtract 128. This gives you your estimated ideal weight. *Example:* If your height is 69 inches (5'9" x 12" = 69"): 69" x 4 = 276 minus 128 = 148 pounds.	Take your height in inches, multiply by 3.5 and subtract 108. This gives you your estimated ideal weight. *Example:* If your height is 64 inches (5'4" x 12" = 64"): 64" x 3.5 = 224 minus 108 = 116 pounds.

Estimating your daily caloric needs.

Calculate your estimated ideal weight and multiply it by:

- 10-14 if you are not very active
- 15 if you are moderately active
- 16 if you are very active

Remember that body composition, which is the percentage of weight composed of each nutrient, definitely affects energy needs. So, use the ideal weight estimate only as a guideline for what athletes should weigh.

IDEAL BODY WEIGHT ESTIMATE

A method of estimating ideal body weight is outlined below. This method of estimating ideal body weight is made using an athlete's current percent body fat and desired percent body fat. Percent body fat is that percentage of total body weight which is fat. For example, if someone weighs 100 pounds and has 20% body fat, that person would have 20 lbs. of fat:

20 pounds of fat (20% of 100 lbs. = 20 lbs.)

80 pounds lean body weight (muscle, bone, water, organs, skin, etc.)

100 pounds total weight

Percent body fat can be estimated using skinfold measurements or hydrostatic weighing. Directions for measuring skinfolds and hydrostatic weighing are in Section D - Skills Training for Nutrition-Fitness Assessment.

The recommended percent body fat ranges for teenagers and children have not been established yet. Typically men should have between 12% to 17% body fat. Women should have between 19% and 25% body fat. Men are classified as obese if their body fat is greater than 25%. Any woman with greater than 30% body fat is classified as obese. Male athletes body fat typically ranges from 4% to 18% Female athletes body fat ranges from 6% to 30%. Some body fat is essential! Body fat lower than 2-5% for males and 6-12% for females is a sign of poor nutrition-fitness status or health.

To determine ideal body weight for a person, you simply divide the person's lean body weight by the fraction of his or her weight that you want to be lean. Remember, you can estimate lean body weight if you know the percentage of a person's total weight that is fat. Percentage of body fat can be estimated using skinfold measurements and underwater weight. Skinfolds are measured with calipers. Underwater weight is measured by hydrostatic weighing. Page 69 explains hydrostatic weighing technique. Pages 62 and 130 explain how to measure skinfolds.

The following example on page 44 shows the steps for figuring ideal body weight once you know a person's current percent body fat and have set a desired percent body fat.

STEPS IN CALCULATING IDEAL BODY WEIGHT

	EXAMPLES	
	ATHLETE #1	ATHLETE #2
Step #1		
·Current Weight	150# (68 kg)	150# (68 kg)
% Body Fat	15%	30%
Fat Weight (current weight x % body fat) →	22.5# (10.2 kg) 150 x .15 = 22.5 lbs	45.0# (20.4 kg) 150 x .30 = 45 lbs
Step #2		
·Lean Body Weight (Total Wt. minus Fat Wt.) →	127.5# (57.8 kg) 150 - 22.5 = 127.5 lbs	105# (47.6 kg) 150 - 45 = 105 lbs
Step #3		
·Ideal Weight (Lean Body Weight/.85*) →	150# (68 kg) 127.5 ÷ .85 = 150 lbs	123# (56 kg) 105 ÷ .85 = 123.5 lbs

If goal is 15% body fat, this means there would be 85% lean body weight.

15% Fat wt. (.15)
*85% Lean body wt. (.85)
100% Total Weight (1.0)

This information can be used to recommend weight loss goals.

Weight Loss Recommendation: (Current wt. minus Ideal wt.)	NONE	27# (12 kg)

KEY: # = pounds
kg = kilograms
wt = weight

The following chart summarizes the calorie requirements for various sports. Keep in mind that these are estimates of energy needs. A particular athlete's energy needs will be based on their basal metabolic rate which is determined by their age, sex, body weight, and body composition, plus the calorie needs for their activity level.

Exercise and Energy Expenditure Chart

	Aerobic Benefits	Muscle Strength	Weight Control	Calories/ Hour*
☑ Jogging	4	3	4	600
☑ Bicycling	4	3	3	500
☑ Swimming	4	4	3	600
☑ Handball, Squash, Racquetball	4	3	4	420
☑ Cross-country Skiing	4	4	4	600
☑ Downhill Skiing	3	3	3	410
☑ Basketball	4	3	4	420
☑ Tennis–Single	3	3	3	410
☑ Calisthenics	1	4	2	320
☑ Walking	2	2	2	320
☑ Golf (no carts)	2	2	1	320
☑ Softball and Baseball	2	2	1	264
☑ Bowling	1	1	1	270

4 = very good 3 = good 2 = fair 1 = poor

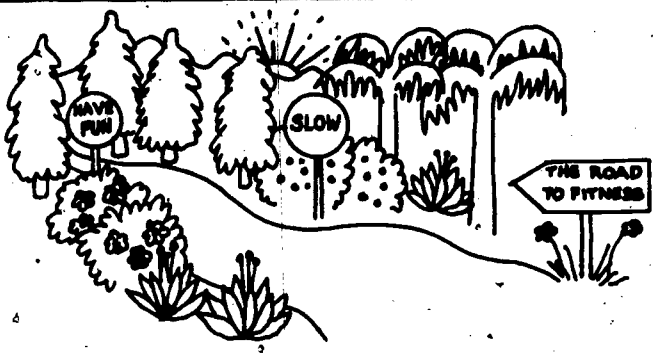
5/82 *Estimates for adult men and women.

This chart is from a pamphlet entitled *Fitness 3 - Your Way to Better Health.*

Calorie Values of Food

All the energy released from food eventually becomes heat in the body. The rate of heat production in the body depends on the energy released from the foods ingested. Energy expenditure in the body and potential energy in foods are measured in calories.

A summary of the nutritional value of foods can be found in Nutritive Value of Foods, United States Department of Agriculture Bulletin No. 72. This reference is in the appendix on page 181 to 207. The energy content of fast foods can be found in the pamphlet in your Sports-Nutrition book entitled Nutrient Analysis of Fast Foods published by Ross Laboratories in Columbus, Ohio.



The most effective training programs are based on what you have learned in Section A - *SPORTS NUTRITION ESSENTIALS* as well as on general physical training principles that include overload, specificity, reversibility, and individuality. There are also basic principles for aerobic and anaerobic components of athlete training programs. The next section of your Sports-Nutrition packet will review all of these training principles.

B - FITNESS ASSESSMENT AND CONDITIONING

NUTRITIONAL STATUS ASSESSMENT OVERVIEW

A person's health is influenced by the food he or she eats and the way these nutrients are utilized in the body. Assessment of nutritional status provides insight into nutrient intake and utilization as well as provides a means of preventing and treating malnutrition. Nutrition status assessment in sports encompasses three techniques: diet analysis, body composition assessment using anthropometric measurements, and biochemical data analysis.

Diet Analysis

Diet analysis is a way of comparing a person's nutrient intake to the recommended dietary allowances or recommended food guidelines. See Section D - Athlete Diet Check Out. When using this method, one should keep in mind that diet recall data may over-estimate or under-estimate nutrient intake. For example, many people cannot accurately remember what they ate or how much they ate the day before. Also, one day's diet may not be a true indicator of what the person usually eats. However, regularly keeping tabs on what a person eats is a good way to check out what goes in to fuel the body and to check out how recorded foods measure up to recommended diet and nutrient guidelines.

Body Composition

Assessment of an athlete's body composition - % lean body mass and % body fat - can help athletes determine if any weight loss or weight gain is needed and set goals for the amount of weight gain or loss. Remember, body composition measurements and their interpretations only give estimates of body composition. Skinfold measurements and hydrostatic weighing are the body composition assessment techniques included in this packet. See Section D - Nutrition-Fitness Assessment Skills Training.

Biochemical Profile

Biochemical data analysis is an examination of blood, urine, tissue biopsy, and hair chemistries. Biochemical data provides information for evaluating samples of tissue nutrient levels. The interpretation of the data can be used to screen for nutrient excesses and deficiencies.

Results of these tests must be carefully interpreted by qualified medical personnel. Many factors can affect the results of the test and lead to errors in test results. Exercise, drugs, alcohol, and methods of processing the blood or urine affect the values. Furthermore, the lab values are based on normal values derived from examining large numbers of people. These values will apply to most people. However, because of individual variation, what is normal for the population as a whole, may not be normal for a particular person.

Hair analysis in its current status is an unaccurate measure of nutritional status, because the normal values for the various nutrient levels in hair have not been well established. Therefore, there are no reliable norms for evaluating the results of hair analysis.

AMERICAN ALLIANCE FOR HEALTH, PHYSICAL EDUCATION, RECREATION AND DANCE (AAHPERD) HEALTH FITNESS TEST INTRODUCTION

Physical fitness is a composite of endurance, strength, flexibility, cardiovascular fitness, and normal body composition. The physically fit person should be able to do normal daily physical activities without feeling fatigued. The physically fit body is able to function at its best all of the time. Diet, exercise, rest, and relaxation are vital for maintaining physical fitness.

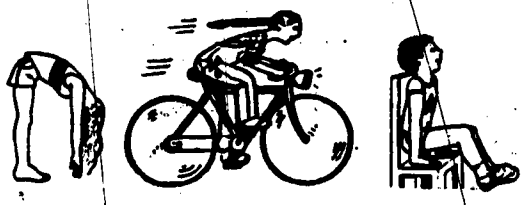
Endurance is the ability of muscles to sustain strenuous activity for a long continuous period of time.

Strength is the ability of the muscles to exert a maximum force against a resistance or object.

Flexibility is the ability of a muscle to be used throughout its maximum range of motion.

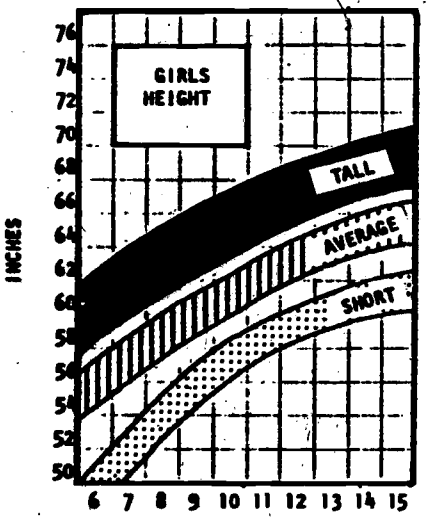
Cardiovascular fitness is the capacity of the heart, lungs, circulatory, and respiratory systems to do work (activity) efficiently and to recover quickly when activity is finished.

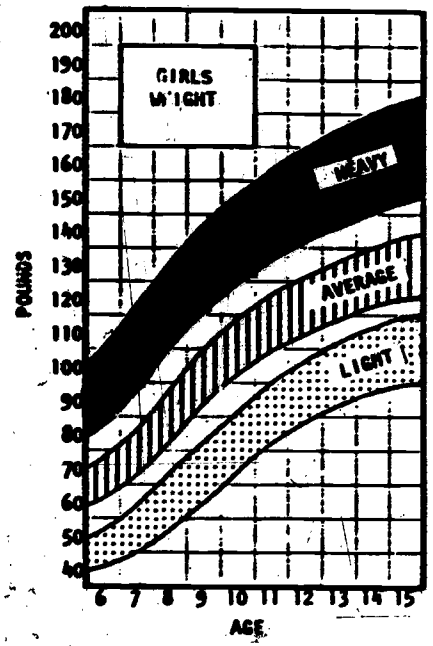
Body Composition is the comparison of the body's fat content to the body's muscle mass. Body fat should be within normal limits and muscles well toned to maintain health. A continuous physical fitness program will assist in maintaining the proper proportions of body fat to muscle.



The age, height, and weight charts are tools commonly used to assess students' growth patterns. The growth charts in MEASURE UP are based on computerized data collected from 1963 to 1974 by the National Center for Health Statistics.

MEASURE UP





The shaded areas show the range of actual heights and weight for most adolescents in the United States.

HEIGHT STATUS

1. Find your age along the bottom of the chart. Draw a vertical line up from your age to the top of the chart.

2. Find your height on the top chart and draw a horizontal line across. Mark an "X" where your height line crosses your age line. RECORD your height and height group (Tall, Average, or Short) on Handout #26, THE BODY SHOP.

WEIGHT STATUS

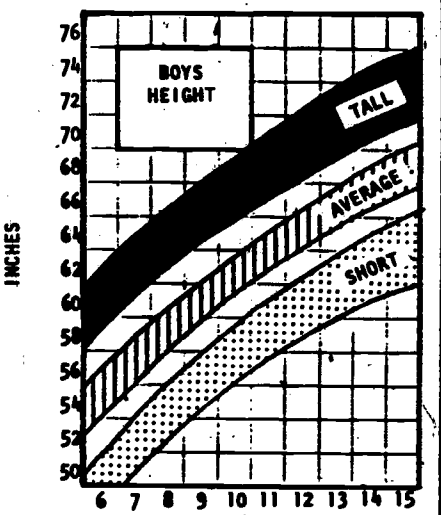
1. Find your weight on the bottom chart and draw a horizontal line across. Mark an "X" where your weight line crosses your age line. RECORD your weight and weight group (Heavy, Average, or Light) on THE BODY SHOP.

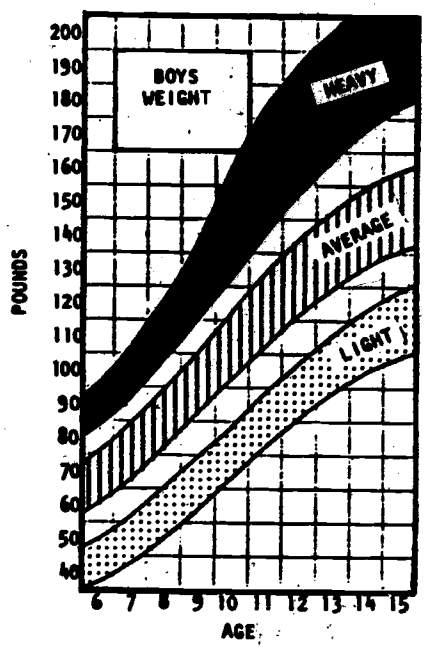
EXAMINING THE FACTS ON HEIGHT AND WEIGHT

What is the range of heights for most people your age?

What is the range of weights for most people your age? Is your weight within this range? If not, what are some reasons?

Going on crash diets to lose weight can be dangerous. If you are concerned about your weight, a health professional can assist you in deciding if you need to lose or gain weight.





The AAHPERD Health Fitness Test is designed to measure the key components of fitness: *Muscle Strength* and *Endurance* (sit ups); *Flexibility* (sit and reach); *Cardiovascular Endurance* (9 minute/1 mile run); and *Body Composition* (skinfold fat measurement).

The tests may be given in any gymnasium or out of doors. With the exception of the sit and reach apparatus and skinfold calipers, no special equipment is required. Administering the test does require careful planning to utilize both space and time advantageously. A station for each test should be planned and clearly marked ahead of time.

Arrangements for timing and recording scores can be handled by the athletes. Organizing the athletes into squads is usually helpful for smooth test administration. Each athlete can record his or her scores as the test is given using the handout on the next page called THE BODY SHOP. Sometimes an assistant, squad captain, or trainer can record all team scores.

The AAHPERD Health Fitness Tests are useful for evaluating athletes' potential to perform, motivating them to improve their fitness level, and evaluating a training program.

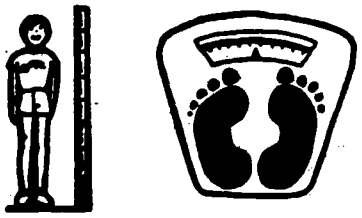
THE BODY SHOP

Complete the BODY SHOP checkout to find out what kind of shape your body is in. Record your measurements and scores as you complete each test. What parts of you are in good shape? What parts need a tune up?

NAME _____

Age _____

HEIGHT & WEIGHT



	TEST 1	TEST 2
DATE		
HEIGHT		
HEIGHT GROUP		
WEIGHT		
WEIGHT GROUP		

PULSE

	TEST 1	TEST 2
DATE		
RESTING PULSE		
PULSE AFTER EXERCISE		

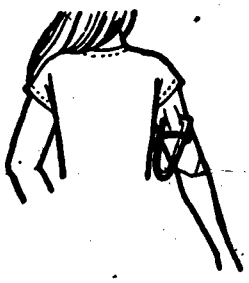
PHYSICAL FITNESS TEST

Put a Check Mark (✓) in your percentile rank

PERCENTILE

	SIT-UPS		9 MINUTE/1 MILE RUN		SIT & REACH		TRICEPS SKINFOLD		TRICEPS SUBSCAPULAR SKINFOLD	
	1	2	1	2	1	2	1	2	1	2
100										
95										
90										
85										
80										
75										
70										
65										
60										
55										
50										
45										
40										
35										
30										
25										
20										
15										
10										
5										

BODY COMPOSITION

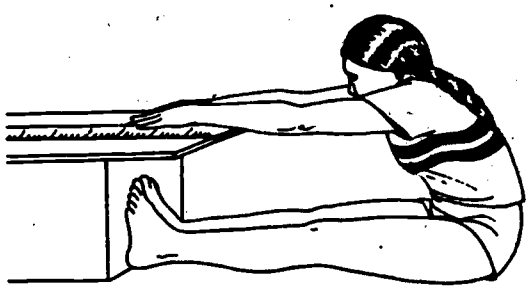


The students should be given reasonable warm-up prior to the testing (5 to 15 minutes). A test should not be given to any student whose medical status is questionable.

The directions for the fitness test are given in the test booklet, AAHPERD HEALTH FITNESS TEST. Be certain to follow directions exactly for each test. Following the directions will enable you to compare your students' scores with the national norms.

After completing the test, the student compares the score received in each test to the percentile tables attached to the AAHPERD HEALTH FITNESS TEST. These are very rough estimates of fitness. The student must be informed of this fact. If, for example, a 12 year old girl successfully completed 35 sit ups in 60 seconds, she would be at the 45th percentile. The 45th percentile means that 45 percent of the girls who take the test would fall below her score. The 45th to 55th percentile range is considered a measure of "average" fitness. Likewise, if a 12 year old boy ran a mile in 7 minutes and 24 seconds (7:24), he would rank at the 75th percentile or 75 percent of all boys taking the test would fall below him. He would fall in the "very fit" range. Remember, these ranges are *not* exact physical fitness scores.

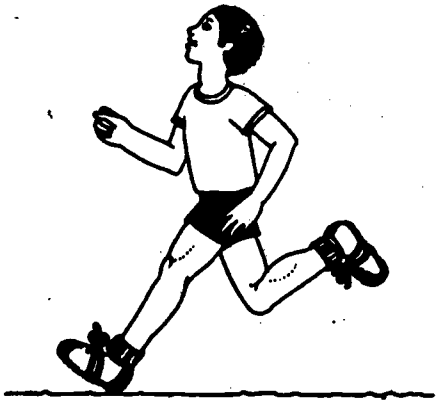
AAHPERD FITNESS TEST



American Alliance for Health, Physical Education, Recreation, and Dance: *Health Related Physical Fitness Test Manual.* Reston, VA.: AAHPERD, 1981.

NINE MINUTE/1 MILE RUN

1



Nine Minute Run or One Mile Run

To conduct the 1 mile or 9 minute run, you will need to have access to a measured running area (like a quarter mile or 440 yds or 400 meter track). It is essential to know the distance of the running area. You will also need to have a stop watch. As norms are given for both nine-minute run and one mile run, you have the option as to which test to run.

If you choose the one-mile run, you will need to time each student. Assign each student a number, have a recorder record time of each student as he/she completes the run.

Method of Recording

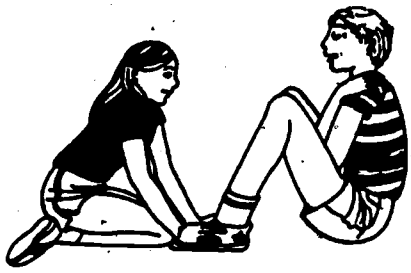
Start all students at the same time; start stop watch when you start the students. As the first student crosses the finish line, start calling out times. Recorder matches time to student's number. Knowing the distance of the track/running area allows you to record distance for the 9 minute run. Distance for the 9 minute run is whatever total distance the student covers in 9 minutes.

What Do The Scores Mean?

The score that the student receives on each test is then compared to percentile tables ranking by using TABLES 1 and 2 in this booklet. These are very rough estimates of fitness. The student needs to be reminded of this. If, for example, a 13 year old girl ran 1537 yards in 9 minutes, she would be at the 45th percentile, that is, 45 percent of the students who take the test would fall below her score. The 45th to 55th percentile range is considered a measure of average fitness. Likewise, if a 12 year old boy ran a mile in 7 minutes and 24 seconds (7:24), he would rank at the 75th percentile or 75 percent of all students taking the test would fall below him. He would just fall in the "very fit" range. After determining the percentile ranking, the student should record the result on Handout #26, THE BODY SHOP. It is important to remember these are ranges not exact physical fitness scores.

2

SIT-UPS



Equipment

Clean floor, mat, or dry turf and stop watch.

Description

The pupil lies on his back with his knees bent, feet on the floor with the heels between 12 and 18 inches from the buttocks. The angle at the knees should be less than 90 degrees. While lying on the floor, the pupil crosses his arms on the chest by placing his hands on the opposite shoulders. His feet are held by his partner to keep them in touch with the surface. The pupil curls to a sitting position by contracting his abdominal muscles. The arms must contact the chest at all times. The chin must remain in a tucked position. The sit up is accomplished when the elbows touch the thighs. The pupil returns to the starting position before he sits up again. The timer gives the signal "ready-go", and the sit-up performance is started on the word "go". Performance is ended on the word "stop". The number of correctly executed sit-ups performed in 60 seconds shall be the score.

Rules

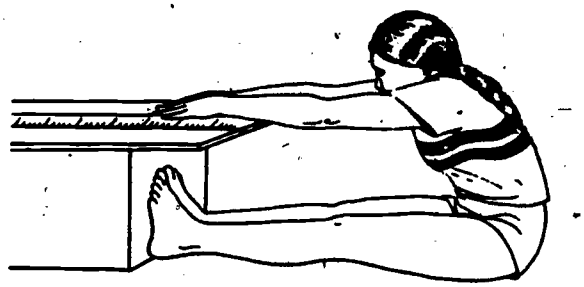
1. Only one trial shall be allowed unless the teacher believes the pupil has not had a fair opportunity to perform.
2. No resting is permitted between situps.

Scoring

Record the number of correctly executed sit-ups the pupil is able to do in 60 seconds. A foul nullifies the count for that sit-up. The watch is started on the word "go" and stopped on the word "stop". The student should compare the test score to the percentile rank by using TABLE 3. After determining the percentile ranking, the student should record the result on Handout #26, THE BODY SHOP.

3

SIT AND REACH



Equipment

The test apparatus consists of a sturdy box 12 inches high with a measuring scale placed on top. The scale's 23 cm mark is placed in line with the side against which the pupil's feet will be placed. This apparatus can be improvised by using a narrow bench and a meter stick. The test apparatus should be placed against a wall to prevent the apparatus from sliding away from the pupil.

Description

First, the student removes his shoes. Then, the pupil sits down at the test apparatus with his feet shoulder-width apart and his legs fully extended. The feet are placed flat against the side of the box. The hands are placed on top of each other and the arms are extended forward. After assuming this position, the student reaches forward along the measuring scale four times. On the fourth trial, the maximum reach is held for one second.

Rules

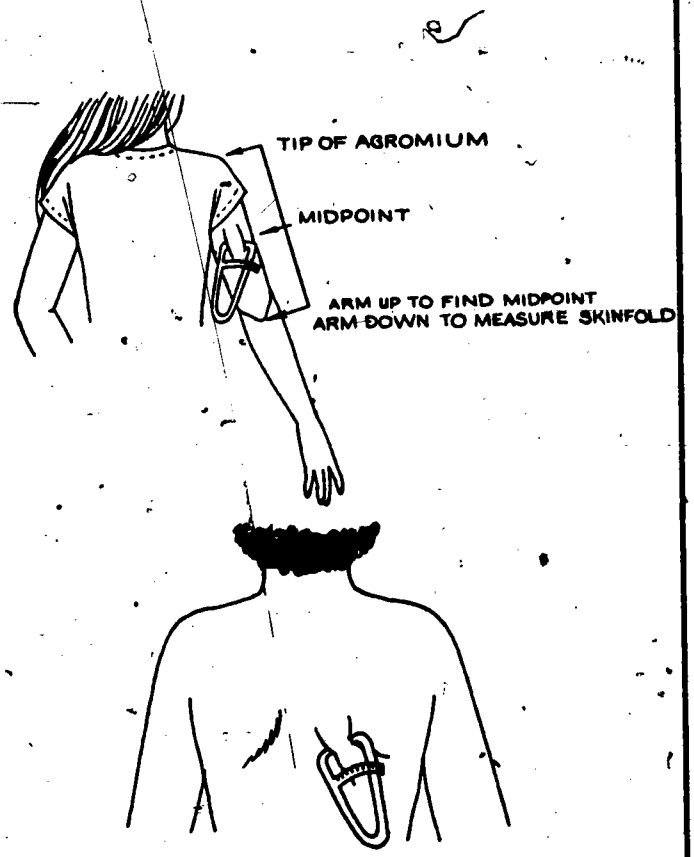
The test must be repeated if the pupil *does not* a) reach with both hands evenly; or b) keep both legs straight. The tester should place one hand on the knees to prevent the knees from bending.

Scoring

The student should compare the SIT AND REACH test score to the percentile rank by using TABLE 4. After determining the percentile ranking, the student should record the result on Handout #26, THE BODY SHOP.

4

TRICEPS/SUBSCAPULAR SKINFOLD



Equipment

The Ross Laboratories ADIPOMETER skinfold caliper is used for obtaining the skinfold fat measurements

Description

Skinfolds are made up of the skin and a layer of subcutaneous fat pulled away from the underlying muscle (see illustration). While there are a number of body sites where skinfolds can be measured, the tricep skinfold is easy to use and is a fairly accurate indicator of body fat.

Triceps skinfold is taken on the right upper arm.

1. First, measure the length of the upper arm with the forearm at a right angle to the upper arm (see illustration). Locate the bony projection at the shoulder (the tip of the acromium) and the body projection at the elbow (olecranon). Use the measuring tape to measure the distance between these two points. Find the mid-point of the upper arm and mark with a felt tip pen.

2. Drop the arm by the side of the body. Grasp the skinfold with the thumb and index finger just above the midpoint.

3. Measure the skinfold with the calipers. Apply enough pressure to the calipers so the black lines are aligned.

4. Record the skinfold measurement in millimeters on THE BODY SHOP - Handout #17.

Subscapular skinfold is also an accurate measurement for determining body fat. If time permits, this measurement can also be taken either by a nurse in the nurse's office or as a classroom demonstration with student volunteers. This measurement is taken at a point just below the bottom of the shoulder blade in the line of natural cleavage. Have the child clasp hands behind the back. Locate the bottom of the shoulder blade and mark with a felt tip pen. Grasp and measure the thickness of the skinfold just below your marked point. (see illustration). Measure the skinfold with the calipers. Record the measurement on THE BODY SHOP - Handout #17.

Scoring

The skinfold measurement is registered on the caliper's scale which measures from 0-60mm in 2mm increments. Measure the skinfold three times. Then record the average of the three measurements. If the three measurements are 12, 10, and 14, the number recorded will be 12. The recommended procedure is to measure the sum of the tricep and sub-scapular skinfold. However, the tricep skinfold is recommended if only one skinfold is measured. The student should compare the skinfold test score to the percentile rank by using TABLES 5 and 6. After determining the percentile ranking, the student should record the result on Handout #26, THE BODY SHOP.

Table 2-1. Percentile Norms. Ages 5-18 for the One Mile Run (minutes and seconds) for Boys.

	Age	5	6	7	8	9	10	11	12	13	14	15	16	17+
	Percentile													
	99	7:45	8:15	7:17	8:14	6:43	6:25	6:04	5:40	5:44	5:36	5:44	5:40	5:41
	95	9:02	9:06	8:06	7:58	7:17	6:56	6:50	6:27	6:11	5:51	6:01	5:48	6:01
A	90	9:41	9:30	8:36	8:12	7:29	7:26	7:19	6:44	6:22	6:05	6:08	6:02	6:13
	85	10:40	10:00	8:59	8:22	8:00	7:40	7:30	6:57	6:33	6:13	6:18	6:12	6:28
	80	11:13	10:23	9:18	8:45	8:22	7:57	7:48	7:12	6:42	6:21	6:29	6:22	6:30
	75	11:32	10:56	9:37	9:14	8:36	8:10	8:00	7:24	6:52	6:36	6:35	6:29	6:36
	70	11:50	11:20	9:46	9:31	8:50	8:23	8:08	7:37	7:00	6:41	6:42	6:41	6:42
B	65	12:34	11:33	10:04	9:43	9:02	8:34	8:21	7:48	7:06	6:48	6:56	6:47	6:57
	60	12:48	11:47	10:48	10:20	9:14	8:49	8:39	7:59	7:14	6:54	7:02	6:53	7:07
	55	13:17	12:03	11:10	10:41	9:30	9:03	8:56	8:08	7:20	7:01	7:07	7:03	7:15
C	50	13:46	12:29	11:25	11:00	9:56	9:19	9:06	8:20	7:27	7:10	7:14	7:11	7:25
	45	14:09	12:50	11:44	11:24	10:24	9:34	9:25	8:34	7:40	7:15	7:23	7:19	7:30
	40	14:17	13:20	12:04	11:49	11:01	9:45	9:46	8:51	7:51	7:24	7:30	7:27	7:45
D	35	14:52	13:55	12:44	12:12	11:25	10:10	10:10	9:10	8:02	7:34	7:41	7:40	7:58
	30	15:18	14:13	13:30	12:30	11:44	10:36	10:40	9:30	8:24	7:54	7:52	7:51	8:08
	25	16:05	15:10	14:02	13:29	12:00	11:05	11:31	10:00	8:35	8:02	8:04	8:07	8:26
	20	16:37	15:16	14:37	13:56	12:25	11:31	12:02	10:42	8:50	8:15	8:26	8:41	8:38
E	15	17:08	15:51	15:06	14:25	13:21	12:11	12:40	11:20	9:09	8:43	8:48	9:10	9:05
	10	17:21	16:56	15:50	15:16	14:19	13:00	13:37	12:07	9:39	9:30	9:25	9:52	10:37
	5	18:25	17:36	17:17	16:19	15:44	14:26	15:25	13:41	10:23	10:32	10:37	10:40	10:56

AAHPERD Health Related Physical Fitness Test

Table 2-2. Percentile Norms. Ages 5-18 for the One Mile Run (minutes and seconds) for Girls

	Age	5	6	7	8	9	10	11	12	13	14	15	16	17+
	Percentile													
	99	9:03	8:06	7:58	7:45	7:21	7:09	7:07	6:57	6:20	6:44	6:36	6:33	6:54
	95	9:45	9:18	8:48	8:45	8:24	7:58	7:48	7:26	7:10	7:18	7:39	7:07	7:26
A	90	11:23	9:52	9:35	9:30	8:44	8:30	8:10	7:44	7:45	7:39	8:01	7:47	8:05
	85	12:08	10:40	9:55	9:46	9:08	8:50	8:36	8:06	8:01	7:54	8:10	8:13	8:28
	80	12:46	11:06	10:27	10:17	9:31	9:10	8:57	8:16	8:12	8:03	8:24	8:33	8:44
	75	13:09	11:24	10:55	10:35	9:58	9:30	9:12	8:36	8:18	8:13	8:42	9:00	9:03
	70	13:26	11:46	10:55	10:50	10:07	9:47	9:28	8:55	8:27	8:23	8:58	9:26	9:10
B	65	13:52	12:26	11:24	11:06	10:17	10:02	9:44	9:06	8:41	8:37	9:10	9:52	9:41
	60	14:14	12:46	11:43	11:30	10:32	10:23	10:00	9:21	8:56	8:55	9:36	10:06	9:28
	55	14:42	13:10	12:03	11:43	10:56	10:49	10:16	9:33	9:14	9:04	9:47	10:21	9:34
C	50	15:08	13:48	12:30	12:00	11:12	11:06	10:27	9:47	9:27	9:36	10:05	10:45	9:47
	45	15:39	14:06	12:55	12:15	11:29	11:24	10:56	10:05	9:37	10:00	10:35	11:72	9:59
	40	16:20	14:19	13:42	12:45	12:00	11:41	11:12	10:22	9:57	10:20	10:51	11:35	10:04
D	35	17:07	14:51	14:06	13:15	12:20	11:51	11:29	10:38	10:12	10:40	11:43	12:00	10:14
	30	17:32	15:06	14:08	13:47	12:42	12:09	11:51	11:00	10:31	11:11	12:06	12:32	10:50
	25	17:58	15:27	14:30	14:16	13:18	12:54	12:10	11:35	10:56	11:43	12:21	13:00	11:28
	20	18:18	15:55	15:10	14:56	13:52	13:31	12:36	11:57	11:23	12:21	13:04	14:06	12:12
E	15	18:28	16:58	15:27	15:24	14:22	14:00	13:16	12:35	12:29	13:56	14:07	14:49	12:50
	10	18:38	18:11	16:03	16:30	15:25	15:12	14:41	13:34	13:08	15:20	15:25	15:02	13:05
	5	19:00	18:50	17:44	16:58	16:42	17:00	16:56	14:48	14:55	16:59	16:22	15:30	15:24

AAHPERD Health Related Physical Fitness Test

A = Very Fit; B = Above Average; C = Average; D = Needs Some Work; E = Needs a Lot of Work

Table 2-3. Percentile Norms. Ages 5-18 for the 9-Minute Run (yards) for Boys

	Age	5	6	7	8	9	10	11	12	13	14	15	16	17+
	Percentile													
	99	1975	2000	2400	2520	2450	2520	2520	2880	2615	2886	2757	2888	2888
	95	1760	1780	2030	2200	2175	2250	2250	2400	2402	2473	2544	2615	2615
A	90	1530	1660	1900	2100	2040	2120	2100	2175	2230	2301	2402	2888	2804
	85	1425	1564	1780	1940	1940	2013	2065	2042	2213	2284	2384	2485	2888
	80	1370	1525	1733	1870	1875	1950	1970	2000	2160	2221	2282	2888	2494
	75	1320	1460	1663	1810	1835	1910	1905	1975	2085	2167	2228	2282	2360
	70	1310	1440	1640	1770	1800	1865	1880	1900	2040	2120	2181	2282	2335
B	65	1275	1400	1580	1725	1780	1810	1860	1860	2000	2079	2160	2221	2282
	60	1220	1360	1540	1686	1740	1780	1808	1810	1984	2085	2106	2177	2246
	55	1200	1288	1480	1660	1686	1725	1770	1780	1888	1987	2088	2150	2210
C	50	1170	1280	1440	1625	1660	1680	1725	1780	1906	1986	2027	2088	2160
	45	1120	1238	1400	1540	1625	1620	1680	1740	1844	1915	1988	2027	2128
	40	1100	1200	1370	1500	1600	1600	1640	1680	1808	1877	1926	2019	2000
D	35	1075	1170	1340	1470	1537	1884	1600	1620	1782	1833	1804	1975	2048
	30	1010	1130	1310	1420	1480	1536	1575	1580	1731	1786	1888	1884	2006
	25	980	1080	1243	1380	1440	1487	1540	1500	1674	1748	1816	1887	1988
	20	940	1050	1195	1340	1370	1420	1440	1480	1620	1691	1782	1838	1904
E	15	880	990	1140	1263	1310	1356	1380	1356	1557	1628	1699	1770	1841
	10	830	940	1070	1180	1243	1250	1275	1300	1450	1521	1592	1663	1734
	5	800	816	980	1053	1104	1110	1170	1000	1388	1439	1510	1581	1652

AAHPERD Health Related Physical Fitness Test

Table 2-4. Percentile Norms. Ages 5-18 for the 9-Minute Run (yards) for Girls

	Age	5	6	7	8	9	10	11	12	13	14	15	16	17+
	Percentile													
	99	1884	1980	2340	2280	2300	2240	2170	2370	2197	2236	2273	2311	2349
	95	1540	1709	1900	1980	2080	2067	2000	2175	2085	2123	2161	2199	2237
A	90	1418	1620	1710	1750	1870	1900	1930	2070	2005	2043	2081	2119	2157
	85	1368	1564	1660	1665	1770	1780	1833	1940	1889	1937	1975	2013	2051
	80	1330	1520	1570	1600	1700	1760	1780	1840	1837	1875	1913	1951	1989
	75	1300	1440	1540	1540	1660	1660	1733	1780	1785	1823	1861	1899	1937
	70	1245	1380	1480	1520	1560	1600	1680	1735	1755	1776	1814	1852	1890
B	65	1225	1310	1460	1475	1540	1587	1620	1700	1669	1738	1774	1812	1850
	60	1220	1285	1408	1440	1515	1555	1570	1660	1655	1693	1731	1769	1807
	55	1185	1250	1380	1405	1475	1480	1550	1600	1617	1655	1693	1731	1769
C	50	1140	1208	1344	1368	1435	1460	1480	1580	1577	1615	1653	1691	1729
	45	1100	1180	1310	1330	1395	1435	1460	1542	1537	1575	1613	1651	1689
	40	1060	1140	1280	1315	1360	1375	1405	1500	1498	1537	1575	1613	1651
D	35	1010	1100	1225	1280	1320	1345	1380	1475	1456	1494	1532	1570	1608
	30	1000	1060	1180	1250	1280	1280	1366	1420	1416	1454	1492	1530	1568
	25	980	1017	1150	1225	1243	1250	1345	1360	1385	1407	1445	1483	1521
	20	886	980	1110	1180	1225	1230	1300	1220	1317	1355	1393	1431	1469
E	15	830	915	1080	1110	1130	1160	1200	1200	1255	1293	1331	1369	1407
	10	780	880	997	1066	1080	1100	1125	1130	1149	1187	1225	1263	1301
	5	700	780	880	970	980	940	904	1000	1069	1107	1145	1183	1221

AAHPERD Health Related Physical Fitness Test Norms

A = Very Fit; B = Above Average; C = Average; D = Needs Some Work; E = Needs a Lot of Work

AAHPERD Health Related Physical Fitness Test Items

Table 2-11. Percentile Norms. Ages 5-18 for Sit-ups for Boys

	Age	5	6	7	8	9	10	11	12	13	14	15	16	17+
	Percentile													
	99	47	47	53	55	52	59	61	68	70	70	69	70	65
	95	30	36	42	48	47	50	51	56	58	59	59	51	62
A	90	27	33	39	42	43	47	48	52	54	54	55	59	59
	85	25	30	37	40	41	44	46	50	52	52	52	55	58
	80	24	28	34	38	39	42	44	48	50	51	50	53	54
	75	23	26	33	37	38	40	42	46	48	49	49	51	52
	70	22	25	31	35	36	39	41	45	46	48	46	50	51
B	65	21	23	30	34	35	37	40	43	45	46	47	49	50
	60	20	22	29	32	34	36	39	42	44	45	46	47	49
	55	19	21	28	31	33	35	38	40	42	44	45	46	48
C	50	18	20	26	30	32	34	37	39	41	42	44	45	46
	45	17	19	25	29	31	33	35	38	40	41	42	44	45
	40	15	18	24	29	30	31	34	36	39	40	41	42	44
D	35	14	17	22	28	29	30	33	35	38	39	40	40	43
	30	13	16	21	26	27	29	31	33	36	38	39	39	40
	25	11	15	19	25	25	27	30	31	35	36	38	38	38
	20	9	13	17	23	24	25	28	30	33	35	36	35	37
E	15	7	12	15	21	22	23	26	28	31	33	34	33	34
	10	5	9	14	19	20	19	23	25	29	31	31	30	31
	5	2	6	10	15	15	15	17	19	25	27	28	28	25

AAHPERD Health Related Physical Fitness Test

Table 2-12. Percentile Norms. Ages 5-18 for Sit-ups for Girls

	Age	5	6	7	8	9	10	11	12	13	14	15	16	17+
	Percentile													
	99	35	42	51	55	51	54	55	61	60	57	64	63	65
	95	28	35	40	44	44	47	50	52	51	51	56	54	54
A	90	27	32	37	41	41	44	46	48	48	48	50	50	50
	85	25	30	34	38	39	41	44	45	46	45	47	49	47
	80	24	29	32	36	37	40	42	43	43	43	45	45	45
	75	24	28	31	35	35	39	40	41	41	42	43	42	44
	70	23	26	30	34	34	37	39	40	40	40	41	39	43
B	65	22	25	29	32	33	35	37	40	39	39	41	37	42
	60	20	24	28	31	31	34	36	39	37	38	40	35	40
	55	20	23	27	30	30	33	35	37	36	37	38	34	39
C	50	19	22	25	29	29	32	34	36	35	35	37	33	37
	45	18	20	24	28	28	30	33	35	34	34	35	32	36
	40	16	19	23	27	27	29	32	33	33	33	33	31	35
D	35	15	18	22	25	26	28	30	32	32	32	32	30	33
	30	13	16	21	23	25	26	29	31	30	31	31	30	32
	25	12	14	20	22	23	25	28	30	29	30	30	29	31
	20	10	13	19	20	21	23	26	29	27	28	28	26	29
E	15	9	11	16	19	19	21	24	27	25	26	27	25	27
	10	6	9	13	17	17	19	21	23	23	24	25	23	25
	5	2	6	10	12	14	15	18	19	18	20	20	20	19

A = Very Fit; B = Above Average; C = Average; D = Needs Some Work; E = Needs a Lot of Work

AAHPERD Health Related Physical Fitness Test Items

Table 2-13. Percentile Norms. Ages 5-18 for Sit and Reach (cm) for Boys

	Age	5	6	7	8	9	10	11	12	13	14	15	16	17+
	Percentile													
	99	36	37	38	38	37	37	38	52	41	43	47	45	48
	95	32	34	33	34	34	33	34	35	36	39	41	42	45
	90	31	32	31	32	32	31	32	32	34	37	39	40	43
A	85	30	31	30	31	31	30	31	31	33	36	37	38	41
	80	29	30	29	30	30	29	30	30	32	34	36	37	40
	75	29	29	28	29	29	28	29	29	30	33	34	36	40
	70	28	28	27	28	28	28	28	29	29	31	33	35	38
B	65	27	28	27	27	28	27	27	28	28	30	32	34	37
	60	26	27	26	27	27	26	26	27	27	30	32	32	36
	55	26	26	25	26	26	26	26	27	27	29	31	31	35
C	50	25	26	25	25	25	25	25	26	26	28	30	30	34
	45	25	25	24	25	25	24	24	25	25	27	29	29	33
	40	24	24	24	24	24	23	23	24	24	26	28	28	32
D	35	23	24	23	23	23	22	23	23	23	25	27	27	31
	30	23	23	22	23	22	21	22	22	22	24	26	26	30
	25	22	22	22	22	22	20	21	21	20	23	24	25	28
	20	22	22	20	21	21	19	20	20	19	22	23	23	26
E	15	21	20	19	20	20	18	18	18	18	21	22	21	25
	10	19	18	18	18	18	17	18	18	15	18	19	18	23
	5	17	16	16	16	16	12	12	13	12	15	13	11	15

AAHPERD Health Related Physical Fitness Test

Table 2-14. Percentile Norms. Ages 5-18 for Sit and Reach (cm) for Girls

	Age	5	6	7	8	9	10	11	12	13	14	15	16	17+
	Percentile													
	99	37	38	37	39	39	41	41	46	49	49	49	48	47
	95	34	34	34	36	35	35	37	40	43	44	46	46	44
	90	32	33	33	34	34	34	36	38	40	42	44	43	43
A	85	31	32	32	33	33	33	34	36	38	40	43	42	42
	80	31	31	31	32	32	32	33	35	37	39	42	41	41
	75	30	30	31	31	31	31	32	34	36	38	41	39	40
	70	29	29	30	30	30	30	31	33	35	36	40	38	40
B	65	28	29	29	30	30	29	30	32	33	36	39	37	39
	60	28	28	29	29	29	29	30	32	32	35	37	36	37
	55	27	27	28	28	28	28	29	31	31	34	37	35	36
C	50	27	27	27	28	28	28	29	30	31	33	36	34	35
	45	26	26	27	27	27	27	28	29	30	32	34	33	34
	40	25	25	26	26	26	27	27	28	29	31	33	33	33
D	35	25	25	26	25	25	26	26	27	27	30	32	32	33
	30	24	24	25	24	24	25	25	26	26	29	32	31	32
	25	23	23	24	23	23	24	24	25	24	28	31	30	31
	20	23	22	23	22	22	22	23	23	23	26	30	28	29
E	15	22	22	22	21	21	21	22	22	22	24	28	26	28
	10	20	20	20	19	20	19	20	20	20	23	25	23	26
	5	18	18	16	17	17	16	16	15	17	18	19	14	22

A = Very Fit; B = Above Average; C = Average; D = Needs Some Work; E = Needs a Lot of Work

Table 2-9. Percentile Norms. Ages 6-18 for Triceps Skinfold for Boys

	Age	6	7	8	9	10	11	12	13	14	15	16	17
	Percentile												
Below Normal	95	5	4	4	5	5	5	5	4	4	4	4	4
Minimal	90	5	5	5	6	6	6	6	5	5	5	5	5
Low	75	6	6	6	7	7	7	7	7	6	6	6	6
	50	8	8	8	8	9	10	9	9	8	8	8	8
Average	25	9	10	11	12	12	14	13	13	12	11	11	11
High	10	12	12	14	16	16	19	20	19	17	16	16	16
	5	13	14	17	20	20	22	23	23	21	21	20	20

Table 2-10. Percentile Norms. Ages 6-18 for Triceps Skinfold for Girls

	Age	6	7	8	9	10	11	12	13	14	15	16	17
	Percentile												
Below Normal	95	6	6	6	6	6	6	6	6	7	7	8	8
Minimal	90	6	6	6	7	7	7	7	7	8	9	9	10
Low	75	7	8	8	9	9	9	9	9	11	12	12	12
	50	9	10	10	11	12	12	12	12	14	15	16	16
Average	25	11	12	14	14	15	15	16	17	18	20	21	20
High	10	14	16	18	19	20	20	22	23	23	25	26	25
	5	16	17	20	22	23	23	25	26	27	29	30	29

Table 2-7. Percentile Norms. Ages 6-18[a] for Sum of Triceps plus Subscapular Skinfolds (mm) for Boys[b]

	Age	6	7	8	9	10	11	12	13	14	15	16	17
	Percentile												
Below Normal	99	7	7	7	7	7	8	8	7	7	8	8	8
	95	8	9	9	9	9	9	9	9	9	9	9	9
Minimal	90	9	9	9	10	10	10	10	10	9	10	10	10
Low	85	10	10	10	10	11	11	10	10	10	11	11	11
	80	10	10	10	11	11	12	11	11	11	11	11	12
	75	11	11	11	11	12	12	11	12	11	12	12	12
Low Average	70	11	11	11	12	12	12	12	12	12	12	12	13
	65	11	11	12	12	13	13	13	12	12	13	13	13
	60	12	12	12	13	13	14	13	13	13	13	13	14
	55	12	12	13	13	14	15	14	14	13	14	14	14
	50	12	12	13	14	14	16	15	15	14	14	14	15
High Average	45	13	13	14	14	15	16	15	16	14	15	15	16
	40	13	13	14	15	16	17	16	17	15	16	16	16
	35	13	14	15	16	17	19	17	18	16	16	17	17
	30	14	14	16	17	18	20	19	19	18	18	18	19
	25	14	15	17	18	19	22	21	22	20	20	20	21
High	20	15	16	18	20	21	24	24	25	23	22	22	24
	15	16	17	19	23	24	26	27	29	27	25	24	26
	10	18	18	21	26	28	33	33	36	31	30	29	30
	5	20	24	28	34	33	38	44	46	37	40	37	38

[a]The norms for age 17 may be used for age 18.

[b]Based on data from Johnston, F. E., D. V. Hamill, and S. Lemeshow. (1) *Skinfold Thickness of Children 6-11 Years* (Series II, No. 120, 1972), and (2) *Skinfold Thickness of Youths 12-17 Years* (Series II, No. 132, 1974). U.S. National Center for Health Statistics, U.S. Department of HEW, Washington, D.C.

AAHPERD Health Related Physical Fitness Test Items

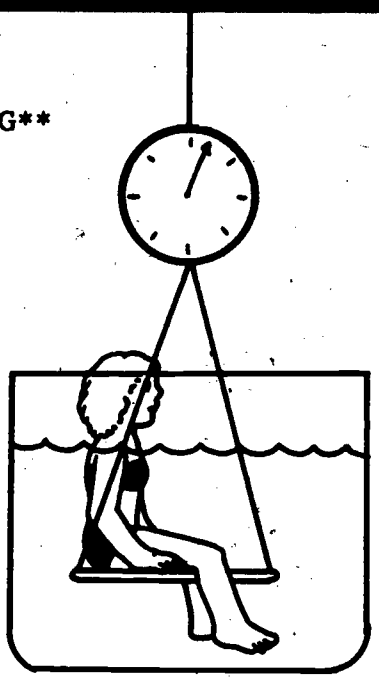
Table 2-8. Percentile Norms. Ages 6-18[a] for Sum of Triceps plus Subscapular Skinfolds (mm) for Girls[b]

	Age	6	7	8	9	10	11	12	13	14	15	16	17
	Percentile												
Below Normal	99	8	8	8	9	9	8	9	10	10	11	11	12
	95	9	10	10	10	10	11	11	12	13	14	14	15
Minimal	90	10	11	11	12	12	12	12	13	15	16	16	16
Low	85	11	12	12	12	13	13	13	14	16	17	18	18
	80	12	12	12	13	13	14	14	15	17	18	19	19
	75	12	12	13	14	14	15	15	16	18	20	20	20
Low Average	70	12	13	14	15	15	16	16	17	19	21	21	22
	65	13	13	14	15	16	16	17	18	20	22	22	23
	60	13	14	15	16	17	17	17	19	21	23	23	24
	55	14	15	16	16	16	18	19	20	22	24	24	26
	50	14	15	16	17	18	19	19	20	24	25	25	27
High Average	45	15	16	17	18	20	20	21	22	25	26	27	28
	40	15	16	18	19	20	21	22	23	26	28	29	30
	35	16	17	19	20	22	22	24	25	27	29	30	32
	30	16	18	20	22	24	23	25	27	30	32	32	34
	25	17	19	21	24	25	25	27	30	32	34	34	36
High	20	18	20	23	26	28	28	31	33	35	37	37	40
	15	19	22	25	29	31	31	35	39	39	42	42	42
	10	22	25	30	34	35	36	40	43	42	46	46	46
	5	26	28	36	40	41	42	46	51	52	56	57	58

[a]The norms for age 17 may be used for age 18.

[b]Based on data from Johnston, F. E., D. V. Hamill, and S. Lemeshow. (1) *Skinfold Thickness of Children 6-11 Years* (Series II, No. 120, 1972), and (2) *Skinfold Thickness of Youth 12-17 Years* (Series II, No. 132, 1974). U.S. National Center for Health Statistics, U.S. Department of HEW, Washington, D.C.

HYDROSTATIC WEIGHING**



Weighing a person completely submerged underwater is called hydrostatic weighing. Underwater weighing is part of a method of determining a subject's body fat percentage. Underwater weighing provides information on the person's body volume which is necessary for calculating body density and percentage of fat. The theory behind the hydrostatic method is that a person weighs less underwater than on land. How much less the person weighs underwater depends on the person's body density. It is known that fat floats on water because fat is less dense than water. On the other hand, lean mass (muscle, bones, etc.) sinks in water because the mass is more dense than water. Therefore, a fat person will tend to float because of the buoyancy effect of a large amount of low-density fat while a lean person will struggle to float because his high body density will tend to sink in water.

With these principles in mind, the person's body fatness can be estimated using the following questions:

$$\text{Body volume} = \text{weight on land} - \text{weight in water}$$

$$\text{Body density} = \frac{\text{weight}}{\text{volume}} = \frac{\text{weight on land}}{\text{weight on land-weight in water}}$$

$$\text{Percent fat} = \frac{*\ 495}{\text{body density}} - 450$$

*The equation is known as the "Siri equation" that incorporates values derived from the densities of fat and fat-free tissues.

Description

The subject is first weighed on land. Then, the person is submerged in water, usually while seated on a light-weight chair suspended from a scale. The obese person may need to be weighed with a pre-weighed diver's belt to prevent them from floating. After blowing out all residual air in the lungs, the subject is weighed. The procedure is repeated several times to maximize the removal of the lung's residual air. The weight of the chair and belt weights used are subtracted from the total weight to calculate the person's true underwater weight. Corrections are made for other factors such as air remaining in the lungs and in the

intestinal tract. The underwater weighing method may vary depending on the type of equipment available. For example, subjects are sometimes weighed in water while lying on their stomach or back. Also, a swimming pool can be used in lieu of a tank.

Summary

Hydrostatic weighing and skinfold measurements used in estimating percent body fat can help approximate a person's ideal body weight (IBW), weight loss needed to reach ideal body weight, and any changes in an athlete's percent body fat needed to meet the recommended body fatness for a given sport. See Section A - Sports Nutrition Basics and page 44.

**This technique is not part of the AAHPERD Test, but is another method of determining body composition.

GENERAL FITNESS PRINCIPLES

1. **Overload:** In order to achieve a gain in strength from a muscle or muscle group, it is necessary to stress that muscle beyond the point to which it is normally stressed. The demands of the exercise must be sufficient to force adaptation. Exercise that is too mild will not be valuable for improving an athlete's physical condition.

2. **Specificity:** The physical adaptations that occurs with training is specific to the type of training performed. If flexibility is the desired result, exercises specific for increase in range of motion must be performed. It is hypothesized that much of the training adaptation comes from a learning effect of the central nervous system, and more efficient nervous system processing with repeated use of body motions.

3. **Reversibility:** Training effects diminish quickly. Upon cessation of an exercise program, physical training effects reverse dramatically in the first two weeks. Hence the saying, if you don't use it, you lose it.

4. **Individuality:** Since individual tolerance for exercise varies, it becomes necessary to have a gradual progression of intensity and duration of exercise. Individual pacing is important, based on fitness level, skill level and rate of progression.

AEROBIC TRAINING PRINCIPLES

F - Frequency
Minimum of 3 times per week
3-5 is recommended, alternating days.

I - Intensity
Working at 60-85% of maximum heart rate.
(Target Heart Rate Zone)

T - Time or duration
20 minutes per exercise session, working at Target Heart Rate Zone.
40-60 minutes are suggested to include adequate warm-up and cool-down time.

T - Type of Activity
Aerobic, continuous and rhythm, walking, jogging, swimming, cycling, rope jumping, aerobic dance, cross-country skiing, hiking.

TRAINING TERMS

1. Aerobic: Aerobic means with air, oxygen. Aerobic exercise is that which promotes the supply and use of oxygen. It is, therefore, exercise that can be performed rhythmically and continuously enough to enable a continual supply of oxygen to reach the muscle cells, while retaining a training heart rate (HR). The best forms of exercise that meet this criteria are walking, jogging, swimming, bicycling, or aerobic dance.

2. Anaerobic: Anaerobic means without air, oxygen. Anaerobic exercise is that in which the activity is so rapid that the body cells cannot process enough oxygen to meet the muscle cells' needs. As a result, the muscles can continue the activity for only a short duration. Anaerobic exercise examples include sprints in running or swimming or any sport activity where a maximum effort is required.

3. Interval Training: A series of repeated bouts of exercise alternated with periods of relief. Light or mild exercise usually constitutes the relief period. Interval training thus is intermittent in nature, alternating periods of high stress with ones of lower stress.

4. Circuit Training: The procedure involves a sequence of 5 to 10 exercises with variable repetitions or resistance. To increase physical demands, the exercises can be intensified by increasing the number of repetitions or amount of resistance.

5. Isokinetic Contraction: Contraction in which the muscle generates force against a resistance.

6. Isometric Contraction: Contraction in which the force exerted by the muscle results in no observable movement.

7. Isotonic Contraction: Contraction in which the muscles generate force against a constant resistance and movement results, either shortening (concentric) or lengthening (eccentric).

HEART RATE TERMS

1. Resting HR: HR upon awakening from sleep. The lower the HR at rest, THE BETTER CONDITION A PERSON IS IN. American Heart Association accepts 50-100 bpm as normal resting. Women's HR are 7-8 beats higher than men's. Average HR is 70-80 bpm.

2. Training or Target HR (also called exercise or working HR): The working HR is taken during exercise or not more than 5 seconds following exercise cessation. Training HR values range between 60-85% of the maximal HR. Research has proven that exercising at this percentage is sufficient to work the heart hard enough to give a training effect, i.e., strengthen the heart. Exercise HR increases linearly with work load.

3. Maximal HR: The peak HR or fastest rate at which the heart can work. Maximal HR is reached in exhaustive exercise or laboratory testing. A reliable formula to estimate max HR is: 220 - age = Max HR. This is reliable + or - 5-8 beats. Max HR is purely a function of age. No amount of training will increase it.

4. Recovery HR: HR taken a set period of time following exercise cessation (30 seconds and up) the faster the heart returns to the normal or resting rate, following exercise, the better condition it is in.

Compiled by Desert SW Fitness

FITNESS COMPONENTS

Component	Definition	Training Principles	Physiological Factors	Assessment
Major:				
Flexibility	Range of movement about a joint or sequence of joints; muscle elasticity as lengthening capacity.	Static (slow, continuous, stationary) stretching as opposed to ballastic (bouncing) stretching. Stretch prior to and following aerobic exercise. Feel tension not pain or strain.	Muscle spindle golgi tendon organ, reciprocal innervation (antagonistic muscle group), muscles, tendons, and ligaments.	Sit and Reach Test
Muscular Strength and Endurance	Strength is the capacity to exert a maximal force while endurance is the capacity to exert that force over time, resisting muscular fatigue. Power is the rate of producing that force.	High load, low repetition for maximum strength, bulk, definition. Low load, high repetition for maximum tone or endurance, less hypertrophy. Training one limb will result in a training effect in the opposite limb (cross innervation); rehabilitative significance. Isometric, isotonic, isokinetic (see terms).	Muscle cell, muscle unit area, hypertrophy-atrophy, oxygen supply to unit area, innervation/contraction process, testosterme level, cross-over effect, slow twitch and fast twitch muscle fiber.	1-minute Sit-up Test, Bench Press Test

Component	Definition	Training Principles	Physiological Factors	Assessment
Cardiovascular Endurance	The ability of the heart muscle, respiratory system, and blood vessels to utilize oxygen over a period of time; stamina or overall body endurance.	Frequency--3-5 sessions per week. Intensity --60-85% of maximal HR. Duration--20-60 minutes. Type of activity--slow, continuous, rhythmic.	Oxygen consumption, heart rate, vital lung capacity, muscle hypertrophy, coronary artery condition.	Step Test; 12 minute walk/run or swim; 1.5 mile run; 3 mile walk; exercise stress test, submaximal or maximal.
Body Composition	Percent lean body mass (muscle, bone, organs) relative to percent body fat.	"Spot reduction" exercise leads to increased muscle tone in the muscle groups exercised, but no guarantee of decreased fat in the muscle or muscle surface. Endurance activity slowly and consistently expends overall calories. Low-level endurance activity (60%) results in burning of 60% fat, whereas higher levels utilize more carbohydrate as the fuel source. Endurance activity decreases appetite.	Caloric intake versus expenditure, metabolism --BMR and exercise metabolism, appetite control mechanisms, muscle and fat cell development, size, and weight, nutrients.	Measurements, skin-fold measures, underwater weigh.

FITNESS FACTS

Evaluating your exercise program

by Shelley Whitlatch

If you are one of the millions of Americans who have jumped on the fitness bandwagon, evaluating your exercise program may be advantageous to determine how well it follows the exercise principle. Exercise physiology research, on both highly trained athletes and average individuals, has replaced the guesswork and superstitions of the old exercise workout with scientific foundations that promote a quality fitness program.

The progression of every exercise session should include a warm-up, a muscular strength and endurance segment, aerobic conditioning, and a cool-down.

Warm Up:

The warm-up involves activity that gradually increases the heart rate and body temperature. Stretching, joint preparation, and low-key whole-body exercise such as walking, jumping jacks, or jump roping are part of this warm-up. Warm-up duration should range from 8 to 15 minutes.

Muscular Strength and Endurance:

Muscular strength and endurance work should include exercises for the abdominals, upper body, hips, and thighs. This portion of the workout may be 10 to 30 minutes, depending on the amount of emphasis placed on this component of fitness. Familiar exercises in this area are sit-ups, push-ups, leg-lifts, and weight training exercises.

Aerobic Principles:

The aerobic portion of the workout must adhere to the following training session principles.

F—*Frequency* 3-5 sessions per week
I—*Intensity* 60-85% of maximum heart rate
T—*Time or duration* 20 minutes minimum at target heart rate
T—*Type of exercise* slow, continuous, rhythmic activity

In regard to frequency, spread your exercise sessions throughout the week so that no more than two days pass without exercise.

To calculate your training or target heart rate level (THR), utilize the table below. Find your age in the left column. Moving to the right across the table, determine the number at 60% and at 85%. This is your THR zone. For example, THR for a 46 year-old would be 18-26 pulse beats during a 10-second count.

To further individualize your THR, take your perceived exertion into account. For example, if your THR is 22-26 and you're very tired when exercising at a pulse rate of 25-26, slow your pace down to the lower levels of your THR zone. Conversely, if you feel little or no stress, increase your THR to the mid to upper level of your zone.

Learn to be aware of both how you feel and your heart rate. You should never feel strain or pain. Another good rule of thumb is being capable of talking with someone while you are exercising. Finally, you should be able to continue your level of exercising for 20 minutes. Research has shown that a period of work shorter than 20 minutes is not sufficient overload to train or improve the condition of your cardio-respiratory system.

The best aerobic activities are jogging, swimming, bicycling, and cross-country skiing. Good endurance activities include brisk walking, aerobic dance, and folk or social dance. Recreational games like racquetball, basketball, and soccer can be aerobic providing work continues at the THR level for 20 minutes continuously. Research has not proven tennis to be aerobic.

Cool Down:

The final segment of the workout is the cool-down. The purpose of the cool-down is to gradually slow your heart rate from exercise level to recovery level. Exercise at this pace continues circulation, thereby ridding the muscle unit area of lactic acid, a waste-product of exercise that causes muscle soreness or tightness.

The cool-down may include (1) slow, rhythmic movements such as walking, arm swings, etc., (2) stretching to again stretch those muscles shortened by the jarring of jogging or aerobic dance, (3) additional abdominal or hip exercise if this is a problem area, and (4) a relaxation component. For relaxation try deep breathing or muscle contraction and release. The recovery heart rate should be 120 beats per minute or less by the end of the cool-down.

The same sample workout progressions below suggest a time plan for your exercise program.

45 Minute Program
10 min. warm-up
8 min. muscular strength & endurance
20 min. aerobic
7 min. cool-down

60 Minute Program
10 min. warm-up
5 min. muscular strength & endurance
30 min. aerobic
5 min. muscular strength & endurance
10 min. cool-down

Adherence to proper exercise progression and aerobic principles will ensure maximum conditioning during your exercise time. It will also lead to a more injury-free, enjoyable program that will make fitness a fun and essential part of your everyday lifestyle.

Training Heart Rate 10 second count

Age	Estimated Maximum Heart Rate	Percent of Maximum HR 60%	70%	80%	85%
10-14	210-205	21	24	28	29
15-16	205-204	21	24	27	29
17-18	203-202	20	24	27	28
19-21	201-199	20	23	27	28
22-24	198-196	20	23	26	28
25-27	195-193	19	23	26	27
28-30	192-189	19	22	25	27
31-33	189-187	19	22	26	27
34-36	186-184	18	22	26	26
37-39	183-181	18	21	24	26
40-42	180-178	18	21	24	25
43-45	177-175	18	20	23	25
46-48	174-172	17	20	23	25
49-51	171-169	17	20	23	24
52-54	168-166	17	19	22	24
55-57	165-163	16	19	22	23
58-60	162-160	16	19	21	23
61-63	159-157	16	18	21	22
64-66	156-154	15	18	21	22
67-69	153-151	15	18	20	22
70-72	150-148	15	17	20	21
73-75	147-146	15	17	19	20

Shelley Whitlatch earned an M.S. in exercise physiology from the University of Arizona in 1977. She is currently the owner of Desert Southwest Fitness, a firm which designs and coordinates corporate fitness programs.

The following reprint summarizes key information about fitness assessment and conditioning.

----- NOTES -----

PHYSICAL CONDITIONING OF THE YOUNG ATHLETE

Introduction

Like his more mature counterpart, the young athlete needs to concentrate on physical conditioning to develop his full athletic potential. In addition to the obvious gains made in endurance, speed, and strength, physical conditioning in the young athlete promotes a better learning and execution of sports skills, mental alertness, reduction in the potential for serious injury, faster recovery from injuries, better tolerance to extremes in altitudes or climate and, most important, a more efficient athlete.

General Conditioning

Since physical conditioning is essential to any youth sports program, it is important to understand the basic scientific principles of conditioning and how they relate to the training program of the preadolescent and adolescent athlete. The young athlete needs to work on each of the basic components of conditioning - strength, muscular endurance, power, agility, speed and reaction time, flexibility, neuromuscular skill, and cardiovascular endurance. In addition, he must have the proper body composition. The degree to which the athlete concentrates on each of these areas depends largely on the sport he is training for, and even on the specific position or event within that sport. The upper body strength necessary for success in shot-putting is not a prerequisite for success in distance running, although a certain minimal level of upper body strength is required. Likewise, the size required of the interior lineman in football is quite different from that required of the defensive back.

Most sports depend heavily on the development of more than one component. For example, a batter in baseball requires power, agility, speed, and neuromuscular skill, while a center in basketball depends on strength, endurance, speed, and neuromuscular skill. Also, many of these components are interrelated. Muscular endurance requires a certain level of body strength, and speed is greatly influenced by body composition. In a study of professional football players,[1] a correlation of r-0.66 was found between the time required to complete the 40-yard dash and the player's total amount of body fat, i.e., the more fat he carried, the slower he was. Excess body fat has a definite negative influence on almost all of the other components. Thus, the ratio of fat to total weight should be in proper proportion, which means that body composition should certainly be less than 15% relative fat for males and 20% for females.

Body fat can be measured accurately by submerging the athlete in water and determining his weight following a maximal expiration. This weight, corrected for trapped air volumes such as the residual volume and gastrointestinal gas volume and total body weight, are placed in an equation to estimate total body density. Total body density can then be used to fractionate total body weight into lean

weight and fat weight. This technique, however, will tend to overestimate the fat component in youngsters who have not attained full bone maturation and muscle growth. It is assumed that during growth and development, the density of the lean tissue is constantly increasing until it reaches its adult value at full maturation. Body composition can also be estimated from regression equations using skinfolds, muscle girths, or bone diameters, singularly or in combinations. Figure 1 illustrates the underwater weighing and Figure 2 the skinfold techniques. Table 1 provides estimates of the body composition values for male and female athletes in various sports.

Figure 1. Weighing the athlete underwater, determining body-density from which estimates of body fat content and lean body mass can be made.

Figure 2. Measuring the skin-fat fold at specific body-sites can be used to estimate the percentage of total body weight that is composed of body fat.

Table 1. Relative body fat values for males and females in various sports.*

Sport	Males fat %	Females fat %
Baseball-Softball	12-14	16-26
Basketball	7-10	16-27
Football	8-18	--
Gymnastics	4- 6	9-15
Ice Hockey	13-15	--
Jockeys	12-15	--
Skiing	7-14	18-20
Soccer	9-12	--
Speed Skating	10-12	--
Swimming	5-10	14-26
Track and Field		
Sprinters	6- 9	8-20
Middle Distance Runners	6-12	8-16
Distance Runners	4- 8	6-12
Discus	14-18	18-24
Shot Put	14-18	20-30
Jumpers and Hurdlers	6- 9	8-16
Tennis	14-16	18-22
Volleyball	8-14	16-26
Weightlifting	8-16	--
Wrestling	4-12	--

*The values represent the range of means reported in various published and unpublished studies.

Physiological Changes

As the young athlete participates in a conditioning program, many physiological changes take place that enhance his athletic performance. Increases in strength are accompanied by an increase in the muscle size of the male, while the female has little, if any, gain in muscle size with increasing strength. Thus, strength gains are not dependent on gains in muscle size. The factors influencing changes in both strength and size are not well understood. Strength is possibly more a phenomenon of reduced neurological inhibitions, while size could be triggered by the male androgenic hormones.[2] In any case, a 5% per week gain in strength over several weeks is considered to be a substantial improvement.

Endurance conditioning is of two basic types, muscular and cardiorespiratory. Muscular endurance is closely related to strength training. Cardiorespiratory endurance refers to the ability to resist fatigue in a total body exercise, e.g., distance running. The cardiorespiratory endurance component is important for nearly every sporting event or activity. The football player relies on short bursts of activity from play to play; thus, football is predominantly a speed and power type of activity requiring considerable anaerobic conditioning. However, when it comes time to play the fourth quarter, the endurance component becomes critical. A player with poor endurance will be fatigued, will not be able to execute properly, and will be more prone to serious injury.

The best physiological estimate of both total body and cardiorespiratory endurance is one's maximal aerobic power, which is represented by the maximal oxygen uptake (VO_2 max). VO_2 max is typically assessed during a treadmill or bicycle ergometer test to exhaustion (Fig. 3, 4). As the speed and/or grade on the treadmill or the resistance on the bicycle is increased, there is a proportional increase in the oxygen consumed, until that point where the body has reached its capacity to supply oxygen to the muscles with further increases in work.

Exhaustion will result shortly thereafter, as a result of the inability of the body to meet the demands of the working muscles for oxygen. VO_2 max is sensitive to both conditioning and deconditioning.[3] The highest values recorded (approximately 75 to 95 ml/kg per min) have been found in male long-distance runners and cross-country skiers. Typical values for athletes in various sports are presented in Table 2. Endurance training can significantly improve maximal oxygen uptake in youth athletes. Ekblom[4] noted a 15% improvement in six 11-year-old boys over a 6-month period of training. Dobeln and Eriksson[5] noted a 12% to 14% improvement in 12 boys, 11 to 13 years of age, after a 4-month training program. Daniels et al[6] noted no change in young, 10 to 18-year old, male middle-distance runners relative to their VO_2 max expressed per unit of body weight, as they were followed longitudinally from 2 to 5 years, although absolute VO_2 max in liters per minute continued to increase in direct proportion to body weight. Ekblom[7] has noted

similar plateaus in VO_2 max with further training in well-trained young athletes. Astrand and Rodahl[8] present similar data for adults, but indicate that further training can increase the percentage of the maximal aerobic capacity that may be used during prolonged work. Drinkwater[9] reported similar changes in the endurance capacity of women with training.

Figure 3. The bicycle ergometer, which can be used to measure maximum oxygen uptake when used with appropriate apparatus to determine oxygen utilization as shown in the figure with the treadmill.

Figure 4. Monitoring heart rate, the electrocardiogram, and measuring the maximum oxygen uptake using the treadmill.

Table 2. Maximal oxygen uptake values for males and females in various sports.*

Sport	Males ml/kg/min	Females ml/kg/min
Baseball/Softball	48-54	42-52
Baseball	42-56	40-48
Bicycling (competitive)	66-72	48-60
Football	44-60	
Gymnastics	52-60	36-48
Ice Hockey	52-62	
Jockeys	50-60	
Orienteering	48-56	
Skiing (cross country)	75-95	65-75
Soccer	55-65	
Speed Skating	56-75	46-58
Swimming	50-65	38-56
Track and Field		
Sprinters	44-60	38-52
Middle Distance	66-72	54-64
Distance	68-84	56-74
Discus	42-50	30-44
Shot Put	42-50	30-44
Volleyball	46-60	38-50
Weightlifting	40-50	
Wrestling	52-62	

* The values represent the range of means reported in various published and unpublished reports

Anaerobic power is an extremely important physiological concept relative to athletic performance, but unfortunately, it is not easily defined, and is even more difficult to measure in the laboratory. Anaerobic metabolism is available for use while the aerobic system is being mobilized for action during the first few seconds to minutes of exercise, and is available at that point when an athlete reaches his maximal aerobic power, although anaerobic metabolism is undoubtedly ongoing throughout the entire exercise bout, but at a very low rate. The term "anaerobic power" is used loosely to define that quality of the athlete to utilize maximally his available anaerobic resources. How does one measure this? Several field tests have been developed that claim to measure this important characteristic of the athlete, but their validity is questionable. In the laboratory setting, attention is now being directed toward the concept of anaerobic threshold,[10] which defines that workload, or fraction of VO_2 max at which point the blood lactate levels begin to increase above the initial baseline levels. While this concept is presently attractive, considerable developmental work must be completed before it can be applied to the training of athletes. Conditioning also substantially changes power and agility, although such changes are difficult to quantify. Power is improved through a combination of strength and speed gains, while agility is improved by gains in strength, speed, coordination, and flexibility. Speed may or may not be altered with training. It will increase with growth in both men and women, but if an athlete already has considerable experience in running, his speed may increase very little with further training. Strength, flexibility, and anaerobic power are the key factors to be emphasized in training programs for speed development, recognizing that any change will be modest.

It is important to understand that the degree of improvement in any of these components of athletic performance is limited by one heredity. Shephard[11] pointed out that the average person can greatly improve his overall physical fitness, but he is unlikely to close more than a fraction of the gap between his values and those of a champion athlete. Astrand[12] comments, "I am convinced that anyone interested in winning Olympic gold medals must select his or her parents very carefully." It is important to recognize this factor when training young athletes.

Conditioning Programs

Strength

Strength is largely increased through weight-training programs. These can be in the form of isometric (maximal or near maximal contraction with no external movement), isotonic (maximal or near maximal contraction moving a fixed weight through the full range of joint motion, i.e., traditional weight training), or accommodating resistance training (the weight lifted is varied through the full range of motion to simulate the strength curve of the muscle, attempting to provide a fixed percentage of maximal contraction

throughout the full range of joint motion). Another form of strength training has recently been developed, which is termed isokinetic strength training. With isokinetic training, the resistance will match exactly the force that is being applied by the muscles, with the motion being controlled at a fixed speed of movement. The isokinetic approach is logically the most efficient and should result in the greatest strength gains, because one is able to tax the muscle or muscle group maximally throughout the full range of motion. This system of training would appear to be the safest for young athletes, since there are no moving weights involved, and the resistance is never more than the force one can exert. No matter which approach is used, two important concepts must be applied -- overload and progressive resistance. Overload means placing a demand on the muscle in excess of that to which it is normally exposed. Progressive resistance means that as the muscle becomes stronger, the external load or resistance must be proportionally increased. Although general strength training is important for most sports or activities, certain sports require special routines to strengthen those muscles of primary use in the activity. For example, the pitcher in baseball or the quarterback in football can profit from resisted movements simulating the throwing action. Swimmers have successfully used strength training both in and out of the water that simulate their competitive strokes. For such specialized sports, strength-training should be very specific to the actual movements employed in those sports, including performance of the strength-training program at speeds approximating those attained in competition. The area of strength training is one in which there are many claims being made, but very little hard data to back up these claims. To date, there is little evidence that would support the use of one system of strength training over another, despite those claims made by individuals with vested interests.

Cardiorespiratory Endurance

There are several efficient ways of training for cardiorespiratory endurance. Slow, interval running, and long, slow, distance running are the two most popular forms of endurance training. Slow, interval running involves running intervals of approximately 2 to 2½ minutes, or 600 to 800 meters, alternating with slow jogging. Repetition running is similar to slow, interval running, except that the distance is increased up to 2 miles. Walking or jogging is interspersed between runs. Long, slow, distance running consists of continuous running for long distances at relatively slow speeds (approximately 60% to 80% of capacity). Fartlek training is an informal type of fast-slow-fast running, usually over natural surfaces in the country. All of these training patterns are adaptable to swimming, bicycling, and any other sport activities. None of these training systems offers a clear advantage over any of the others. Whatever differences exist, they are too small to be of major significance.

Anaerobic Training

Anaerobic training develops the athlete's capacity to sustain an oxygen debit, or to work when the oxygen delivery to the working muscles is insufficient. Fast interval or repetitive sprinting is probably the most widely used anaerobic training method. The athlete simply runs a series of all-out sprints with short periods of walking or jogging interspersed. Acceleration sprinting is another method which involves the progression from jogging to striding, and from striding to sprinting, and from sprinting to walking. The pattern is then repeated several times. Again, the superiority of one method over another has not been clearly established.

Circuit Training

This form of training involves speed work, anaerobic work, and strength, flexibility, and endurance training. Each circuit consists of 8 to 10 stations, which are set up to meet the needs of the athlete in the program. For example, a circuit could consist of 20 sit ups in 30 seconds at one station, maximum pull-ups at a second station, two-arm curls at the third station, and so forth. The athlete runs from one station to the next, trying to complete the circuit three times in a fixed period of time. Each day he tries to decrease the time to complete the circuit and to increase the number of repetitions or the amount of weight at each station. This concept has recently been applied to weight training, where the athlete lifts for 30 seconds, moves to the next station and rests 15 seconds, lifts for 30 seconds, moves to the next station and rests for 15 seconds, and continues to repeat this pattern of 30-second work to 15-second rest through all stations, completing three full circuits in a single workout. This is a very taxing form of conditioning, but it does result in multiple benefits.[13]

Specificity of Training

It is important to recognize that training is highly specific. Training for one sport will not assure peak conditioning for another sport. This was dramatically pointed out by several recent research studies conducted in Denmark.[14-15] Subjects were trained on bicycle ergometers, using either their arms or legs, not both. Maximal and submaximal exercise tests on the bicycle ergometer were given to both groups at the beginning and the conclusion of the training period. The group that trained with their arms made substantial improvements on the arm test but not on the leg test, while the group that trained only with their legs demonstrated the opposite effect. Thus, an activity such as jogging or running is excellent for conditioning the legs and overall endurance, but has little, if any, effect on upper body strength. It is therefore, important to select a training regimen that will attend to all of the components of major importance to a particular sport. Selecting conditioning activities that closely approximate movement patterns in that sport is also important. A well-planned conditioning program will certainly provide a more efficient and economical use of the time available to both the coach and the athlete.

Summary

Proper conditioning of the preadolescent or adolescent athlete is an important aspect of the total athletic experience. Physical conditioning promotes learning and execution of sport skills, mental alertness, reduction in the potential for injury, faster recovery from injury, better adaptation or tolerance to extremes in altitude or climate, and more efficient athletes. General conditioning consists of activities that develop strength, endurance, power, agility, speed and reaction time, flexibility, and neuromuscular skill. Each of these can be improved through the proper conditioning program. Most methods in current use are equally valuable in effecting change in any one specific area. Training, however, is very specific to the sport for which one is training. This points to the need for judiciously selecting a regimen that maximizes those factors that need to be developed.

Source: Wilmore, Jack H., in Smith, N.J. (ed): *Sports Medicine for Children and Youth*, Report of the Tenth Ross Roundtable on Critical Approaches to Common Pediatric Problems. Columbus, Ohio, Ross Laboratories, 1979, p. 63-72.

References

1. Wilmore JH, Parr RB, Haskell WL, Costill DL, Milburn LJ, Kerlan RK: Football pro's strengths and weaknesses charted. *Physician Sportsmed* 4:45-54, 1976.
2. Wilmore JH: *Athletic Training and Physical Fitness: Physiological Principles and Practices of the Conditioning Process*. Boston, Allyn & Bacon, 1977.
3. Saltin B, Blomquist G, Mitchell JH, Johnson RL Jr, Wildenthal KN, Chapman CB: Responses to submaximal and maximal exercise after bed rest and training. *Circulation* 38 (suppl): 1-78, 1968.
4. Ekblom B: Effect of physical training in adolescent boys. *J Appl Physiol* 27:350-355, 1969.
5. Dobeln WV, Eriksson BO: Physical training, maximal oxygen uptake, and dimensions of the oxygen transporting and metabolizing organs in boys 11-13 years of age. *Acta Paediatr Scand* 61:653-660, 1972.
6. Daniels J, Oldridge N, Nagle F, White B: Differences and changes in Vo_2 among young runners 10 to 18 years of age. *Med Sci Sports* 10:200-203, 1978.
7. Ekblom B: Physical training in normal boys in adolescence. *Acta Paediatr Scand* 217 (suppl): 60-62, 1971.
8. Astrand PO, Rodahl K: *Textbook of Work Physiology*. New York, McGraw-Hill Book Co Inc, 1970, p 381.
9. Drinkwater BL: Physiological responses of women to exercise in Wilmore JH (ed): *Exercise and Sport Sciences Reviews*. New York, Academic Press Inc, 1973, pp 125-153.
10. Davis JA, Vodak PA, Wilmore JH, Vodak J, Kurtz P: Anaerobic threshold and maximal aerobic power for three modes of exercise. *J Appl Physiol* 41:544-550, 1976.
11. Shephard RJ: *Endurance Fitness*. Toronto, University of Toronto Press, 1969, p 115.
12. Astrand PO: Proceedings of the International Symposium on Physiol Activity and Cardiovascular Health. *Can Med Assoc J* 96:730, 1967.
13. Wilmore JH, Parr RB, Girandola RN, Ward P, Vodak PA, Barstow TJ, Pipes TVN, Romero GT, Leslie P: Physiological alterations consequent to circuit weight training. *Med Sci Sports* 10:79-84, 1978.
14. Clausen J, Trap-Jensen J, Lassen N: The effects of training on heart rate during arm and leg exercise. *Scand J Clin Lab Invest* 26:295-301, 1975.
15. Clausen JP: Effect of physical training on cardiovascular adjustments to exercise in man. *Physiol Rev* 57:779-815, 1977.

C - NUTRITION AND ATHLETIC PERFORMANCE

HYDRATION MANAGEMENT

Water is the most prevalent nutrient of the body comprising between 50% and 60% of the total body weight. Water functions as solvent and transport medium for nutrients and as part of the body's cooling system. The major way the body cools itself is through evaporation of sweat. Inadequate hydration interfers with adequate temperature regulation that, in turn, can decrease performance.

The management of the player's hydration is essential for top performance. Hard working athletes may lose 2 to 4 liters of sweat (4 to 8 pounds body water) during a single strenuous workout. Athletes such as wrestlers and boxers as well as many dieters deliberately try to lose weight by exercising in hot weather, rubber sweat suits, and saunas to increase water loss. These methods are dangerous ways to reduce body weight! Weight loss must be accomplished by a reduction of body fat not body water if the performer is to be in peak condition when tackling the stress of exercise or competition.

The following chart is a list of symptoms that can occur in various stages of dehydration.

SPECTRUM OF DEHYDRATION

DEHYDRATION WEIGHT LOSS (% INITIAL WEIGHT LOSS)

0 Normal Weight

Thirst

2 Stronger thirst, vague discomfort and sense of oppression, loss of appetite.

3 Decreased performance

4 Economy of movement.

Lagging pace, flushed skin, impatience, in some, weariness and sleepiness, apathy, nausea, emotional instability.

6 Tingling in arms, hands, and feet; heat oppression, stumbling, headache, fit men suffer heat exhaustion, increases in body temperature, pulse rate and respiratory rate.

8 Labored breathing, dizziness, skin turning blue
Indistinct speech.
Increasing weakness, mental confusion

10 Spastic muscles; inability to balance with eyes closed.
General incapacity.

Delirium and wakefulness; swollen tongue.

Circulatory insufficiency; marked blood concentration and decreased blood volume, failing kidney function.

Shriveled skin, inability to swallow.

Dim vision.

15 Sunken eyes, painful urination.

Deafness, numb skin, shriveled tongue.

Stiffened eyelids.

Cracked skin, cessation of urine formation.

20 Bare survival limit

DEATH

Source: Briggs, G.M. and Calloway, D.H.: Nutrition and Physical Fitness, Phila.: W.B. Saunders Co., 1979

Thirst is NOT a reliable indicator of water needs under pre-event stress and hot environmental conditions. Therefore, the athlete must plan ahead for optimum hydration. The hydrated state can be maintained by consuming fluid before, during, and after exercise. The following chart lists the American Dietetic Association's recommended guidelines for fluid consumption in hydration management.

HYDRATION MANAGEMENT RECOMMENDATIONS

TIME	FLUID CONSUMPTION
2 Hours before event	2½ cups
10-15 min. before event	2 cups
10-15 min. intervals during event	½ to 1 c. (not to exceed 1 quart per hour)
After event	Replace weight loss with fluids

During events associated with profuse sweating, fluid replacement is more important than carbohydrate replacement. Carbohydrates slow down the emptying of fluids from the stomach. The practice of drinking sports drinks containing 5% glucose may decrease performance by retarding fluid uptake in the body. For best results, cool water (5°C or 41°F) leaves the stomach faster than warm water, thereby facilitating faster absorption.

Rehydration is the most important post-event nutritional concern. Drinking fluids before and during exercise will not equal water losses in an intense workout. A record of the athlete's weight before and after the event will determine the amount of fluids lost from exercising. Use the weigh-in chart on the following page to monitor all athletes' fluid losses at practice time. The athlete should continue to drink water at frequent intervals until his or her weight has returned to the pre-event levels. In cases of large water losses (4 to 7% weight loss) the rehydration process may take 24 to 36 hours!

Electrolyte Management

Sodium, chloride, and potassium are the major electrolytes responsible for regulating the body's neuro-muscular activity and fluid balance. The importance of electrolyte functions has brought electrolyte management to the forefront of sports-nutrition. The improper use of electrolyte replacements often results in an electrolyte imbalance that can cause decreased performance.

The amount of sodium, chloride, and potassium in the typical American diet exceeds the RDA for these nutrients. Under most

WEIGHT CHART FOR PREVENTION OF DEHYDRATION

NAME OF PLAYER	DATE											
	TIME OF PRACTICE											
	WEIGHT	IN / OUT	Wt. Loss	IN / OUT	LOSS	IN / OUT	LOSS	IN / OUT	LOSS	IN / OUT	LOSS

conditions, athletes can meet their electrolyte needs from foods they ordinarily eat. The following chart lists electrolyte gains, losses, and recommendations.

ELECTROLYTES: TYPICAL INTAKE, RECOMMENDED INTAKE AND SWEAT CONCENTRATION

	Sodium (grams)	Chloride (grams)	Potassium (grams)
Typical Daily Intake	2-7	4-11	2-6
Estimated Safe and Adequate Daily Intake	1-4	2-5	2-6
Sweat Concentration, Grams/Liter	.3-3	.3-3	.2-1

Source: Fox, E.L.: Sports Physiology, Phila.: W.B. Saunders Co., 1979.

Research has demonstrated that electrolyte intake during exercise does NOT improve performance or prevent muscle cramps. Electrolyte losses in sweat vary greatly depending upon hormonal controls, acclimation and exercise intensity and duration.

Concentrated solutions of glucose (5% or more)* or salt (sodium chloride) cannot be tolerated in doses greater than 1.2 or 1.8 grams per hour. Also, excessive salt intake may lead to potassium depletion. Glucose replacement via dilute solution should not exceed 1.5 to 2 ounces (50 to 60 grams) per hour. Typically, a conditioned athlete can lose up to 6 pounds (6 pints) of sweat without requiring salt or electrolyte replacements. The chart below summarizes fluid replacement.

A GUIDE TO SALT REPLACEMENT

Losses Attributable To Sweating			
WATER LOSS POUNDS OR PINTS	SALT LOSS GRAMS	WATER REPLACED (PINTS)	SALT REPLACEMENT NEEDED
2	1.5	2	None: Diet adequate
4	3.0	4	None: Diet adequate
6	4.5	6	None: Diet adequate

* Sports drinks like Gatorade, Sportade, etc. contain glucose in 5% solution. A 5% glucose solution = 5 gms of glucose in 100 mls of solution.

If temperatures are excessively high at the beginning of the season, the coach may recommend drinking fluid and electrolyte replacements. If water loss is greater than six pounds during a training session, a solution of 1/3 teaspoon of table salt in 1 quart of water or sports drinks like Gatorade diluted with equal parts of water can be used. Otherwise, salt levels in the athlete's food will adequately replace sodium losses. A glass of orange juice will replace the potassium lost in 4 to 6 pounds (pints) of sweat. Refer to the Sports-Nutrition Eaters Guide for foods that contain sodium and potassium.

If heat tolerance is underestimated and the athlete begins to experience heat stress, cramps, or exhaustion, he or she should stop exercising, move to a cooler environment and drink copious amounts of cool water. See chart below. In the cases of heat stroke, medical attention is needed immediately. While waiting for medical treatment, the athlete's body should be cooled by using alcohol rubs, ice packs, and immersing the body in cold water. See heat injury chart below.

By following hydration management guidelines and being aware of heat injury symptoms, coaches and athletes can eliminate decreases in performance associated with the stresses of heat.

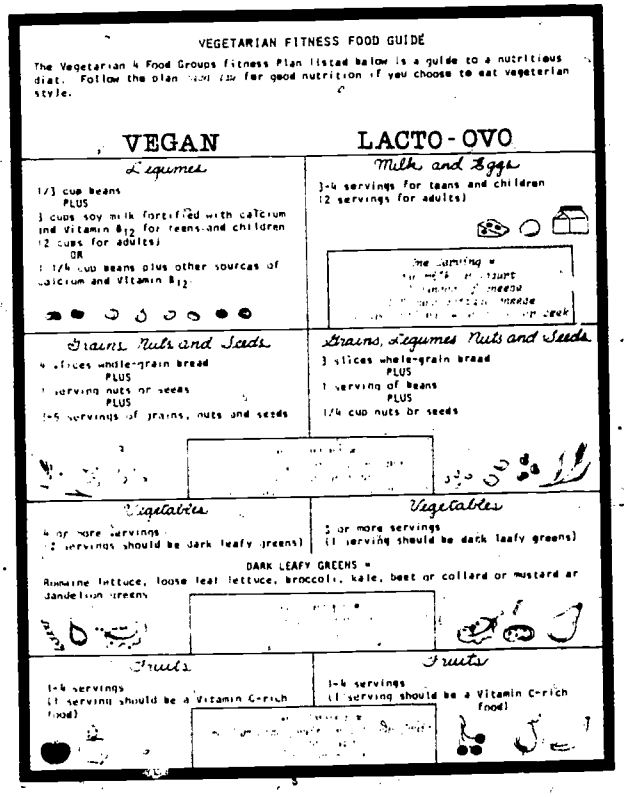
STAGES OF HEAT INJURIES AND SYMPTOMS

Stage 1:	Heat Stress	Thirst, fatigue, grogginess
Stage 2:	Heat Cramps	Muscle pain and cramps
Stage 3:	Heat exhaustion	Reduce sweating, weak rapid pulse, general weakness
Stage 4:	Heat stroke	No sweating, increased body temperature, numb dry skin

FOOD GUIDES FOR ATHLETE TRAINING

What athletes eat today will affect performance for today's practice, tomorrow's sports competition, and their future fitness and health.

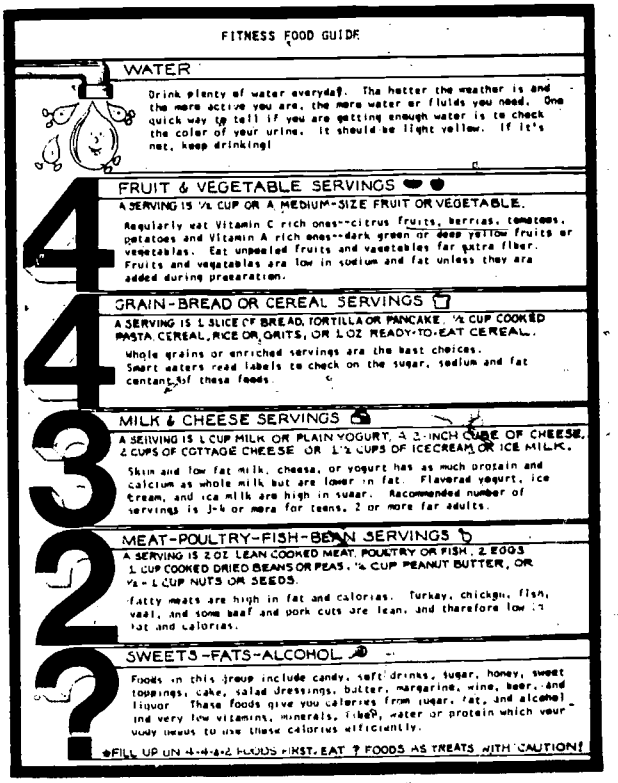
Eating three meals a day is not a criterion for a nutritionally adequate diet! Forty or more nutrients are required by the body for good health.



VEGETARIAN FITNESS FOOD GUIDE

The Vegetarian 4 Food Groups fitness Plan listed below is a guide to a nutritious diet. Follow the plan [illegible] for good nutrition if you choose to eat vegeterian style.

VEGAN	LACTO-OVO
Legumes	*Milk and Eggs*
1/1 cup beans PLUS 3 cups soy milk fortified with calcium and Vitamin B_{12} for teens and children (2 cups for adults) OR 1 1/4 cup beans plus other sources of calcium and Vitamin B_{12}	3-4 servings for teens and children (2 servings for adults) One serving = [illegible] yogurt [illegible] cheese [illegible] cottage cheese [illegible] cup milk
Grains Nuts and Seeds	*Grains, Legumes Nuts and Seeds*
4 slices whole-grain bread PLUS 1 serving nuts or seeds PLUS 3-5 servings of grains, nuts and seeds	3 slices whole-grain bread PLUS 1 serving of beans PLUS 1/4 cup nuts or seeds
Vegetables	*Vegetables*
4 or more servings (2 servings should be dark leafy greens)	3 or more servings (1 serving should be dark leafy greens)
DARK LEAFY GREENS = Romaine lettuce, loose leaf lettuce, broccoli, kale, beet or collard or mustard or dandelion greens	
Fruits	*Fruits*
1-4 servings (1 serving should be a Vitamin C-rich food)	1-4 servings (1 serving should be a Vitamin C-rich food)



FITNESS FOOD GUIDE

WATER

Drink plenty of water everyday. The hotter the weather is and the more active you are, the more water or fluids you need. One quick way to tell if you are getting enough water is to check the color of your urine. It should be light yellow. If it's not, keep drinking!

4 FRUIT & VEGETABLE SERVINGS

A SERVING IS ½ CUP OR A MEDIUM-SIZE FRUIT OR VEGETABLE.

Regularly eat Vitamin C rich ones--citrus fruits, berries, tomatoes, potatoes and Vitamin A rich ones--dark green or deep yellow fruits or vegetables. Eat unpeeled fruits and vegetables for extra fiber. Fruits and vegetables are low in sodium and fat unless they are added during preparation.

4 GRAIN-BREAD OR CEREAL SERVINGS

A SERVING IS 1 SLICE OF BREAD, TORTILLA OR PANCAKE, ½ CUP COOKED PASTA, CEREAL, RICE OR GRITS, OR 1 OZ READY-TO-EAT CEREAL.

Whole grains or enriched servings are the best choices. Smart eaters read labels to check on the sugar, sodium and fat content of these foods.

3 MILK & CHEESE SERVINGS

A SERVING IS 1 CUP MILK OR PLAIN YOGURT, A 1-INCH CUBE OF CHEESE, 2 CUPS OF COTTAGE CHEESE OR 1½ CUPS OF ICECREAM OR ICE MILK.

Skim and low fat milk, cheese, or yogurt has as much protein and calcium as whole milk but are lower in fat. Flavored yogurt, ice cream, and rice milk are high in sugar. Recommended number of servings is 3-4 or more for teens, 2 or more for adults.

2 MEAT-POULTRY-FISH-BEAN SERVINGS

A SERVING IS 2 OZ LEAN COOKED MEAT, POULTRY OR FISH, 2 EGGS, 1 CUP COOKED DRIED BEANS OR PEAS, ½ CUP PEANUT BUTTER, OR ½ - 1 CUP NUTS OR SEEDS.

Fatty meats are high in fat and calories. Turkey, chicken, fish, veal, and some beef and pork cuts are lean, and therefore low in fat and calories.

? SWEETS-FATS-ALCOHOL

Foods in this group include candy, soft drinks, sugar, honey, sweet toppings, cake, salad dressings, butter, margarine, wine, beer, and liquor. These foods give you calories from sugar, fat, and alcohol and very few vitamins, minerals, fiber, water or protein which your body needs to use these calories efficiently.

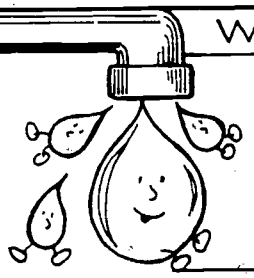
*FILL UP ON 4-4-3-2 FOODS FIRST. EAT ? FOODS AS TREATS WITH CAUTION!

Nutritionists have developed eating guides to help athletes translate their essential nutrient needs into food. The 4-4-3-2-? Guide to Good Eating and the Vegetarian Food Guide are simple hassle-free game plans for nutritious eating. These two eating guides are also on the Sports-Nutrition Eater's Guide Poster. These food guides are *not* a guarantee of nutritional adequacy. Foods vary in nutrient content and foods you pick to eat from each food group in the food guides make a big difference in the nutritional adequacy of your diet! However, if you regularly eat minimally processed foods using a food guide's recommended number of servings, you will be more apt to meet your 40 (plus) nutrient needs than if you randomly eat foods.

Research shows that most athletes' nutrient needs are not significantly different from non-athletes...with the exception of energy or calorie needs. The recommended number of servings in the 4-4-3-2-? Guide to Good Eating or Vegetarian Food Guide provides about 1200 calories. Athletes or active people need more than 1200 calories. Many athletes need between 2500-4000 or more calories a day. (NOTE: Section A - Sports Nutrition Essentials provides guidelines for estimating an individual athlete's energy needs.) If athletes enjoy getting those extra calories only from soda, candy, or potato chips, they can. They will not quickly develop deficiency diseases. They will also *not* promote their health. Low nutrient-density foods or what some people call junk foods will not improve their performance. Sugary and greasy foods supply lots of calories for fuel, but they lack all those vitamins, minerals, and protein that muscles need to operate in top shape. You fill your car with gas, but the engine also needs oil to run. Similarly, when a person fills their body with calories, they will also need the other nutrients to function well.

Sports nutritionists recommend that athletes should get most of their extra calories from the fruit, vegetables, and grain food groups. These foods are high in carbohydrate, vitamins, and minerals. Carbohydrate is a super fuel nutrient for muscles. Sports nutritionists also recommend eating high-protein foods in moderation. They also point out that high-fat foods are loaded with cholesterol and saturated fat. Too much cholesterol in the blood can be a risk factor for developing heart disease. Too much protein makes the kidneys work harder and can lead to dehydration. Too much of a vitamin or mineral can lead to malnutrition and health problems. Remember, malnutrition means *bad* nutrition. Malnutrition results from an *imbalance* of nutrients...that is an excess or deficiency of any nutrient.

GUIDE TO GOOD EATING



WATER

Drink plenty of water everyday. The hotter the weather is and the more active you are, the more water or fluids you need. One quick way to tell if you are getting enough water is to check the color of your urine. It should be light yellow. If it's not, keep drinking!

4 FRUIT & VEGETABLE SERVINGS

A SERVING IS ½ CUP OR A MEDIUM-SIZE FRUIT OR VEGETABLE.

Regularly eat Vitamin C rich ones--citrus fruits, berries, tomatoes, potatoes and Vitamin A rich ones--dark green or deep yellow fruits or vegetables. Eat unpeeled fruits and vegetables for extra fiber. Fruits and vegetables are low in sodium and fat unless they are added during preparation.

4 GRAIN-BREAD OR CEREAL SERVINGS

A SERVING IS 1 SLICE OF BREAD, TORTILLA OR PANCAKE; ½ CUP COOKED PASTA, CEREAL, RICE OR GRITS; OR 1 OZ. READY-TO-EAT CEREAL.

Whole grains or enriched servings are the best choices. Smart eaters read labels to check on the sugar, sodium and fat content of these foods.

3 MILK & CHEESE SERVINGS

A SERVING IS 1 CUP MILK OR PLAIN YOGURT; A 2-INCH CUBE OF CHEESE; 2 CUPS OF COTTAGE CHEESE; OR 1½ CUPS OF ICECREAM OR ICE MILK.

Skim and low fat milk, cheese, or yogurt has as much protein and calcium as whole milk but are lower in fat. Flavored yogurt, ice cream, and ice milk are high in sugar. Recommended number of servings is 3-4 or more for teens, 2 or more for adults.

2 MEAT-POULTRY-FISH-BEAN SERVINGS

A SERVING IS 2 OZ LEAN COOKED MEAT, POULTRY OR FISH, 2 EGGS, 1 CUP COOKED DRIED BEANS OR PEAS, ¼ CUP PEANUT BUTTER, OR ½ - 1 CUP NUTS OR SEEDS.

Fatty meats are high in fat and calories. Turkey, chicken, fish, veal, and some beef and pork cuts are lean, and therefore low in fat and calories.

? SWEETS-FATS-ALCOHOL

Foods in this group include candy, soft drinks, sugar, honey, sweet toppings, cake, salad dressings, butter, margarine, wine, beer, and liquor. These foods give you calories from sugar, fat, and alcohol and very few vitamins, minerals, fiber, water or protein which your body needs to use these calories efficiently.

★FILL UP ON 4-4-3-2 FOODS FIRST. EAT ? FOODS AS TREATS WITH CAUTION!

VEGETARIAN FITNESS-FOOD GUIDE

The Vegetarian 4 Food Groups Fitness Plan listed below is a guide to a nutritious diet. Follow the plan *each day* for good nutrition if you choose to eat vegetarian style.

VEGAN

Legumes

1/3 cup beans
PLUS
3 cups soy milk fortified with calcium and Vitamin B_{12} for teens and children (2 cups for adults)
OR
1 1/4 cup beans plus other sources of calcium and Vitamin B_{12}.

Grains, Nuts and Seeds

4 slices whole-grain bread
PLUS
1 serving nuts or seeds
PLUS
3-5 servings of grains, nuts and seeds

Vegetables

4 or more servings
(2 servings should be dark leafy greens)

Fruits

1-4 servings
(1 serving should be a Vitamin C-rich food)

LACTO-OVO

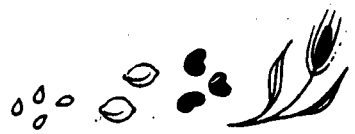
Milk and Eggs

3-4 servings for teens and children
(2 servings for adults)

One Serving =
1 cup milk or yogurt
1 1/2 ounces of cheese
1 1/2 cups cottage cheese
Eggs are optional - up to 4 per week

Grains, Legumes, Nuts and Seeds

4 slices whole-grain bread
PLUS
1 serving of beans
PLUS
1/4 cup nuts or seeds



One Serving =
1 slice bread, tortilla or pancake
1 cup oats or rice
1/3 cup beans or 1/4 cup nuts or seeds

Vegetables

3 or more servings
(1 serving should be dark leafy greens)

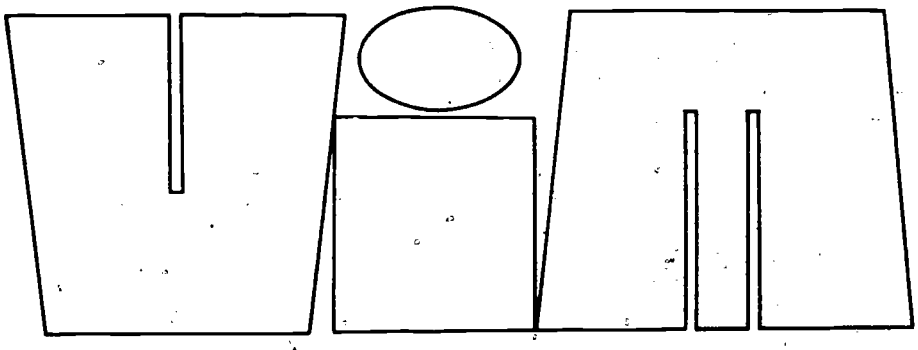
DARK LEAFY GREENS =
Romaine lettuce, loose leaf lettuce, broccoli, kale, beet or collard or mustard or dandelion greens

One Serving =
1/2 cup vegetables
3/4 cup salad

Fruits

1-4 servings
(1 serving should be a Vitamin C-rich food)

One Serving =
1 medium size fruit or 1/2 cup fruit
1/2 cup juice
1/4 medium melon



VARIETY • INDIVIDUALITY • MODERATION

When choosing food, keep in mind the VIM Game Plan.

1. *VARIETY.* There is no one magical food. Eat many different types of foods. Each food will give you different nutrients. This increases the likelihood of getting enough of the 40 or more nutrients the body needs.

2. *INDIVIDUALITY.* If the VIM - Game Plan for Athletes' Diets means changes in what an athlete usually eats, *make changes gradually.* Instead of going "cold turkey", sports nutritionists recommend making small changes toward a healthier diet that will help athletes keep eating on the right track! The psychological effects of food and diets on athletic performance are not documented but are very real. Athletes have individual preferences for equipment and food alike. Abrupt changes in eating patterns or foods may well impair performance. As a rule of thumb, if eating special foods and following a special diet pattern seems to work and is not harmful to the athlete, by all means use it. However, if a practice is a health risk, do not take chances! Some athletes also may have allergies or food intolerances which must be considered during training and sport performance. It is a good idea to get professional help from a dietitian to help solve these special individual eating problems.

3. *MODERATION.* The body needs a balance of energy or calories and the 40 or more essential nutrients. *Too much* or *too little* of any nutrient can short circuit a nutrition game plan! Moderation can help avoid malnutrition. For example, regularly taking megadoses of vitamin and mineral supplenents that contain more than 10 times the Recommended Dietary Allowances can lead to malnutrition from *excessive* nutrient intake. Not drinking enough water to keep the body well hydrated can lead to malnutrition due to a *deficiency* of the nutrient water. Choose minimally processed foods which are not loaded with added sugar, sodium, salt, or fat. Minimally processed foods usually retain most of their original nutritional value. This means that there is a better chance of getting the essential minerals and vitamins needed for energy production and muscle contraction.

ERGOGENIC AIDS

An ergogenic aid is a substance that improves work performance. Historically, athletes have experimented with substances to try to enhance performance by improving strength, speed, or endurance. The practice continues today.

Most substances alleged to be ergogenic aids are ineffective, dangerous, or both. The list of these substances used by athletes today is long and includes anabolic steroids, amphetamines, caffeine, warm-up procedures, oxygen inhalation, appetite stimulants, glycogen loading, and nutrient supplementation such as protein, vitamins, and minerals.

Anabolic steroids are synthetic hormones made in laboratories which function like the male hormone testosterone. Anabolic steroids are drugs that are used to increase muscle size, strength, and endurance. The American College of Sports Medicine's position on anabolic steroids states that these drugs have no place in athletics. Research has shown that these drugs are especially hazardous to adolescents. Anabolic steroids have been associated with liver disease, growth stunting through premature fusing of long bones, acne, and sterility. Steroids can also produce masculinization in girls. Furthermore, steroids have never been shown to increase work performance in young school age athletes. Bee pollen is also being promoted as an ergogenic aid which acts like an anabolic steroid to increase muscle mass and strength. There is no evidence that this substance does anything except increase sales for companies that make it.

Amphetamines have also been used in sports because they mask the feeling of fatigue. However, these drugs also have side effects which compromise good judgment on the playing field. These effects are dizziness, confusion, and an inhibition of awareness of heat stress. They also interfere with normal heart function and have been the cause of death in endurance events.

Breathing oxygen in an effort to promote rapid recovery has been in vogue for many years, particularly in professional athletes. Several studies have indicated that oxygen treatment does enhance work performance but it does not seem to speed up recovery. From an economic and practical standpoint, the use of oxygen as an ergogenic aid seems limited.

Traditionally, warm-up procedures have been used in an effort to prevent joint and muscle injuries. Laboratory studies have shown that muscle and joint injuries do not occur with any greater frequency when not warming-up as compared to warming up. However, warm-ups do provide a psychological lift to athletes. Also, these exercises help reduce abrupt increases in cardiac or heart workload in sudden, intense exercise. Therefore, the practice of

warming up should be an important part of any exercise program. See Sports-Nutrition Fitness Poster.

Nutritional supplements such as protein, vitamins, and minerals are all popular "ergogenic" aids. Many research studies show some improvement in performance with particular vitamin supplementation, but there is almost an equal number of studies that show no benefit. Many athletes believe that if small amounts of vitamins are good, a lot more will be better! This is *not* true. Malnutrition can be caused by either a deficiency or excess of a nutrient.

In moderate doses, the water soluble vitamins -- Vitamin C and the B-vitamins -- are not dangerous. This mainly is due to the fact that excess intakes are not stored in the body. Any excess intake above basic need is eliminated in the urine. Fat soluble vitamins -- A, D, E, K -- can reach toxic levels in the body because excessive intakes above need are stored in fat and can build up to high levels. The Sports-Nutrition Eaters Guide Poster lists symptoms associated with a deficiency as well as excess intake of several vitamins.

Vitamins function like oil in a car. A little extra will not make the engine run better. Vitamins do *not* contain energy. They work in conjunction with some enzymes which convert carbohydrate, fat, protein, and alcohol into energy.

Remember also, that vitamins work in teams. For example, Vitamin C helps iron be absorbed. Keep in mind that vitamin supplements contain only some of the more than 40 nutrients the body needs.

What about megadoses of vitamins? *Ten times the Recommended Dietary Allowance (RDA) of a vitamin is considered to be a mega-dose.* Regular use of megadoses of vitamins may be dangerous. Vitamins are chemical substances with specific functions. Excessive amounts of vitamins take on other chemical activity and may become dangerous. For example, megadoses of Vitamin C can destroy Vitamin B_{12}. The body functions best when its systems are in balance. Athletes who eat using the 4-4-3-2-? Guide to Good Eating or Vegetarian Food Guides, will get sufficient vitamins from foods they eat. They do not need vitamins from pills.

Protein supplements are expensive. They are also unnecessary because the protein content in foods most people eat usually far exceed a person's protein needs.

Mineral supplementation of iron is often a good idea for female athletes who commonly have anemia due to an insufficient iron intake. Mineral supplementation of sodium chloride or salt has been promoted for years. Some people feel that salt tablets need to be used to replace the salt lost in sweat. In fact, one

of the body's adaptations to heat stress is to conserve sodium by reducing salt content of the sweat. The salt people get from foods they eat will adequately replace salt loss from sweat even in hot weather. We now know that salt tablets should *not* be used because they can actually promote fluid retention and potassium loss.

Caffeine has been demonstrated to be an ergogenic aid that can prolong moderate intensity work performance for endurance sports. Contrary to popular belief, caffeine's stimulant effect is *not* the reason it prolongs endurance. Rather, caffeine stimulates the release of fats from tissues into the blood so they can be oxidized and reduces the rate at which the cells oxidize or burn glycogen. So the limited glycogen stores are used at a slower rate and the unlimited fat becomes the main energy fuel source. No studies have shown that caffeine increases speed or strength. For more information on what caffeine does in the body, read the following handout *Caffeine: What It Does*. Caffeine has side effects. Inspite of its ergogenic effects, it is not a desirable substance for use by school age athletes. The reference in the packet entitled *Nutrition Fitness - A Winning Combination* published by the Arizona Cooperative Extension Service, also discusses how caffeine works and the effects of a high sugar intake before exercise.

The list of alleged ergogenic aids grows yearly. The risks of substances alleged to be ergogenic aids outweigh the benefits associated with their use. Most "ergogenic" aids are illegal in competitive sports. Young athletes should not be taught that what you really need to do to win is to "pop a pill". Sports are a great way to teach children and teenagers to work hard and succeed on the basis of their personal accomplishments, individually and as part of a team. Sports can also turn-on young people to the rewards of exercise and help them develop exercise habits they can use for a lifetime to stay fit.

CAFFEINE: WHAT IT DOES

Caffeine is a relatively mild stimulant, and is one of the world's most widely used drugs. Those who use caffeine heavily may have side effects from it, and there are individuals sensitive to even small amounts. But many people can consume caffeine in coffee, tea, and other drinks without unpleasant reactions. Indeed, the stimulant effect of caffeine, which can suppress fatigue, provides a psychological lift, and improve alertness, probably underlies the wide popularity of caffeine-containing beverages.

In addition to stimulating the nervous system, caffeine can produce a variety of other effects, depending in part on the amount consumed. It increases heartbeat and basal metabolic rate, promotes secretion of stomach acid, and steps up production of urine. It also dilates some blood vessels, constricts others, and prolong capacity for muscular work.

Subjectively, the overall effect may be experienced as a "lift", a feeling of being wide-awake and able to focus on mental or manual tasks.

There is no persuasive evidence that moderate caffeine intake is harmful to the average healthy adult. But excessive consumption may lead to chronic caffeine intoxication, or "caffeinism", a medical term for the well-known "coffee nerves". Common symptoms include restlessness and disturbed sleep, heart palpitations, irritation of the stomach, and diarrhea. Caffeine is also mildly addicting. People who ordinarily consume substantial amounts of caffeine-containing beverages or drugs may experience such symptoms as headache or depression for several days when they stop using the products.

What constitutes an excessive intake of caffeine is hard to define. however. It varies widely among individuals. The amount required to cause stimulant effects in a typical adult is estimated to be about 150 to 250 milligrams, the amount of caffeine in one or two cups of brewed coffee. An "excessive" amount - one capable of producing some symptoms of caffeinism in adults - is estimated to range from as low as 200 miligrams per day to 750 milligrams per day.

Some people are able to drink several cups of coffee or tea daily without apparent side effects. Those who are unusually sensitive to caffeine, however, may experience nervousness, nausea, and other sumptoms of caffeinism from a single cup of coffee.

THE COMMON SOURCES OF CAFFEINE

While coffee is the major source of caffeine for Americans, many people consume substantial amounts of caffeine in soft drinks, tea, and other products. The following table reviews the main caffeine-containing products other then soft drinks. The caffeine values listed are typical amounts derived from several sources, including Consumer Report tests, scientific literature, and standard reference works. Where appropriate, examples of specific brands are included.

Product	Caffeine (in milligrams)
Coffee	
Drip (5 oz.)	146
Percolated (5 oz.)	110
Instant, regular (5 oz.)	53
Decaffeinated (5 oz.)	2
Tea	
One-minute brew (5 oz.)	9-33
Three-minute brew (5 oz.)	20-46
Five-minute brew (5 oz.)	20-50
Canned iced tea (12 oz.)	22-36
Cocoa and Chocolate	
Cocoa beverage (water mix, 6 oz.)	10
Milk chocolate (1 oz.)	6
Baking chocolate (1 oz.)	35
Nonprescription drugs	
Stimulants (standard dose)	
Caffedrine Capsules	200
NoDoz Tablets	200
Vivarin Tablets	200
Pain relievers (standard dose)	
Anacin	64
Excedrin	130
Midol	65
Plain aspirin, any brand	0
Diuretics (standard dose)	
Aqua-Ban	200
Permathene H_2Off	200
Pre-Mens Forte	100
Cold remedies (standard dose)	
Coryban-D	30
Dristan	32
Triaminicin	30
Weight-control aids (daily dose)	
Dexatrim	200
Dietac	200
Prolamine	280
Soft drinks	0-52

CAFFEINE: HOW TO CONSUME LESS

Concerns about the possible health effects of caffeine have prompted many people to cut back their consumption.

Most of the caffeine that's taken out of coffee - some two million pounds a year - is bought by the soft-drink industry and added to soda. As per-capita, consumption of coffee has declined - from about three cups a day in 1962 to two cups in 1980 - while soft-drink sales have soared. Soft drinks have replaced coffee as the nation's number one beverage. According to beverage-industry sources, Americans now consume an average of nearly 34 gallons of soft drinks annually per person, compared with about 28 gallons of coffee. Coffee remains the nation's largest source of caffeine, but soft drinks now rank second, ahead of tea, chocolate, and other foods or beverages.

Kola-nut extract, which is used in most cola flavoring, contains natural caffeine. The U.S. Food and Drug Administration therefore requires a beverage that describes itself as "cola" to contain at least a trace of caffeine. But the caffeine natural to the kola nut accounts for only a small percentage of the caffeine in most colas. More than 95 percent of the caffeine in a typical cola or "pepper" beverage is *added* by the manufacturer. So is 100 percent of the caffeine in citrus drinks and other fruit-flavored drinks that contain it. Overall, more than two-thirds of the soft drinks consumed in the U.S. contain added caffeine.

How much do they contain? To find out, Consumer Reports analysed soft drinks for caffeine content.

They selected 24 soft drinks, including the top 10 in national sales. They also included several orange sodas and two colas thought to contain little or no caffeine.

A FEW SURPRISES

You expect to find caffeine in colas and that top sellers such as *Coca-Cola* and *Pepsi Cola* would score high in caffeine. They didn't. Their caffeine content was near the lower end of the range for caffeinated soft drinks.

Even more surprising, though, were some of the test results with the non-colas. Among the brands highest in caffeine were three citrus-flavored beverages - *Mountain Dew, Mellow Yellow, and Sunkist Orange*. Their caffeine content was close to that of a cup of instant coffee. *Diet Sunkist*, on the other hand, turned out to be caffeine-free.

Only two colas - one sugar-free brand and one regular cola - contained no added caffeine. The Royal Crown Company last year began marketing *RC-100*, which is promoted as "100 percent sugar-free, 100 percent caffeine-free". And *Cragmont Cola*, Safeway's house brand, had virtually no detectable caffeine; it's made with decaffeinated kola-nut extract. Among the 10 leading soft-drink brands in sales, only two, *7-Up* and *Sprite*, contained no caffeine.

Caffeine content of soft drinks

(Milligrams per 12-oz can, as determined by CU's tests)

*As reported by the manufacturer; below detection limit in CU's tests. By regulation, cola beverages are required to have some caffeine.

Reference: Consumer Reports, October, 1981.

PRE-EVENT AND POST-EVENT DIET MANAGEMENT

Coaches, trainers, and athletes can get a competitive edge by tuning into the latest information on pre-event and post-event diet management. The five goals of pre-game food management are:

1. Pre-event meals should contain sufficient calories to ward off feelings of hunger.
2. Food must not be in the stomach or upper intestine at game-time.
3. Pre-event meals should contribute to optimum hydration.
4. Food should not be too spicy or high in fiber or residues.
5. The food must be familiar to the athlete.

The nutritionally-smart coach or trainer will insist that: 1) foods be eaten on a regular basis following recommended food guides, 2) foods should be eaten prior to the game, and 3) large amounts of food should not be eaten just before game-time. See Fitness 6 Handout for additional pre-event guidelines. The guidelines above will help the athlete be nutritionally prepared for maximum performance.

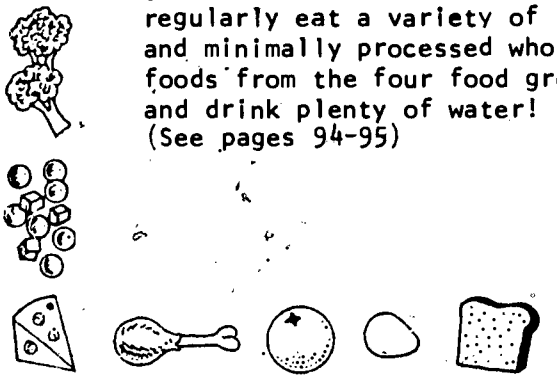
A small easily digested meal should be consumed 3 to 4 hours prior to the event. Research suggests that commercially prepared liquid meals such as Ensure, Nutriment, Sustagen, or Sustacal can be used for pre-event meals. These meals contain approximately 300-400 calories a serving, 58-68% carbohydrate, 18-24% protein, and 8-25% fat! Easily digested foods such as toast, jam, and canned fruit may be eaten along with the liquid drink. A liquid meal may also be consumed 1 to 2 hours before game-time. A liquid meal is not always needed, but it does offer advantages over eating solid food 1 to 2 hours before game time. The liquid meal helps hydrate the body and leaves the stomach in less than 2 hours.

Whether the pre-event meal is solid or liquid, it should be high in carbohydrate and low in protein and fat. Excess protein can induce dehydration, cramping and produce severe diarrhea. A low low-fat content will speed digestion and emptying of the stomach. Electrolyte supplementation is not needed. Electrolyte supplementation slows down digestion and may induce dehydration by causing water to move from the tissues into the intestinal tract in an attempt to dilute the solution's concentration. Vitamin supplementation is also unnecessary since a diet meeting the RDA will provide all the vitamins required for exercise. See Nutrition-Fitness Hit or Myth on page 104.

FITNESS 6

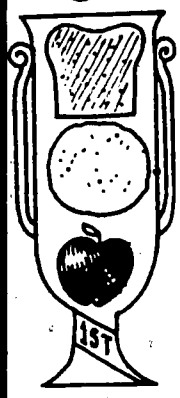
This is the starting line-up for a winning food-fitness game plan. Nutrition Super Stars have every member of the line-up in their game plan for top performance.

1



The Fitness Food Guides are number one in the food-fitness game plan line up. Winners regularly eat a variety of fresh and minimally processed whole foods from the four food groups, and drink plenty of water! (See pages 94-95)

2



Active people need extra energy or calories. Winners energize with calories from complex carbohydrates found in fruits, vegetables, and whole grain or enriched bread, tortillas, pasta and cereals.

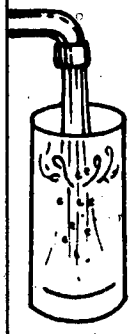
NUTRITION FLASH

Carbohydrate loading has no advantage for continuous exercise which lasts less than an hour. Carbohydrate loading has special health risks for teenagers and should not be tried without expert advice!

3

The Fitness Food Guide has lots of protein...extra meat or protein supplements are not necessary and are expensive. The same goes for vitamin and mineral supplements!

4



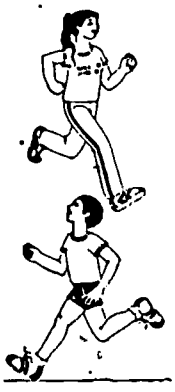
Exercise means sweat and lots of it. Too much water loss means a weak spot in your game plan. Drink plenty of liquids before, during and after exercise to prevent too much body water loss. If you lose 1lb of weight during exercise, you need 2 cups of replacement liquids to keep your performance top rate. Cold water is the best thing to drink! Dilute fruit or vegetable juice and sports drinks with equal parts of water before you drink them to prevent stomach upsets.

5

Salt tablets are dangerous! The salt you lose in sweat is easily replaced by the salt and sodium in foods in the Fitness Food Guides.

6

The winning pre-game eating plan includes:



- eating at least 3 hours before heavy exercise.
- eating foods which have lots of complex carbohydrates, a little protein, and very little fat.
- drinking 2 to 3 cups of cold liquids.

NUTRITION-FITNESS HIT OR MYTH

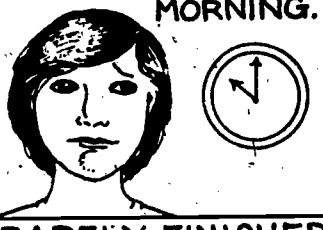
Maria is on the school track team. You are the coach. She is very unhappy with her performance and wants to improve it. Here's what Maria tells you:

I WORK HARD AT EVERY TRAINING PRACTICE. AFTERWARDS, I TAKE A SALT TABLET AND DRINK PLENTY OF COLD WATER.

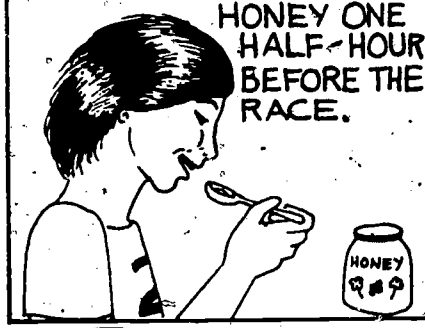
I ALSO WATCH WHAT I EAT. I KNOW HOW IMPORTANT NUTRITION IS FOR FITNESS & SPORTS. EVERY DAY I EAT THE RECOMMENDED NUMBER OF SERVINGS FROM THE FITNESS FOOD PLAN.

I EXERCISE SO MUCH I KNOW I NEED EXTRA CALORIES. SO I EAT EXTRA SERVINGS FROM THE HIGH PROTEIN MEAT & MILK GROUPS. I ALSO DRINK 2-3 GLASSES OF PURE PROTEIN POWDERED DRINK. I KNOW THAT ATHLETES NEED EXTRA PROTEIN FOR STRONG MUSCLES & TOP PERFORMANCE.

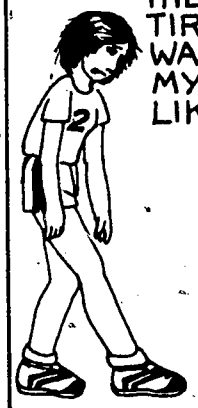
I GET VERY NERVOUS JUST BEFORE EVERY RACE! I USUALLY GET PLENTY OF SLEEP THE NIGHT BEFORE THE LAST RACE I ENTERED DIDN'T START 'TILL 11 A.M. BUT I WAS TOO TENSE TO EAT THAT MORNING.



I HEARD FROM OTHER RUNNERS THAT SUGAR OR HONEY GIVES YOU QUICK ENERGY, SO I HAD A TABLESPOON OF HONEY ONE HALF-HOUR BEFORE THE RACE.



HALFWAY THROUGH THE RACE I FELT TIRED. MY MOUTH WAS DRY AND MY LEGS FELT LIKE LEAD...



I STOPPED AT THE WATER STATION AND RINSED OUT MY MOUTH. I REMEMBERED MY BROTHER TOLD ME NEVER TO DRINK DURING A RACE.

I BARELY FINISHED THE RACE! WHAT HAPPENED TO ME? WHAT CAN I DO SO I CAN RUN FASTER IN THE NEXT RACE?

?

Based on Maria's eating and training habits, what advice would you give her? What did Maria do wrong before the race? What did she do right? Can you identify the myths that she believes in?

HIT OR MYTH *ANSWERS*

Good advice the coach can give Maria:

She should drink water before, during, and after sports activities.

Maria should have a nutritious pre-game meal 3 to 4 hours before heavy exercise.

Things Maria has done wrong before the race:

Taking salt tablets
Eating extra portions of high protein foods
Using protein powdered drink
Not eating breakfast
Eating honey before a game
Never drinking during a race

Things Maria has done right:

Working hard at every training practice
Drinking plenty of water after practice
Regularly eating the recommended servings from the fitness plan

Myths Maria believes in:

Athletes need salt tablets
Athletes need extra amount of protein to build strong muscles
Eating honey provides quick energy just before a race
To avoid drinking water during a race helps improve performance

Considerations for Events Greater Than One-Hour

Muscle glycogen availability is a limiting factor in endurance events. This basic fact has lead endurance athletes in the pursuit of techniques which will maximize glycogen stores. Glycogen loading has become a popular and controversial method of saturating the body's glycogen stores for events longer than 1 hour.

Glycogen loading is not without hazards. Many endurance athletes cannot tolerate this nutritional practice. Leg cramps, excessive fatigue, muscle damage, changes in electrocardiogram have been reported. Therefore, the American Dietetics Association recommends that glycogen loading be used cautiously with high school and college athletes and rarely, if ever, in young children or pre-adolescent athletes. Athletes with diabetes or hypertriglyceremia should consult with their physican before embarking on glycogen loading.

Traditionally, glycogen loading programs have used the following five (5) steps:

1. Muscle glycogen should be depleted by exercise similar to the event one week before the event.
2. Consuming a low-carbohydrate (400 calories), high-protein and high-fat diet for three days.
3. Consuming a high-carbohydrate (1000 to 2100 calories), moderate-protein, and low fat diet 3 days before the event.
4. Eating high-carbohydrate foods up to 10-12 hours before the event.
5. Eating 400-600 calories of carbohydrate four hours before competition. Excessive amounts of sugar products should be avoided.

Nutrition Alert!

The latest research has shown that the traditional glycogen loading technique is not necessary. A nutritionally adequate diet combined with the regular training for a sport will provide glycogen stores equivalent to those obtained through traditional glycogen loading techniques. It is critical to prevent depletion of glycogen stores prior to an event or game. Glycogen depletion can be prevented by *not* having hard practice sessions 1 to 2 days before the event, having the athlete get plenty of rest and eat foods following the training high carbohydrate diet and pre-event food guides.

Pre-Event Meal Considerations for Weight Regulated Sports

Wrestling and boxing place additional stress on its participants by requiring these people to "make weight". Many competitors

resort to dehydration practices in order to "cut weight" rapidly (up to 8 lbs. in 24 hours). Several days after the game, they may be frustrated to find their weight has rebounded to pre-weigh-in levels.

The competitor can avoid large fluctuations in weight by reducing his body fat gradually to an optimum fatness level and "watching" his diet carefully. Because 3,000 to 4,000 calories will be burned up during the practice day, the athlete can enjoy a generous diet. However, high-sodium (see Eater's Guide Poster) and high-fiber foods listed below must be limited prior to weigh-in. High-sodium foods cause water retention and high-fiber foods hold "dead weight" water in the intestines.

These foods should be limited during the 3 days prior to weigh-in. Since many of these foods are nutritious, they should be restricted only during this period. Water should be consumed in copious amounts -- no less than 8 glasses during each 24 hour period.

HIGH FIBER FOODS

	FOOD	AMOUNT	CRUDE FIBER (gms)*
1.	**Cereals**	1/2 to 2/3 cup	
	All Bran		3.0
	40% Bran		.9
	Most ready to eat		Trace-0.3
	Oatmeal		.5
	Shredded Wheat		.5
2.	**Breads**	1 slice	
	Whole wheat		.4
	Enriched white		.05-.2
	Corn tortilla		.3
3.	**Fruits**	1 piece	
	Orange		.8
	Apple		1.0
	Banana		.8
	Watermelon		.3
	Canteloupe		.4
4.	**Vegetables**	1/2 to 2/3 cup	
	Peas, brussel sprouts		.2
	Corn		.6
	Lettuce		.5
	Bean sprouts		.5
	Green beans		.7
	Potato (without skin)		.7
	Tomato		.5-1.0
	Peppers		.7
5.	**Nuts and Seeds**	1/2 cup	
	Walnuts		1.0
	Sunflower seeds		2.0
	Peanuts		2.0
	Brazil nuts		2.1

*NOTE: 1 gram is equal to 1,000 milligrams.

NUTRITION AND POST EVENT RECOVERY

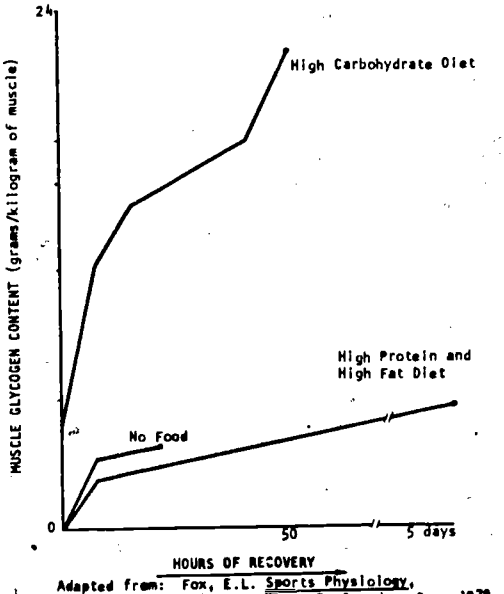
To maintain day to day performance at peak levels, the athlete must consider the post-event effects of exercise. The post-event effects of a hard workout can appear as fatigue decreased strength. These symptoms can be attributed to factors such as dehydration (p. 87), lactic acid accumulation, and depleted glycogen stores and minor muscle damage. The magnitude of these post-event effects are proportional to the intensity and length of the exercise. This means that a longer recovery period is required for more lengthy, strenuous events compared to shorter and/or less demanding events. Without proper management, athletes competing over consecutive days may soon discover that their capabilities have been reduced considerably.

Anaerobic exercise produces an accumulation of lactic acid in muscle tissue. See pages 34-35 for detailed discussion of anaerobic metabolism. The accumulated lactic acid must be removed if the athlete hopes to maintain optimum performance. A quick recovery from the lactic acid accumulation requires an active cooling-down period. Exercising at low aerobic levels for several minutes following intense exercise accelerates the removal of lactic acid.

Aerobic exercise of long duration reduces glycogen stores. Nutritional intervention to restore glycogen can be crucial for a quick recovery. Studies have shown that carbohydrate is the main nutrient for restoring glycogen levels. Also, research has shown that glycogen is restored more quickly when the diet is high in carbohydrate. A high-carbohydrate diet that provides about 70% of its calories from carbohydrate restores muscle glycogen the fastest. The typical American diet with 45-55% carbohydrate calories is less effective in restoring glycogen. Low carbohydrate foods such as meat, cheese, and peanut butter which are high in protein and fat are least effective in restoring muscle glycogen.

This graph shows that the high-carbohydrate diet is most effective in maintaining high levels of muscle glycogen in studies of cyclists and runners. Pages 155-157 in the Appendix gives examples of high-carbohydrate food plans.

EFFECTS OF DIET COMPOSITION ON MUSCLE GLYCOGEN RECOVERY
FIGURE



Adapted from: Fox, E.L. Sports Physiology. Philadelphia: W.B. Saunders Co., 1979.

In practical terms, a diet containing 50-60% carbohydrate provides adequate glycogen stores for most sports competition and intense practices.

To maintain muscle glycogen, the athlete needs light exercise and a diet high in carbohydrate both before and after the endurance event. High carbohydrate foods includes breads, grains and cereal products, starchy vegetables, and fruits. To provide high glycogen saturation, choose first from the high nutrient density-high carbohydrate foods listed. Then to meet additional calorie needs, the athlete may choose to eat high carbohydrate and low-nutrient density foods such as cookies, pastries, sweet rolls, and fruit pies.

HIGH NUTRIENT DENSITY - HIGH CARBOHYDRATE FOOD SOURCES

Breads	Grains/Cereals	Starchy Vegetables
Cornbread	Rice	Carrots
Whole wheat bread	Barley	Onions
Rice cake	Pasta (spaghetti, noodles, macaroni)	Potatoes, white
Oatmeal cookies	Groats	Lima beans
Crackers (assorted)	Grits	Peas
Tortillas	Popcorn	Pumpkin
Rolls	Oatmeal	Squash
English muffins	Ready-to-eat cereals	Yam or sweet potatoes
	Pancakes	Corn
	Waffles	Pinto beans
	Crackers	

Fruits		
Cantaloupe	Apples	Oranges
Watermelon	Applesauce	Assorted fruit juices
Peaches	Bananas	Raisins
Pineapples	Pears	Grapefruit
		Apricots

This list contains common readily available nutritious high carbohydrate foods. However, the list is not all inclusive. Check food labels for carbohydrate and sugar content of processed foods which can be used as supplementary carbohydrate sources.

WEIGHT CONTROL - BODY COMPOSITION MANAGEMENT

Management of weight and body composition are basic to a successful athlete training program.

Body Weight and Fatness

Regular measurement of body weight and fatness is the best tool for weight and body composition management of athletes. The guidelines for evaluating body weight and fatness are included in Section A - Sports Nutrition Essentials and Section B - Fitness Assessment and Conditioning.

Weight Maintenance

The goal of a weight maintenance program is to balance calorie and fluid intake with output. Monitoring only weight has limitations because there are transient shifts in body weight due to fluid alone. Regularly measuring weight helps manage hydration of athletes. This is important because excess body fluid is non-functional weight, increases energy requirements, and appears to serve no useful purpose for sports performance. Excessive loss of body fluids or dehydration interfers with adequate temperature regulation and can decrease performance. Measuring weight alone does not allow you to keep close tabs on an athlete's body composition. Trimming excess body fat while increasing muscle mass through training can show up as an increase in weight. Conversely, a decrease in weight may be due to a decrease in muscle mass and increase in body fat.

Monitoring both weight and body fatness using skinfolds or hydrostatic weighing helps the athlete keep tabs on his or her body composition as well as hydration status. Keeping body fatness under control can help the athlete achieve the desired ratio of muscle mass to body weight needed for top performance.

A good weight gain or weight loss program will keep the athletes' body composition at desired levels for competition. The following three principles need to be used in training programs that help athletes achieve desired body composition changes.

1. Gaining or losing weight to achieve recommended body composition changes take time. In most instances, a maximal rate of gain is 1 to 2 pounds of muscle mass a week. A desirable weight loss is 2 pounds a week and in some special cases, 4½ pounds a week.

2. Weight management diets should provide the athlete with optimal intake of the essential 40 nutrients

3. In most instances someone other than the coach should supervise weight-body composition control programs for a team. The heavy demands on a coaches' time makes it tough to monitor their athletes' day-to-day weight control programs. An assistant coach, trainer, school or community dietitian is the best person to monitor weight control programs.

Weight Loss

Ideally, weight loss should come from a decrease in body fat not body fluids. There are about 3,500 calories of energy stored in a pound of body fat. This amount of energy must be oxidized in addition to the energy oxidized for weight maintenance if a pound of body fat is to be lost. Daily energy requirements among athletes varies in a range from about 3,000 to 5,000 calories a day. An athlete can estimate his or her energy requirements using the guidelines in Section A - Sports Nutrition Essentials. The food plans in the Sports-Nutrition Eaters Guide Poster will provide about 1,200 calories. Large or second servings of food can be used to increase calorie intake. A calorie intake lower than 1,200 is not recommended because it decreases the likelihood of obtaining all essential nutrients.

Nutrition Alert!

Many female athletes are iron-depleted and need to concentrate on eating high iron foods or may need an iron supplement. Iron content of some foods are listed on the Sports-Nutrition Eaters Guide Poster.

A modest decrease in food intake and increase in activity will result in loss of approximately one to two pounds of body fat a week is compatible with maintaining good nutritional status and training program activity. In special situations such as a heavy football player who needs to reduce to a lighter wrestling weight, the maximal rate of fat loss should be three to four pounds a week. This is best done by increasing low to moderate intensity aerobic activity rather than making extreme decreases in food intake. Weight loss faster than recommended guidelines will prevent a athlete from maintining needed muscle mass and can decrease performance.

A modest 500 calorie decrease a day will add up to 3500 calories in one week and equal the calories in one pound of fat. An activity increase that uses 500 calories will also reach the same goal.

One factor in creating a feeling of optimum fitness for competition is a "light" feeling in the abdomen. Large food residues may produce an unwanted feeling of heavy fullness. This excess of residue also adds nonfunctional weight -- a problem in weight-control in sports. Thus, limiting the intake of high residue and

high fiber foods for three days prior to competition is a good idea. The following high-residue and high-fiber foods may well be avoided or limited in the diet, *but only during the short period of preparation for top performance.*

HIGH-FIBER or HIGH-RESIDUE FOODS:

1. Raw fruits and vegetables--salads
2. Dried fruits--raisins, apricots
3. Nuts
4. Whole-grain cereal products--whole-grain breads, granola, and bran
5. Berry and fruit pies; desserts with raisin and other dried fruits, and
6. Limit milk and cheese to two servings per day; two glasses of milk or 1 oz. serving of cheese.

Athletes participating in weight-regulated sports, often cut weight through dehydration. Prolonged sessions in the sauna, exercising in plastic suits, induced vomiting, spitting, and the use of diuretics and cathartics are risky practices commonly used to dehydrate before weigh-ins.

Dehydration compromises energy metabolism, limits endurance, and cannot be effectively corrected in the few hours between weigh-in and competition. The use of diuretics and cathartics compounds the effects of water loss by also causing loss of potassium causing muscle weakness. A well-planned hydration and weight-control program makes such drastic weight reduction unnecessary.

Gaining Weight

Many athletes attempt to increase body weight to improve their performance. Weight gain programs are often a part of strength training for sports like weight lifting and football. These athletes need specific nutritional consultation if they attempt to gain 20 or more pounds on unsupervised diets containing large amounts of fat. The harmful effects of high fat diets are often compounded with the use of dangerous and ineffective drugs, in addition to massive vitamin and protein supplements. This is probably the most undesirable and widespread nutrition-related abuse in American sports.

Athlete's who want to gain weight should be screened for family history of early cardiovascular disease. If there is a family history, the athlete and his family should be referred to a physician for blood lipid studies and appropriate follow-up.

The athlete's goal during weight gain is to increase body weight by increasing muscle mass and not merely increasing fat. An

increase in muscle mass can only result from adequate muscle work supported by an appropriate increase in nutrient intake. Without adequate muscle work, no food, vitamin, hormone, or drug will increase muscle mass. Each pound of lean body mass or muscle to be gained will require an added caloric intake in excess of expenditure - of approximately 2,500 calories. Adding 750 to 1,000 calories daily to an athlete's typical diet will provide the energy needs of gaining 1 to 2 pounds a week as well as for the increased energy expenditure of the muscle-training program. The muscle-training program will be prescribed by the coach or trainer and must be suitable for the age and condition of the athlete.

Many athletes will find their daily food intake of 1,000 extra calories is expensive and difficult to work into their busy schedules. Increasing food intake with two large snacks or an additional meal each day will require specific counseling and planning as it does not fit into the life-style of many active, young athletes. In addition, it is strongly recommended that the high calorie intake be provided by a diet that contains less than 30% of calories as fat. This means extra calories will need to come from carbohydrate. Such a diet is recommended as a prudent diet for American men by the American Heart Association. This is a highly desirable diet for the young male athlete. Additional educational material, such as sample menus, for such a diet are available to the physician through the American Heart Association.

Increases in body weight must be monitored weekly. Dietary records and recommendations should be reviewed at each check-in. It is important to estimate the level of body fatness through skin-fold measures at each check-in to detect any increases in body fatness. Increasing fatness demands reduction in calorie intake or an increase in muscle work, or both.

Unfortunately, the use of products that are supposed to be ergogenic aids by individuals on weight gain programs is widespread. These products are potentially dangerous, and ineffective and will be discussed in the part of this section on ergogenic aids.

Food Calorie References

The Food Groups-Energy Nutrient Content guide below can be used to help add or subtract food calories from an athlete's diet and lets you know whether those calories come from fat, carbohydrate, or protein. The reference in this Sports-Nutrition packet Appendix called *Nutritive Value of Foods* from U.S.D.A. and the pamphlet called *Nutritive Value of Fast Foods* from Ross Laboratories can also be used as references for finding the calorie and nutrient content of foods.

Each food group contains some energy nutrients...fat (9 calories per gram or 252 calories per ounce), carbohydrate (4 calories per gram or 112 calories per ounce) and protein (4 calories per gram or 112 calories per ounce). Alcohol is not an essential nutrient but does contain 7 calories per gram or 196 calories per ounce. The chart below summarizes general levels of energy nutrients found in foods in each of the major food groups in the 4-4-3-2-? Guide to Good Eating and Vegetarian Food Guide.

FOOD GUIDES - ENERGY NUTRIENT CONTENT

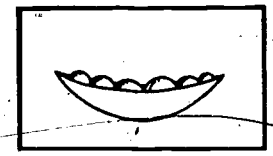
Vegetables	1 serving = 1/2 cup
One serving of vegetables contains: 2 gm. protein, 5 gm. carbohydrate, 25 calories.	
Fruit or Fruit Juice	1 serving = 1 fruit or 1/2 c. fruit or juice
One serving of fruit contains: 10 gm. carbohydrate, 40 calories. Fruits may be fresh, frozen, cooked, or canned.	
Grains-Breads-Cereals	1 serving = 1 sl. bread, tortilla, pancake; 1/2 c. cereal, potato, rice, pasta
One serving of bread or its equivalent contains: 2 gm. protein, 15 gm. carbohydrate, 70 calories. Bread or substitutes include bread, tortillas, biscuits, cereals, pancake , waffle , crackers, potato, rice, macaroni, noodles, popcorn, or pretzels.	
Milk	1 serving = 1 c. milk or yogurt
One cup of skim milk contains: 8 gm. protein, 12 gm. carbohydrate, 80 calories. Milk substitutes include whole*, 2%*, skim, evaporated milk*, 1 1/2 c. ice cream or ice milk, 2" cube of cheese, 2 c. cottage cheese	
Meat-Legumes-Nuts and Seeds	
Meat	
1 oz or its equivalent contains: 7 gm. protein, 3-8 gm. fat, 55-100 calories. Meat or substitutes include lean beef, veal, lamb, pork, fish, fowl, cheese, cottage cheese, eggs, shellfish, and peanut butter.	
Legumes-Dried Beans, Peas	
1/2 c. cooked contains: 7 gm. protein, trace fat, 20 gm. carbohydrate, 105 calories.	
Nuts and Seeds	
1/4 c. contains: 7 gm. protein, 18 gm. fat, 5 gm. carbohydrate	
Fat	1 serving = 1 t margarine, butter, oil; 1 T dressing or cream, 1/4 c. gravy, 1 sl bacon
One serving of fat contains: 5 gm. fat, 45 calories. Fats or oils include butter*, margarine, oils, salad dressing, gravy*, bacon*, and cream*.	
Dessert	1 serving = 1 small piece
One serving contains: 3 gm. protein, 8 gm. fat, 30 gm. carbohydrate, 200 calories. Desserts include pie, sweet roll, cookies, cake, or chocolate.	
Sugars and Sweets	1 serving = 1 tablespoon
One serving contains: 15 gm. carbohydrate, 60 calories. Sugars and sweets include suger, jelly, honey, syrup, hard candy, and 1/2 c. carbonated beverages.	

*Whole milk add 10 gm of fat and 90 calories. 2% add 5 gm of fat and 45 calories.

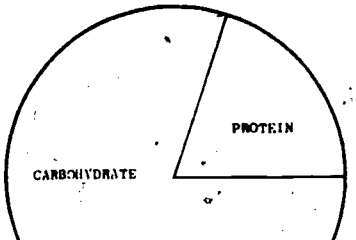
Each of the food groups is a concentrated source of some of the 40 or more essential nutrients. NO ONE FOOD OR FOOD GROUP CONTAINS ALL THE ESSENTIAL NUTRIENTS. Eating a variety of minimally processed foods using the 4-4-3-2-? Guide to Good Eating or Vegetarian Food Guide will give you 40 essential nutrients required by the body to maintain good health and top performance. Increase or decrease serving sizes or number of servings to adjust calories.

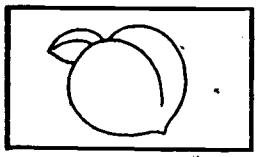
FOOD GUIDE EXCHANGE GROUP PIE GRAPHS

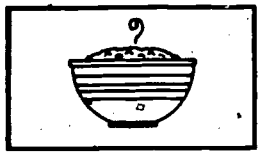
The following pie charts graphically show the percentage of calories supplied by the three energy nutrients - carbohydrate, fat, protein - for a serving from each Food Guide Exchange Group listed on pages 114.



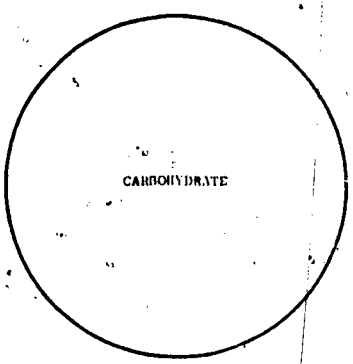
VEGETABLES



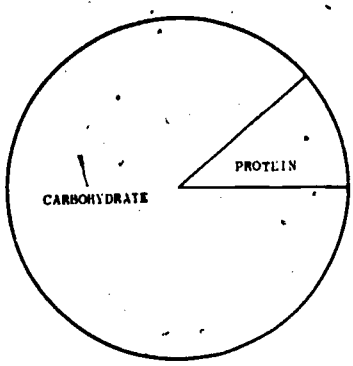


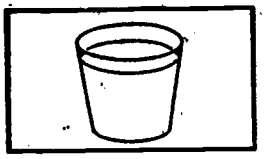


FRUIT

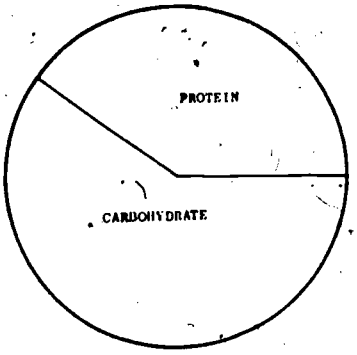


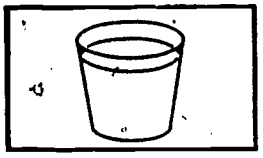
GRAINS·BREADS·CEREALS



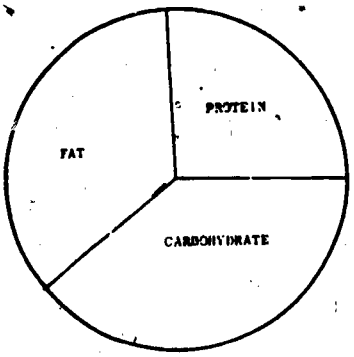


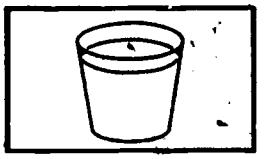
SKIM MILK



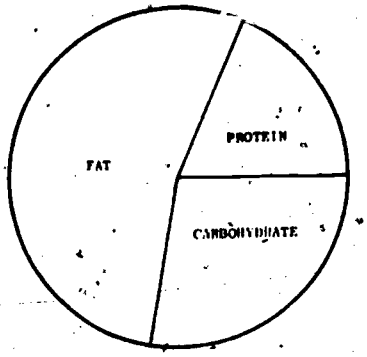


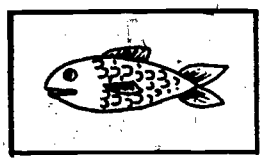
2% MILK



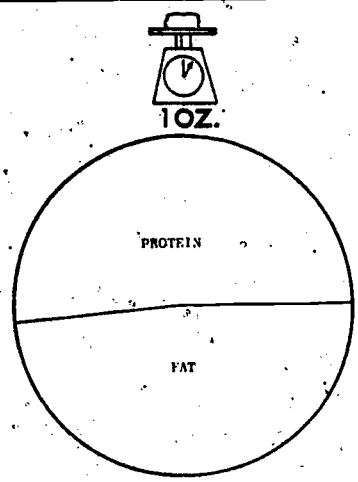


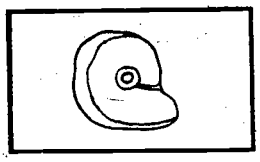
WHOLE MILK



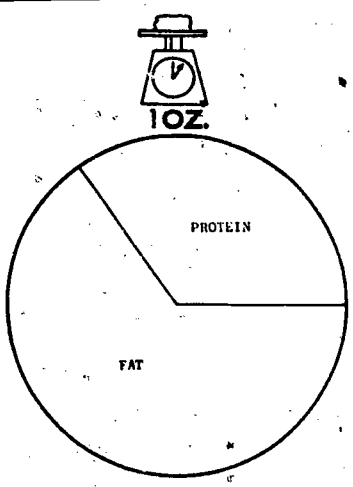


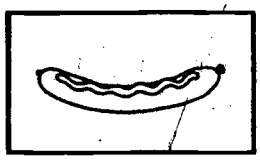
LEAN MEAT



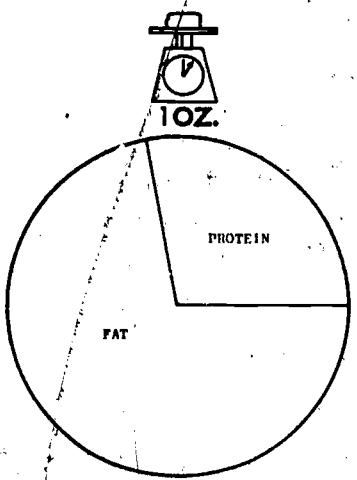


MEDIUM FAT MEAT

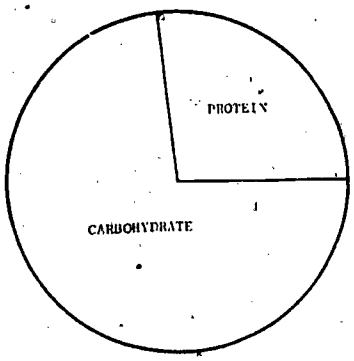


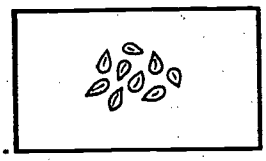


HIGH FAT MEAT

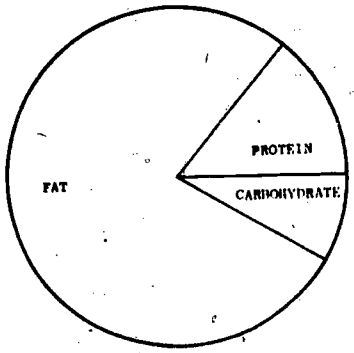


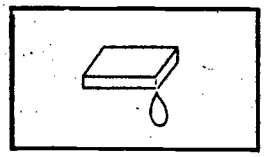
LEGUMES



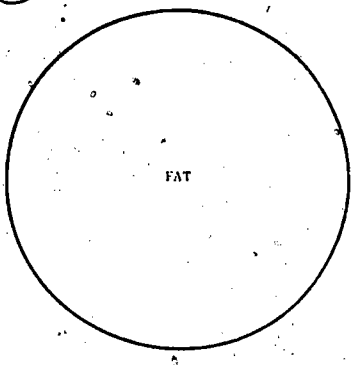


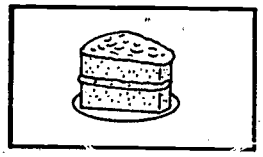
NUTS & SEEDS



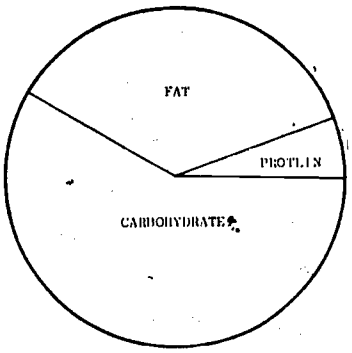


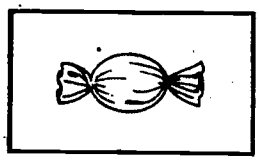
FAT



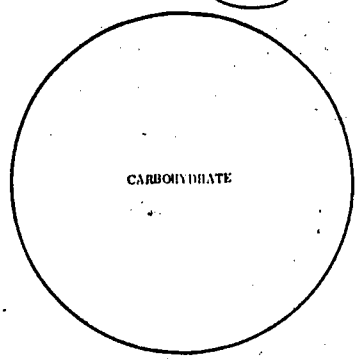


DESSERT





SUGARS & SWEETS



D - NUTRITION-FITNESS ASSESSMENT SKILLS TRAINING

ATHLETE DIET CHECK OUT

A quick way to checkout the nutritional adequacy of what an athlete eats is to keep track of what he or she eats for a day and to compare that list to the recommended number of servings from the 4-4-3-2-? Guide to Good Eating or the Vegetarian Food Guides. EATING ON TARGET can be used to check out how close a person comes to the recommended guidelines for the 4-4-3-2-? eat plan.

It is best to randomly pick days throughout training to have athletes do their diet check-outs. This check-out will help them find out if they are eating on the right track.

There are more sophisticated ways to evaluate the nutritional adequacy of what an athlete eats. Computerized food and nutrient analysis programs are available to help evaluate a person's nutrient intake in comparison to the Recommended Dietary Allowances or rate the nutrient density of their diet. Some computer programs will also help evaluate physical activity level. If you would like to use one of these computerized nutrient and activity analysis programs, you can contact:

Nutri-Fit
Food and Nutrition Extension
200 Gifford
Colorado State University
Fort Collins, Colorado 80523

(303) 491-7334

The cost of an analysis at this time is approximately $5.00.

A sample copy of a printout from a Nutri-Fit diet analysis is included on pages 125 to 129.

EATING ON TARGET

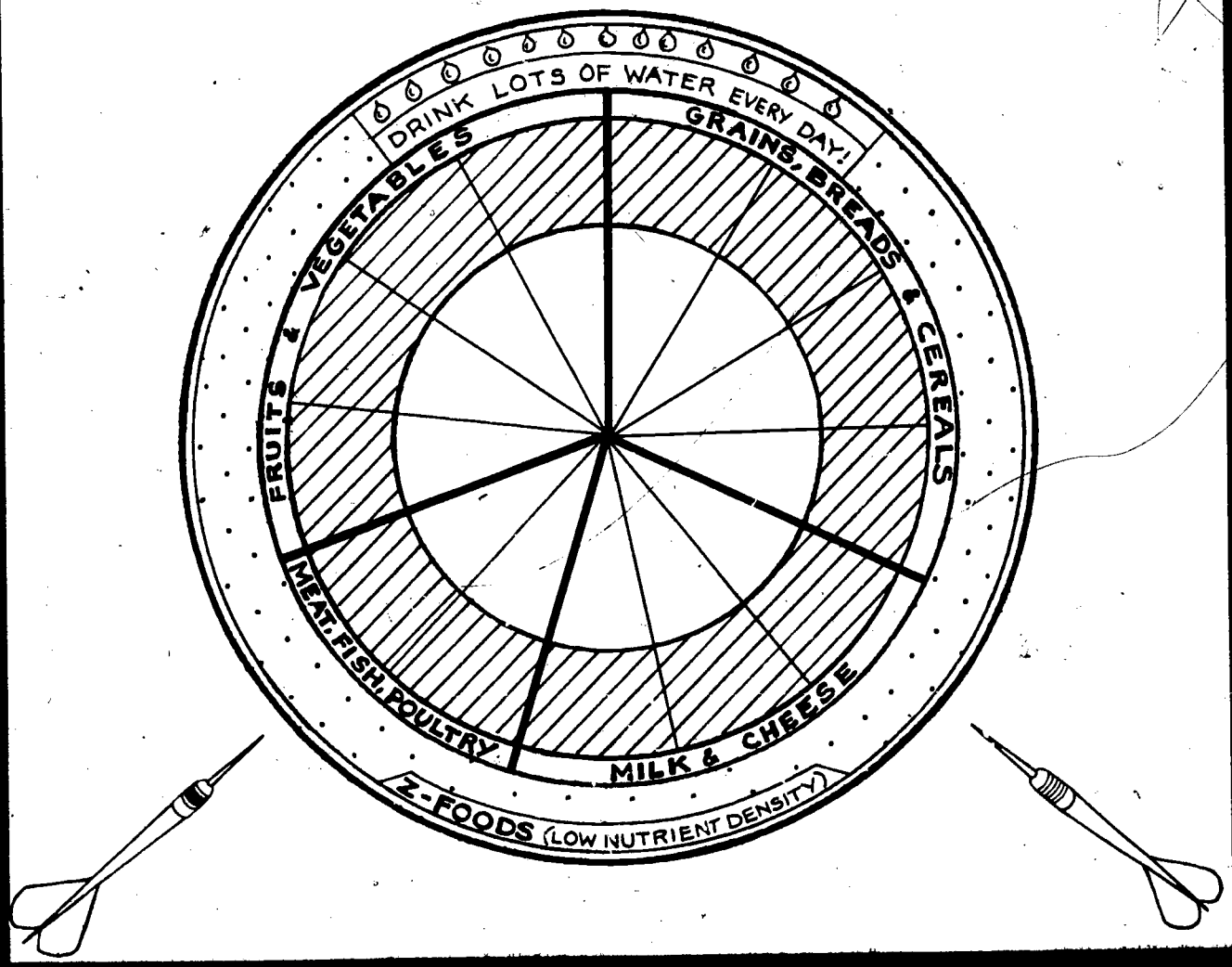
This Food-Fitness dart board will help you tune into how smart you are about what you eat. Smart eaters hit the bull's eye regularly!

Write down what you eat for 1 day. Start when you get up and end when you go to bed. After you eat something in a *Fitness-Food Bull's Eye* group, put a check mark in the bull's eye next to that group. When the bull's eye for each food group is full, put your check marks in the ▨ section of each group. How full is your bull's eye? A full bull's eye is a sign of a smart eater!

Foods like sweets fat and alcohol don't hit the bull's eye. These foods give you *calories* and few if any other nutrients like protein, vitamins, minerals or fiber. They are called *low-nutrient density* foods. Some people call them junk foods.

Put a Z in the dotted (⋱) ring around the bull's eye for each low-nutrient density food you eat.

Smart eaters have a full bull's eye and get most of their energy or calories from foods in the *Fitness-Food Plan*. They occasionally eat Z foods for extra calories.



EXAMPLE OF A COMPUTER BASED DIET ANALYSIS

C O L O R A D O S T A T E U N I V E R S I T Y

C O O P E R A T I V E E X T E N S I O N S E R V I C E

N U T R I - F I T

F O R A V A C A D O

MONDAY, JULY 20, 1981, 3:55 PM.

FEMALE
CURRENT WEIGHT = 135 POUNDS
DESIRED WEIGHT = 125 POUNDS
AGE = 38 YEARS
NOT PREGNANT
NOT LACTATING

REST	8.00 HOURS
LIGHT ACTIVITY	12.00 HOURS
MODERATELY ACTIVE	4.00 HOURS
VERY ACTIVE	0.00 HOUR
EXCEPTIONALLY ACTIVE	0.00 HOUR

DIET FOR MS. AVA CADO

1.			AVA CADO	
2.		38	YEARS OLD	
3.			FEMALE	
4.			NOT PREGNANT	
5.			NOT LACTATING	
6.		135	POUNDS CURRENT WEIGHT	
7.		125	POUNDS DESIRED WEIGHT	
8.		8.00	HOURS RESTING	
9.		12.00	HOURS LIGHT ACTIVITY	
10.		4.00	HOURS MODERATELY ACTIVE	
11.		0.00	HOURS VERY ACTIVE	
12.		0.00	HOURS EXCEPTIONALLY ACTIVE	
13.		7	OPTION PRINTS UNITS, %RDA, & NUT. DENSITY	
14.		2	RECOMMENDED DAILY ENERGY INTAKE BASED ON DESIRED WEIGHT	
15.		1.00	ANALYSIS IS FOR 1.0 DAYS	
16.	1465	.50	CEREAL-DRY, GRAPENUTS	1 CUP
17.	4010	.50	MILK, 2 PERCENT FAT	1 CUP=1 8-OZ GLASS
18.	6430	2.00	SUGAR, WHITE GRANULATED	1 LEVEL TEASPOON
19.	2120	2.00	COFFEE, BLACK	1 CUP (8 OZ)
20.	2715	1.00	DOUGHNUT, CAKE TYPE, PLAIN	1 MED DONUT 3-1/4 IN D
21.	2120	1.00	COFFEE, BLACK	1 CUP (8 OZ)
22.	7330	1.00	MCDONALDS-BIG MAC	1 BIG MAC
23.	5930	1.00	SOFT DRINKS-DIET DRINKS LESS THAN 1 CAL	1 CUP=1 8-OZ GLASS
24.	1370	2.00	CATSUP	1 TABLESPOON
25.	7360	1.00	MCDONALDS-FRENCH FRIES	1 SMALL BAG
26.	3560	1.00	LASAGNE	3X3-3/4-IN PIECE
27.	845	1.00	BREAD, FRENCH, ENRICHED	1 SLICE (13 PER LB).
28.	3810	1.00	MARGARINE, P/S=1.5 (CHIFFON, NUCOA)	1 LARGE PAT=2 TEASPOONS
29.	3635	.75	LETTUCE, RAW, ICEBERG/CRISPHEAD	1 CUP CHOPPED
30.	5525	1.00	SALAD DRESSING, BLUE/ROQ CHEESE, LOW CAL	1 TABLESPOON
31.	3400	.75	ICE CREAM, REGULAR FAT, HARDENED	1 CUP
32.	7115	.75	WINE, TABLE-12 PERCENT ALCOHOL	1 CUP=1 8-OZ GLASS

R E C O M M E N D E D D I E T A R Y A L L O W A N C E S

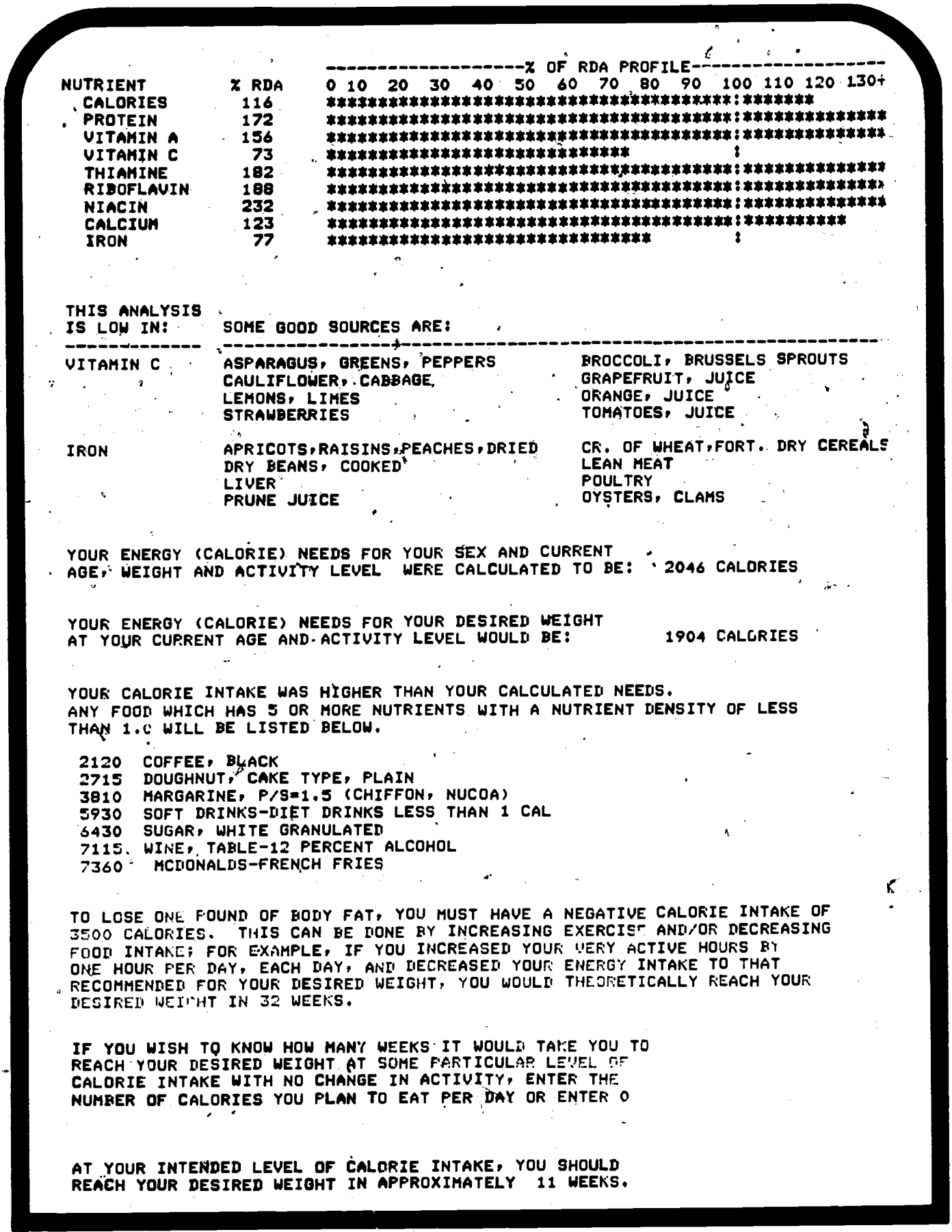
CALORIES	GRAMS PROTEIN	IU'S VIT A	MG'S VIT C	MG'S THIA	MG'S RIBO	MG'S NIAC	MG'S CALC	MG'S IRON
1904	44	4000	60	1.0	1.2	13	800	18

NUTRIENT ANALYSIS OF INDIVIDUAL FOODS

BY PERCENT OF RDA

CODE	NAME	SERV	SERVING SIZE

TOTL CALS	FAT CAL	CHO CAL	PRO CAL	ALCHOL CAL	P/S	MG CHOL	MG SODM	CALS	PROT	VITA	VITC	THIA	RIBO	CALC	IRON
									% OF RDA						
845	BREAD, FRENCH, ENRICHED								1.00	1 SLICE (13 PER LB)					
101	9	77	12	0*****		1	202	5	7	0	0	13	6	1	
1370	CATSUP								2.00	1 TABLESPOON					
31	1	30	2	0	0.0	0	312	1	1	10	7	2	1	0	
1465	CEREAL-DRY GRAPENUTS								.50	1 CUP				124	
197	2	181	23	0	0.0	0	691	10	13	61	0	75	68	3	
2120	COFFEE, BLACK								3.00	1 CUP (8 OZ)					
7	0	0	0	0	0.0	0	7	0	0	0	0	0	0	1	
2715	DOUGHNUT, CAKE TYPE, PLAIN								1.00	1 MED DONUT 3-1/4 IN DI					
164	70	86	7	0	.3	25	210	8	4	0	0	8	6	2	
3400	ICE CREAM, REGULAR FAT, HARDENED								.75	1 CUP					
191	94	81	17	0*****		39	62	10	10	10	1	3	16	18	
3560	LASAGNE								1.00	3X3-3/4-IN PIECE					
436	226	111	99	0	.3	103	1847	22	56	48	35	21	31	46	2
3635	LETTUCE, RAW, ICEBERG/CRISPHEAD								.75	1 CUP CHOPPED					
5	0	4	1	0	0.0	0	3	0	0	3	4	2	2	1	
3810	MARGARINE, P/S=1.5 (CHIFFON, NUCOA)								1.00	1 LARGE PAT=2 TEASPOONS					
72	72	0	0	0	1.5	0	98	3	0	8	0	0	0	0	
4010	MILK, 2 PERCENT FAT								.50	1 CUP=1 8-OZ GLASS					
72	22	29	20	0*****		11	74	3	11	2	2	4	20	21	
5525	SALAD DRESSING, BLUE/ROQ CHEESE, LOW CAL								1.00	1 TABLESPOON					
12	8	2	1	0*****		0	177	0	1	0	0	0	0	1	
5930	SOFT DRINKS-DIET DRINKS LESS THAN 1 CAL								1.00	1 CUP=1 8-OZ GLASS					
2	0	0	0	0	0.0	0	41	0	0	0	0	0	0	0	
6430	SUGAR, WHITE GRANULATED								2.00	1 LEVEL TEASPOON					
30	0	31	0	0	0.0	0	0	1	0	0	0	0	0	0	
7115	WINE, TABLE-12 PERCENT ALCOHOL								.75	1 CUP=1 8-OZ GLASS					
149	0	28	0	120	0.0	0	8	2	0	0	0	0	1	1	
7330	MCDONALDS-BIG MAC								1.00	1 BIG MAC					
542	282	156	102	0*****		74	963	28	58	8	3	35	29	21	2
7360	MCDONALDS-FRENCH FRIES								1.00	1 SMALL BAG					
210	95	102	12	0	2.0	9	112	11	7	1	18	13	1	1	



NUTRIENT	% RDA	% OF RDA PROFILE (0 10 20 30 40 50 60 70 80 90 100 110 120 130+)
CALORIES	116	**********
PROTEIN	172	**********
VITAMIN A	156	**********
VITAMIN C	73	*******
THIAMINE	182	**********
RIBOFLAVIN	188	**********
NIACIN	232	**********
CALCIUM	123	**********
IRON	77	*******

THIS ANALYSIS IS LOW IN:	SOME GOOD SOURCES ARE:	
VITAMIN C	ASPARAGUS, GREENS, PEPPERS	BROCCOLI, BRUSSELS SPROUTS
	CAULIFLOWER, CABBAGE,	GRAPEFRUIT, JUICE
	LEMONS, LIMES	ORANGE, JUICE
	STRAWBERRIES	TOMATOES, JUICE
IRON	APRICOTS,RAISINS,PEACHES,DRIED	CR. OF WHEAT,FORT. DRY CEREALS
	DRY BEANS, COOKED	LEAN MEAT
	LIVER	POULTRY
	PRUNE JUICE	OYSTERS, CLAMS

YOUR ENERGY (CALORIE) NEEDS FOR YOUR SEX AND CURRENT AGE, WEIGHT AND ACTIVITY LEVEL WERE CALCULATED TO BE: 2046 CALORIES

YOUR ENERGY (CALORIE) NEEDS FOR YOUR DESIRED WEIGHT AT YOUR CURRENT AGE AND ACTIVITY LEVEL WOULD BE: 1904 CALORIES

YOUR CALORIE INTAKE WAS HIGHER THAN YOUR CALCULATED NEEDS.
ANY FOOD WHICH HAS 5 OR MORE NUTRIENTS WITH A NUTRIENT DENSITY OF LESS THAN 1.0 WILL BE LISTED BELOW.

2120 COFFEE, BLACK
2715 DOUGHNUT, CAKE TYPE, PLAIN
3810 MARGARINE, P/S=1.5 (CHIFFON, NUCOA)
5930 SOFT DRINKS-DIET DRINKS LESS THAN 1 CAL
6430 SUGAR, WHITE GRANULATED
7115 WINE, TABLE-12 PERCENT ALCOHOL
7360 MCDONALDS-FRENCH FRIES

TO LOSE ONE POUND OF BODY FAT, YOU MUST HAVE A NEGATIVE CALORIE INTAKE OF 3500 CALORIES. THIS CAN BE DONE BY INCREASING EXERCISE AND/OR DECREASING FOOD INTAKE; FOR EXAMPLE, IF YOU INCREASED YOUR VERY ACTIVE HOURS BY ONE HOUR PER DAY, EACH DAY, AND DECREASED YOUR ENERGY INTAKE TO THAT RECOMMENDED FOR YOUR DESIRED WEIGHT, YOU WOULD THEORETICALLY REACH YOUR DESIRED WEIGHT IN 32 WEEKS.

IF YOU WISH TO KNOW HOW MANY WEEKS IT WOULD TAKE YOU TO REACH YOUR DESIRED WEIGHT AT SOME PARTICULAR LEVEL OF CALORIE INTAKE WITH NO CHANGE IN ACTIVITY, ENTER THE NUMBER OF CALORIES YOU PLAN TO EAT PER DAY OR ENTER 0

AT YOUR INTENDED LEVEL OF CALORIE INTAKE, YOU SHOULD REACH YOUR DESIRED WEIGHT IN APPROXIMATELY 11 WEEKS.

DIET ANALYSIS

BY NUTRIENT UNITS

CODE	NAME	SERV	SERVING SIZE

GMS PROT	GMS CHO	GMS FAT	P/S RATIO	MGS PHOS	MGS POT	MGS ZINC	IUS VITA	MGS VITC	MGS THIA	MGS RIBO	MGS NIAC	MGS CALC	MGS IRON
845	BREAD, FRENCH, ENRICHED						1.00	1	SLICE (13 PER LB)				
3	19	1	0.0/ .4=****	29	31	0.0	0	0	.1	.1	1.1	15	.8
1370	CATSUP						2.00	1	TABLESPOON				
1	8	0	0.0/ 0.0= 0.0	14	108	.1	419	4	.0	.0	.5	6	.2
1465	CEREAL-DRY, GRAPENUTS						.50	1	CUP				
6	45	0	0.0/ 0.0= 0.0	226	173	0.0	2469	0	.8	.8	9.9	27	1.9
2120	COFFEE, BLACK						3.00	1	CUP (8 OZ)				
0	0	0	0.0/ 0.0= 0.0	28	259	.2	0	0	0.0	0.0	2.2	14	.7
3400	ICE CREAM, REGULAR FAT, HARDENED						.75	1	CUP				
4	20	10	0.0/ 6.9=****	113	179	.5	435	1	.0	.2	.1	144	
3560	LASAGNE						1.00		3X3-3/4-IN PIECE				
25	28	25	2.4/ 9.6= .3	525	587	.0	1934	22	.2	.4	4.3	369	
3635	LETTUCE, RAW, ICEBERG/CRISPHEAD						.75	1	CUP CHOPPED				
0	1	0	0.0/ 0.0= 0.0	9	72	.2	136	2	.0	.0	.1	8	
3810	MARGARINE, P/S=1.5 (CHIFFON, NUCOA)						1.00	1	LARGE PAT=2 TEASPOO				
0	0	8	2.2/ 1.5= 1.5	1	2	.0	330	0	0.0	0.0	0.0	2	
4010	MILK, 2 PERCENT FAT						.50	1	CUP=1 8-OZ GLASS				
5	7	2	0.0/ 1.2=****	137	214	.0	97	1	.0	.2	.1	175	
5525	SALAD DRESSING, BLUE/ROQ CHEESE, LOW CAL						1.00	1	TABLESPOON				
0	1	1	0.0/ .5=****	7	5	0.0	27	0	0.0	.0	.0	10	
5930	SOFT DRINKS-DIET DRINKS LESS THAN 1 CAL						1.00	1	CUP=1 8-OZ GLASS				
0	0	0	0.0/ 0.0= 0.0	0	0	0.0	0	0	0.0	0.0	0.0	0	
6430	SUGAR, WHITE GRANULATED						2.00	1	LEVEL TEASPOON				
0	8	0	0.0/ 0.0= 0.0	0	0	.0	0	0	0.0	0.0	0.0	0	
7115	WINE, TABLE-12 PERCENT ALCOHOL						.75	1	CUP=1 8-OZ GLASS				
0	7	0	0.0/ 0.0= 0.0	17	162	.0	0	0	0.0	.0	.2	15	
7330	MCDONALDS-BIG MAC						1.00	1	BIG MAC				
26	39	31	0.0/15.0=****	215	387	3.9	327	2	.4	.4	8.2	175	
7360	MCDONALDS-FRENCH FRIES						1.00	1	SMALL BAG				
3	26	11	5.5/ 2.8= 2.0	48	567	.1	51	11	.1	.0	2.8	9	

T O T A L S B Y U N I T S

GMS PROT	GMS CHO	GMS FAT	P/S RATIO	MGS PHOS	MGS POT	MGS ZINC	IUS VITA	MGS VITC	MGS THIA	MGS RIBO	MGS NIAC	MGS CALC
76	231	98	10.5/39.5= .3	1456	2789	5.4	6262	44	1.8	2.3	30.2	991

DIET ANALYSIS

BY NUTRIENT DENSITY

CODE	NAME	SERV	SERVING SIZE	CALS	PROT	VITA	VITC	THIA	RIBO	NIAC	CALC	IRON
845	BREAD, FRENCH, ENRICHED	1.00	1 SLICE (13 PER LB)	1.0	1.4	0.0	0.0	2.6	1.3	1.6	.4	.
1370	CATSUP	2.00	1 TABLESPOON	1.0	.8	6.3	4.5	1.4	.9	2.2	.5	.
1465	CEREAL-DRY, GRAPENUTS	.50	1 CUP	1.0	1.3	6.0	0.0	7.2	6.6	7.3	.3	1.
2120	COFFEE, BLACK	3.00	1 CUP (8 OZ)	1.0	0.0	0.0	0.0	0.0	0.0	43.9	4.8	10.
2715	DOUGHNUT, CAKE TYPE, PLAIN	1.00	1 MED DONUT 3-1/4 IN DIA	1.0	.5	.1	0.0	1.0	.8	.6	.2	.4
3400	ICE CREAM, REGULAR FAT, HARDENED	.75	1 CUP	1.0	1.0	.1	.1	.4	1.6	.1	1.8	.1
3560	LASAGNE	1.00	3X3-3/4-IN PIECE	1.0	2.5	2.1	1.6	.9	1.4	1.4	2.0	.9
3635	LETTUCE, RAW, ICEBERG/CRISPHEAD	.75	1 CUP CHOPPED	1.0	2.7	12.1	14.6	8.8	7.3	3.4	3.7	4.1
3810	MARGARINE, P/S=1.5 (CHIFFON, NUCOA)	1.00	1 LARGE PAT=2 TEASPOONS	1.0	.0	2.2	0.0	0.0	0.0	0.0	.1	0.0
4010	MILK, 2 PERCENT FAT	.50	1 CUP=1 8-OZ GLASS	1.0	3.0	.6	.5	1.3	5.4	.2	5.8	.2
5525	SALAD DRESSING, BLUE/ROQ CHEESE, LOW CAL	1.00	1 TABLESPOON	1.0	1.7	1.1	.8	0.0	1.3	.2	2.0	.1
5930	SOFT DRINKS-DIET DRINKS LESS THAN 1 CAL	1.00	1 CUP=1 8-OZ GLASS	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6430	SUGAR, WHITE GRANULATED	2.00	1 LEVEL TEASPOON	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0
7115	WINE, TABLE-12 PERCENT ALCOHOL	.75	1 CUP=1 8-OZ GLASS	1.0	.1	0.0	0.0	0.0	.2	.2	.3	.5
7330	MCDONALDS-BIG MAC	1.00	1 BIG MAC	1.0	2.0	.3	.1	1.2	1.0	2.2	.8	.8
7360	MCDONALDS-FRENCH FRIES	1.00	1 SMALL BAG	1.0	.6	.1	1.7	1.2	.2	2.0	.1	.2

NUTRIENT DENSITY FOR TOTAL DAILY INTAK

NUTRIENT DENSITY VALUES FOR TOTAL INTAKE	CALS	PROT	VITA	VITC	THIA	RIBO	NIAC	CALC	IR
	1.0	1.5	1.3	.6	1.6	1.6	2.0	1.1	

CALORIES	TOTAL	% OF CALS	U.S. DIETARY GOALS
TOTAL	2227		
FAT	886	39	30
CARBOHYDRATES	925	41	58
PROTEIN	303	13	12
ALCOHOL	120	5	

SKINFOLD MEASUREMENT GUIDELINES FOR ADULTS

Skinfolds are measured on the right side of the body using a skinfold caliper.

Grasp the skinfold between the thumb and forefinger. The skinfold should include two thicknesses of skin and subcutaneous fat, but not muscle.

Apply the calipers approximately one centimeter below the fingers holding the skinfold, at a depth equal to the thickness of the fold. Each fold is taken in the vertical plane while the subject is standing, except for the subscapular, which is picked up on a slight slant running laterally in the natural fold of the skin.

The technique of measurement is repeated completely for each site before going on to the next site. This includes regrasping the skinfold. Whenever there is a difference greater than 0.5 millimeter, a third measurement is necessary. *The mean of the two closest readings represents the value for the site being measured.*

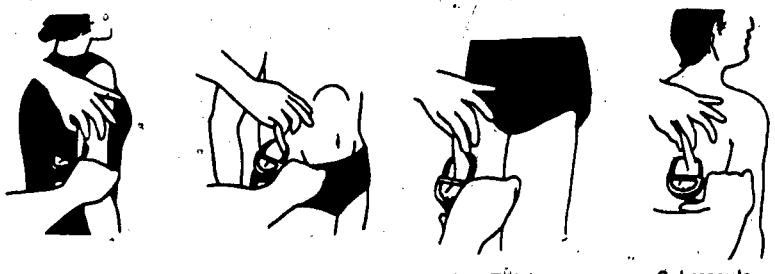
The anatomical landmarks for the skinfold sites are as follows:

Subscapula. The bottom point of the shoulder blade (scapula).

Thigh. The front side of the thigh mid-way between the hip and knee joints.

Triceps. The back of the upper arm midway between the shoulder and elbow joints.

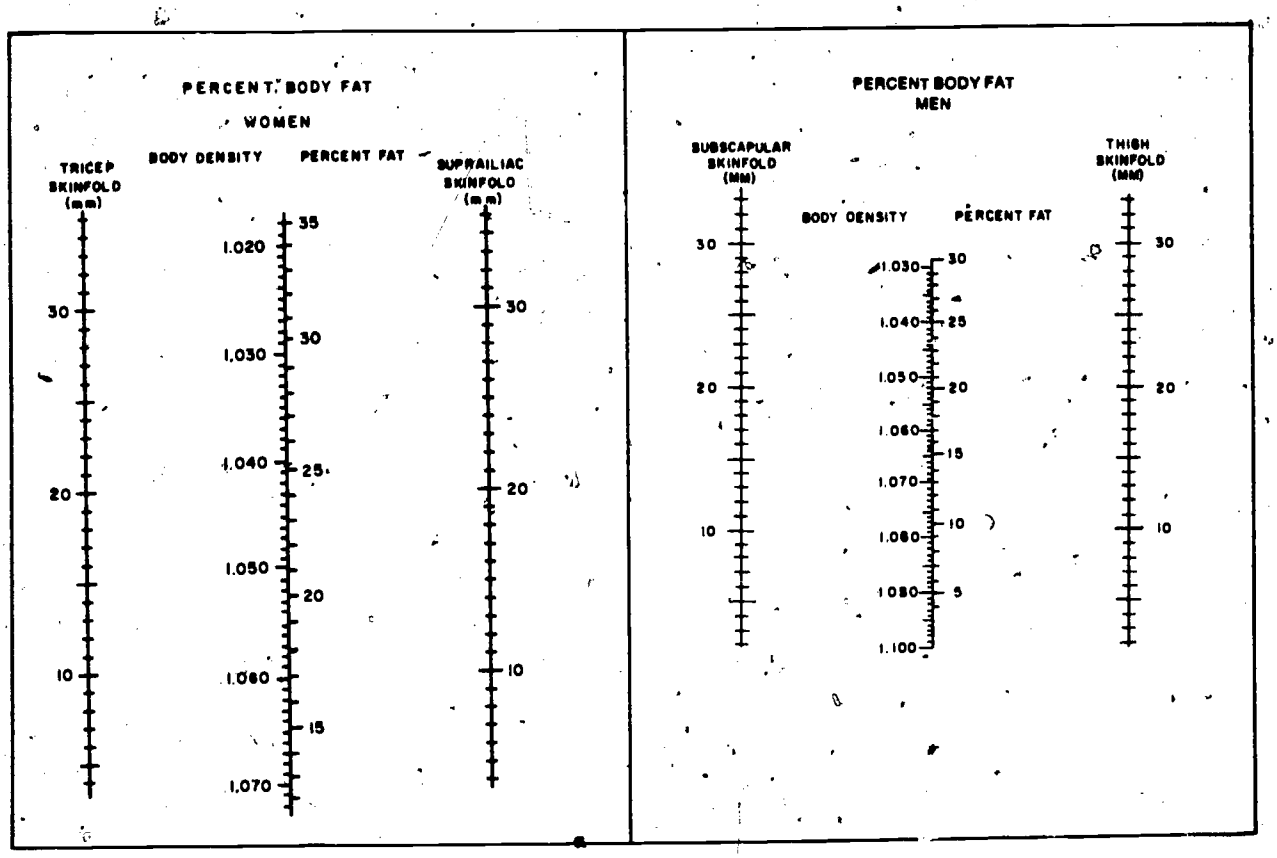
Suprailiac. Just above the top of the hip bone (crest of the ilium) at the middle of the side of the body.



Source: Getchell B. Physical Fitness - A Way of Life. John Wiley and Sons, Inc., New York, 1979.

NOMOGRAMS FOR PREDICTING BODY FAT

Body density and percentage of body fat can be quickly assessed for women and men from the graphs presented below. A straight line joining your skinfold values will intersect the corresponding values for body density and percentage of fat.



Nomogram for Conversion of Skinfolds to Body Density[1] and Percent Body Fat[2]

1. Sloan, A.W. et al. Journal of Applied Physiology, 17:967, 1962.
2. Brozek, J.F. et al. Annals of the New York Academy of Science, 101:113, 1963.

BODY FAT AVERAGES

A body fat classification chart for college-aged men and women is presented in the table below. Remember, a normal rating refers to the average for the group that was measured. This does not necessarily mean this is the most desired rating.

Body Fat Averages*

CLASSIFICATION	WOMAN (%)	MEN (%)
Very low fat: skinny	6-12	3-6
Low fat: trim	12-18	6-12
Average fat: normal	18-28	12-20
Above normal fat: plump	28-32	20-25
Very high fat: fat	32-36	25-30
Obese: over fat	36 and higher	30 and higher

*Based on guidelines from Dr. Tim Lohman, Associate Professor, University of Illinois.

For additional guidelines for typical ranges of percent body fat for adult males and females, please refer to page 6.

REFERENCES

SECTION A

American Dietetic Association. "Nutrition and Physical Fitness - A Statement by the American Dietetic Association." Journal of the American Dietetic Association, Vol. 76, May, 1980.

Bailey, Covert. Fit or Fat. Boston: Houghton Mifflin Co., 1978.

Briggs, George M. and Doris H. Calloway. Nutrition and Physical Fitness. Philadelphia: W.B. Saunders Co., 1979.

Buskirk, Elsworth R. "Some Nutritional Considerations in the Conditioning of Athletes." In William J. Darby, H.P. Broquist, and R.E. Olson (Eds). Annual Review of Nutrition. Palo Alto: Annual Review, Inc., 1981.

Chapman, Carlton B. and Jere H. Mitchell. "The Physiology of Exercise." Scientific American, Vol. 212, May, 1965.

Clark, Nancy. The Athlete's Kitchen. Boston: CBI Publishing Co. Inc., 1981.

Felig, P. and J. Wahren. "Fuel Homeostatis in Exercise." New England Journal of Medicine, Vol. 293, 1975.

General Mills Nutrition Department. Food for Fitness. Minneapolis: MN 55540.

Getchell, Bud. Physical Fitness - A Way of Life. New York: John Wiley and Sons, Inc., 1979.

Hamilton, Eva May and Eleanor Whitney. Nutrition Concepts and Controversies. St. Paul: West Publishing Co., 1979.

Hanley, Daniel F. "Athletic Training - And How Diet Affects It." Nutrition Today, Nov/Dec, 1979.

Howe, J. Nutrition, Health and Athletic Performance. Seattle: American Heart Association of Washington, September, 1975.

Katch, Frank and William D. McArdle. Nutrition, Weight Control, and Exercise. Boston: Houghton Mifflin Co., 1977.

Losik, L.K. Score with Good Nutrition. University of Arizona, Tucson, AZ 85721.

McArdle, William D., Frank I. Katch, and Victor L. Katch. Exercise Physiology - Energy, Nutrition, and Human Performance. Philadelphia: Lea & Febiger, 1981.

Mirkin, G. and M. Hoffman. The Sportsmedicine Book. Boston: Little, Brown and Co., 1978.

Morton Salt, Division of Morton-Norwich Products, Inc. 110 N. Wacker Drive, Chicago, Ill. 60606.

National Academy of Sciences - National Research Council. Recommended Dietary Allowances. Washington, D.C.: National Academy of Sciences, Office of Publications, 1980.

National Dairy Council. "Nutrition and Human Performance." Dairy Council Digest, Vol. 46, Mar/Apr, 1975.

National Dairy Council. "Nutrition and Human Performance." Dairy Council Digest, Vol. 51, May/Jun, 1980.

Reed, P.B. Nutrition: An Applied Science. St. Paul: West Publishing Co., 1980.

Smith, Nathan J. Food for Sport. Palo Alto: Bull Publishing Co., 1976.

Smith, Nathan J. "Gaining and Losing Weight in Athletics." Journal of the American Medical Association, Vol. 236, July 12, 1976.

Tucson General Hospital. Hidden Sugar in Food. Tucson, AZ.

United States Department of Agriculture. Home and Garden Bulletin No. 72 - Nutritive Value of Foods. Washington, D.C.: U.S. Government Printing Office, 1978.

University of Arizona, College of Agriculture, Nutrition and Food Science Department. Nutrition Super Stars 5th and 6th Grade Curriculum. Phoenix: Arizona Department of Education, 1979.

University of Arizona, College of Agriculture, Nutrition and Food Science Department. Nutrition Super Stars 7th and 8th Grade Curriculum. Phoenix: Arizona Department of Education, 1982.

Vitousek, Sharon H. "Is More Better?" Nutrition Today. Nov/Dec, 1979.

Water Quality Association. Richard Werckart, Technical Director. Easy to Use Guide to Sodium in Food, Medicine and Water.

Water and Sewer Department, P.O. Box 27210, 111 E. Pennington Street, Tucson, AZ 85708

Whitney, Eleanor and Eva May Hamilton. Understanding Nutrition. St. Paul: West Publishing Co., 1977.

Wilmore, Jack H. The Wilmore Fitness Program. New York: Simon and Schuster, 1981.

SECTION B

American Alliance for Health, Physical Education, Recreation and Dance. Health Related Physical Fitness Test Manual. Reston, VA: AAHPERD, 1981.

Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association. "Growth Standard Charts for Boys and Girls 4-18." Adapted from Hamill, P.V.V. et al. Physical Growth: A National Center for Health. American Journal of Clinical Nutrition, Vol. 22, 1979.

Whitlatch, Shelley and Gwen Hyatt. Fitness Facts - Evaluating Your Exercise Program. Tucson: Desert Southwest Fitness, 1980.

Wilmore, Jack H. "Physical Conditioning of the Young Athlete." In Smith, N.J. (Ed). Sports Medicine for Children and Youth. Report of the Tenth Ross Roundtable on Critical Approaches to Common Pediatric Problems. Columbus, Ohio: Ross Laboratories, 1979.

Wilmore, Jack H. The Wilmore Fitness Program. New York: Simon and Schuster, 1981.

SECTION C

American Dietetic Association. "Nutrition and Physical Fitness - A Statement by the American Dietetic Association." Journal of the American Dietetic Association, Vol. 76, May, 1980.

Bergstrom, J. and E. Hultman. "Nutrition for Maximal Sports Performance." Journal of the American Medical Association, Vol. 236, 1976.

Briggs, Geroge M. and Doris H. Calloway. Nutrition and Physical Fitness. Philadelphia: W.B. Saunders Co., 1979.

Buskirk, Elsworth R. "Diet and Athletic Performance." Post-graduate Medicine, Vol. 61, Jan, 1977.

Buskirk, Elsworth R. "Some Nutritional Considerations in the Conditioning of Athletes." In William J. Darby, H.P. Broquist, and R.E. Olson (Eds). Annual Review of Nutrition. Palo Alto: Annual Reviews, Inc., 1981.

Caffeine: "How to Consume Less." Consumer Reports. October, 1981.

Church, Charles F. and Helen N. Church. Food Values of Portions Commonly Used. Philadelphia: J.B. Lippincott Co., 1975.

Clark, Nancy. The Athlete's Kitchen. Boston: CBI Publishing Co., Inc., 1981.

Costill, D.M. Lecture in Exercise Physiology and Cardiovascular Disease class. University of Arizona, March 9, 1982, Tucson, AZ 85721.

Fahey, Thomas D. Good-Time Fitness for Kids. New York: Butterick Publishing, 1979.

Fox, E.L. Sports Physiology. Philadelphia: W.B. Saunders Co., 1979.

Hamilton, Eva M. and Eleanor Whitney. Nutrition Concepts and Controversies. St. Paul: West Publishing Co., 1979.

Hirata, I. "Pre-game Meals" A Discussion." Swimming Technique, Vol. 10, April, 1973.

Hirsh, Laurence M. "Practical Hints About Feeding Athletes." Nutrition Today. Nov/Dec, 1979.

McArdle, William D., Frank I. Katch, and Victor L. Katch. Exercise Physiology - Energy, Nutrition, and Human Performance. Philadelphia: Lea & Febiger, 1981.

Rose, K. "A Liquid Pre-game Meal for Athletes." Journal of the American Medical Association, Vol. 178, 1961.

Ryan, A.J. and F.L. Allman. Sports Medicine. New York: Academic Press, Inc., 1974.

Sergass, R.C. "Contemporary Nutrition." Journal of the American Pharmaceutical Association, Vo. 516, 1977.

Smith, Nathan J. Food for Sport. Palo Alto: Bull Publishing Co., 1976.

Smith, Nathan J. "Gaining and Losing Weight in Athletics." Journal of the American Medical Association, Vol. 236, July 12, 1976.

United States Department of Agriculture. Home and Garden Bulletin No. 72 - Nutritive Value of Foods. Washington, D.C.: U.S. Government Printing Office, 1978.

University of Arizona, College of Agriculture, Nutrition and Food Science Department. Nutrition Super Stars 7th and 8th Grade Curriculum. Phoenix: Arizona Department of Education, 1982.

Vitousek, Sharon H. "Is More Better?" Nutrition Today. Nov/Dec, 1979.

Williams, M.H. Nutritional Aspects of Human, Physical and Athletic Performance. Springfield, Ill: Charles C. Thomas, 1976.

Wilmore, Jack H. The Wilmore Fitness Program. New York: Simon and Schuster, 1981.

SECTION D

Food and Nutrition Extension. Nutri-Fit. Fort Collins, Colorado: Colorado State University, 1981.

Getchell, G. Physical Fitness - A Way of Life. New York: John Wiley and Sons, Inc., 1979.

University of Arizona, College of Agriculture, Nutrition and Food Science Department. Nutrition Super Stars 7th and 8th Grade Curriculum. Phoenix: Arizona Department of Education, 1982.

A P P E N D I X

ADDITIONAL RECOMMENDED REFERENCES

American Alliance for Health, Physical Education, and Recreation. Nutrition for Athletes - A Handbook for Coaches. 1201 16th Street, N.W., Washington, D.C. 20036, 1971.

Berland, Theodore. Diets '81 - Rating the Diets. Skokie, Ill: Consumer Guide, May, 1981, Vol. 304, $2.50.

Vodak, Paul. Exercise: The Why and The How. Bull Publishing Company, P.O. Box 208, Palo Alto, CA 94302, 1980.

The following services can provide you valuable information to technical questions and can give suggestions for other sources of information.

Dietitians' Answering Service (Phx)	266-0587
Dairy Council of Arizona 2008 S. Hardy Drive Tempe, AZ 85282	968-7814
Dairy Council of Arizona 4625 E. Ft. Lowell Road Tucson, AZ 85712	795-5759
Arizona Arthritis Foundation	264-7679
Arizona Heart Institute (Phoenix)	955-1000
Arizona Diabetes Assoc. (Phoenix)	274-3514
American Diabetes Assoc. (Tucson)	795-3711
Maricopa County Health Department	258-6381
Pima County Health Department	792-8862
Maricopa County Coop. Ext. Service	255-3355
Pima County Coop. Ext. Service	628-5161
Arizona Department of Education	255-3362
Az. Dept. of Health Services, Bureau Nutrition Services	255-1215

For services in other counties, contact the local health department.

INSTRUCTIONAL AIDS DIRECTORY

BOOKLET

Beyond Diet...Exercise Your Way to Fitness and Health
CPC International Inc., 1974
Price: Free

Best Foods
Box 307
Coventry, Conn. 06238

Food - A Hassle Free Guide to a Better Diet
U.S. Department of Agriculture
Price: $6.00

Government Bookstore
World Savings Building
720 N. Main Street
Pueblo, Colorado 81003

Nutrition and Your Health - Dietary Guidelines for Americans
U.S. Department of Agriculture and U.S. Department of Health and Human Services
Home and Garden Bulletin #232
Price: $2.25

Government Bookstore
World Savings Building
720 N. Main Street
Pueblo, Colorado 81003

Nutritive Value of Foods
U.S. Department of Agriculture
Home and Garden Bulletin #72
Price: $4.50

Government Bookstore
World Savings Building
720 N. Main Street
Pueblo, Colorado 81003

Shaping Up For The Long Run
CPC International Inc., 1980
Price: Free

Best Foods
Dept. SU-4, Box 307
Coventry, Conn. 06238

PAMPHLET/LEAFLET

Alcohol - Ups and Downs
University of Arizona, College of Agriculture, Cooperative Extension Service
Price: Free (up to 10 copies)

Agricultural Communications
College of Agriculture
University of Arizona
Tucson, AZ 85721
(602) 626-4701

Guide to Wise Food Choices
National Dairy Council, 1978
Price: Free

Dairy Council of Arizona
4635 E. Ft. Lowell, #107
Tucson, AZ 85712
(602) 795-5759

or

Dairy Council of Arizona
2008 S. Hardy Drive
Tempe, AZ 85282
(602) 968-7814

PAMPHLET/LEAFLET Continued

Nutrition-Fitness: A Winning Combination
University of Arizona, College of Agriculture, Cooperative Extension Service
Price: Free (up to 10 copies)

Agricultural Communications
College of Agriculture
University of Arizona
Tucson, AZ 85721
(602) 626-4701

Vegetarianism
University of Arizona, College of Agriculture, Cooperative Extension Service
Price: Free (up to 10 copies)

Agricultural Communications
College of Agriculture
University of Arizona
Tucson, AZ 85721
(602) 626-4701

Your Heart and How It Works
American Heart Association
Communication Division
Price: Free

American Heart Association
7320 Greenville Avenue
Dallas, Texas 75231

POSTERS

Guide to Good Eating
National Dairy Council, 1978
Price: Free

Dairy Council of Arizona
4635 E. Ft. Lowell, #197
Tucson, AZ 85712
(602) 795-5759

or

Dairy Council of Arizona
2008 S. Hardy Drive
Tempe, AZ 85282
(602) 968-7814

Shape Up America
Tupperware Educational Services
Price: $.90 each

Tupperware Educational Services
P.O. Box 2353
Orlando, FL 32802

MATERIALS

Adipometer/Skinfold Calipers with instructions and arm circumference tape
Price: Box of 5 calipers, $15.00
or 1 kit with directions, tape and calipers, $4.00

Ross Laboratories
585 Cleveland Avenue
Columbus, Ohio 43216

ARIZONA DEPARTMENT OF EDUCATION
Food and Nutrition Division
Regional Resource Centers

The Nutrition Education Resource Centers are a collection of nutrition education materials housed in seven libraries in the State of Arizona. The establishment of these centers is one component of the Arizona NET Program. These materials are treated as regular library items and thus are available for free loan. Consult the Nutrition Education Resource Center Catalog at your school or public library for instructional aids availability at each regional center. To borrow a specific item, contact your school or local public librarian or go directly to the resource center.

Nutrition Education Resource Center Locations:

Tucson Public Library
200 S. 6th Avenue
Tucson, AZ 85701
(602) 791-4393

Miami-Gila County Library
1052 Adonis
Miami, AZ 85539
(602) 473-2621

Yuma City-County Library**
350 3rd Avenue
Yuma, AZ 85634

Flagstaff Regional Library**
11 W. Cherry
Flagstaff, AZ 86001
(602) 774-0603

Cochise County Library
Drawer A-K
Bisbee, AZ 85603
(602) 432-5703, Ext. 500

Maricopa County Free Library**
3375 W. Durango
Phoenix, AZ 85009
(602) 269-2535

Navajo Nation Library
Window Rock Branch
P.O. Drawer K
Window Rock, AZ 86515
(602) 871-4941, Ext. 1517

- -

Dairy Council of Arizona**
4635 E. Ft. Lowell, #107
Tucson, AZ 85712
(602) 795-5759

Dairy Council of Arizona**
2008 S. Hardy Drive
Tempe, AZ 85282
(602) 968-7814

**Will interlibrary loan films.

For additional information contact:

Nutrition Education and Training Program
Food and Nutrition Division
Arizona Department of Education
1535 W. Jefferson Street
Phoenix, AZ 85007

SPORTS NUTRITION

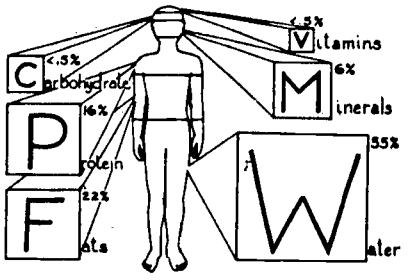
SUGGESTIONS FOR CLASSROOM ACTIVITIES

Section A

1. A unit on nutrition fitness can be created by using a series of learning stations. Use the kit's illustrations or activities as the foundation of each learning station. Along with the illustration or activity, provide instructions for student use and a series of questions related to the illustration or activity.

Example: The picture below called "Body Composition" shows the percentage of nutrients found in the average person's body. Study the picture carefully. Afterwards, fill in the blanks below the picture. Use the picture's information and your weight to find out how many pounds of each nutrient is in your body. See page 4.

Body Composition



Questions:

a. Put down how much you weigh _____ pounds

b. Multiply:

_____% body water x your weight _____ = _____ lbs of water in your body

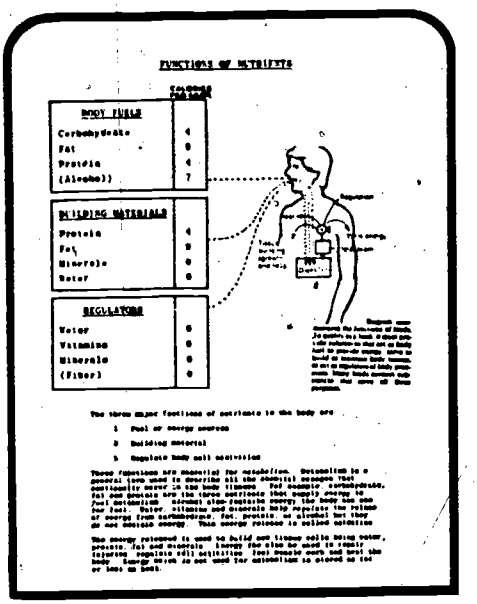
_____% fat x your weight _____ = _____ lbs of fat in your body

_____% protein x your weight _____ = _____ lbs of protein in your body

_____% minerals x your weight _____ = _____ lbs of minerals in your body

Less than _____% vitamins x your weight _____ = less than _____ lbs of vitamins in your body

Less than _____% carbohydrate x your weight _____ = less than _____ lbs of carbohydrate in your body



See page 17.

Study the picture above. Nutrients are placed in three groups depending on the function in the body. List the three major functions of nutrients in the body below:

a. _____

b. _____

c. _____

CALORIE CONTENT OF FUEL NUTRIENTS AND ALCOHOL

FUEL NUTRIENTS	Calories Per Gram	or	Calories Per Ounce
Fat	9		252
Carbohydrate	4		112
Protein	4		121
ALCOHOL	7		196

Check the number of calories provided by a gram of each fuel nutrient. See page 28.

If a person eats 100 gm fat, 75 gm of protein and 450 gms of carbohydrate in one day, how many calories does this equal?

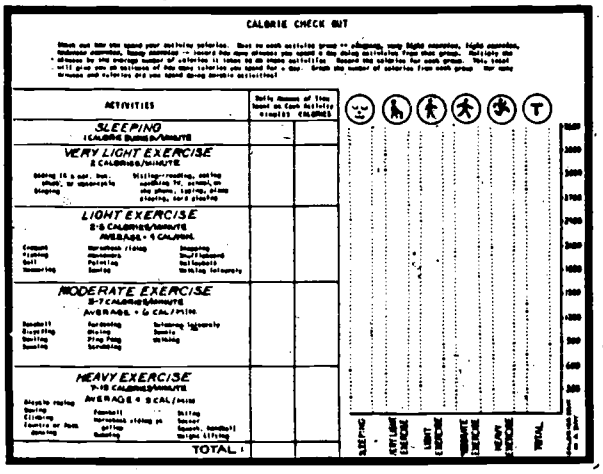
e.g. 100 gm fat x 9 calories/gm = 900 calories

75 gm prot. x ___ calories/gm = ___ calories

450 gm carb. x ___ calories/gm = ___ calories

TOTAL = ___ calories

2. Have your students estimate and compare their daily calorie needs using Calorie Check Out. See page 41.



3. Have students who want to lose excess body fat plan an exercise program to increase energy expenditure using the charts on page 41 and 45 in conjunction with weight loss guidelines on page 110-111.

Exercise and Energy Expenditure Chart

	Aerobic Benefits	Muscle Strength	Weight Control	Calories/ Hour*
☑ Jogging	4	3	4	600
☑ Bicycling	4	3	3	500
☑ Swimming	4	4	3	600
☑ Handball, Squash, Racquetball	4	3	4	420
☑ Cross-country Skiing	4	4	4	600
☑ Downhill Skiing	3	3	3	410
☑ Basketball	4	3	4	420
☑ Tennis–Single	3	3	3	410
☑ Calisthenics	1	4	2	320
☑ Walking	2	2	2	320
☑ Golf (no carts)	2	2	1	320
☑ Softball and Baseball	2	2	1	264
☑ Bowling	1	1	1	270

4 = very good 3 = good 2 = fair 1 = poor

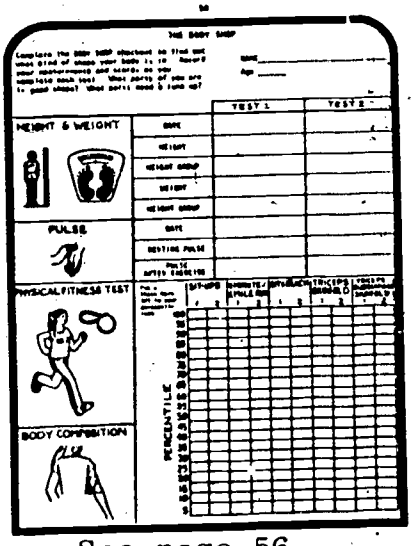
*Estimates for adult men and women.

See page 45.

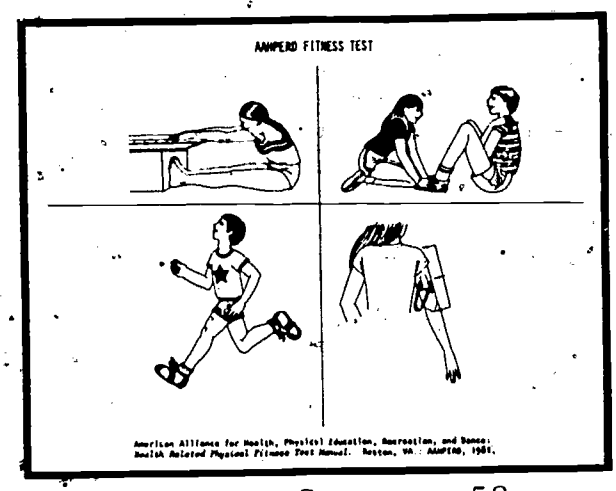
Section B

1. Have your students compare the height/weight values using the chart on page 54 with the values determined from their AAHPERD skinfold test. These measurements will help students determine if their body compositions are average, above average, or below average for their age.

2. To allow students to observe changes in their physical fitness, have the students take the AAHPERD Health Related Fitness Test periodically and place their results in the Body Shop.



See page 56.



See page 58.

3. Plan an aerobic conditioning program for your student athletes based on the principles in the Fitness Guide Poster and/or p. 71-84. Using overhead transparencies or handouts constructed from the kit's illustrations and posters, give your athletes a short lecture at the beginning of practice explaining the principles and methods of aerobic conditioning. You may need five 5-10 minute discussions on this topic.

4. In health class, construct learning stations using the AAHPERD Health Related Fitness Test with fitness principles. Have each student perform sit-up, sit and reach, and skinfold measurements at individual stations. The nine minute mile run may be done in conjunction with a physical education class. Combine the above stations with stations containing illustrations and discussions of aerobic fitness principles, pulse rate checkout, and the three parts of a personal fitness program as shown on the Sports-Nutrition Fitness Guide Poster. Give students calendars to help them keep a record of their level of fitness using the Body Shop (p. 56) and develop a weekly personal fitness program. The personal fitness program should include: frequency, intensity, activity duration, and type of exercise. Have students make periodic checks of the physical fitness status throughout the school year.

5. Include in the student's report card a physical fitness report. The report should include present as well as previous test scores to indicate fitness level progress. The report should be designed to compare the student with criterion standards indicating goals for improvement or maintenance of a desired fitness level. The report should not contain a letter grade. A format similar to the Body Shop can be adapted for the physical fitness report.

6. At the beginning of your sports program, evaluate each student's level of physical fitness by using the AAHPERD fitness tests and norm charts. Record the student's fitness level. Periodically reevaluate the student's fitness to see if additional improvements, when appropriate, have occurred. This procedure can be used to motivate students to up their fitness level by allowing the students to keep his/her own fitness record. See Body Shop, p. 56.

7. The procedure of student fitness evaluation described in the above example may be used to evaluate the effectiveness of your sports training program in improving strength, flexibility, endurance, and body composition of your athletes.

8. The AAHPERD Health Related Fitness Test can be used as an exercise prescription aid for the development of physical fitness. Several ways in which the test may be used are listed and explained below.

   a. Individual Diagnosis. The attained scores may reveal the student's fitness strengths and weaknesses. An individualized program may be tailored to meet the needs of those whose scores fall below the established standards.

   b. Educational Purposes. Test results can be used to stimulate interest in health topics. The test can be used to teach in the classroom basic concepts of cardiovascular health, physiology and health, and body composition.

   c. Training Program Evaluation. A periodic check can be helpful to see if the training program objectives are achieved. Two methods of evaluation can be used. First, the average score of the group rather than the individual score can be compared to the norm. A second approach is to determine the percentage of students who exceed the standard test score mean. Program evaluation over several years can assist in determining if the physical education program is improving the fitness level of your students.

*The AAHPERD Youth Fitness Test provides additional fitness-related and skills related tests for youth. For current prices and order information, write AAHPERD Promotion Unit, 1900 Association Drive, Reston, VA 22091.

Section C

1. Provide a short discussion to inform your athletes/students on dehydration signs/symptoms. In the locker room and/or practice area beside a weight scales, post the spectrum of dehydration (p. 87) and/or stages of heat injury (p. 91). Also, post both Hydration Management Recommendations (p. 88) and a Guide to Salt Replacement (p. 90) along with recommendations of salt replacement for sweat losses greater than six

pounds/day (p. 90-91). Post the weight chart for Prevention of Dehydration next to the scales. Have each student sign-up and record his or her weight before and after practice to monitor water losses.

SPORTS-NUTRITION CASE STUDIES

Case Study #1

Wendy is a 17 year old runner on the cross-country team. She is well aware of the high-energy demands of her sport. Wendy, concerned about her diet, tries to eat three well-balanced meals plus snacks every day. Although she seems to be eating a wide variety of nutritious foods, Wendy's dietary intake of iron is low. Can you help Wendy?

1. Why does Wendy need iron in her diet?
2. How could a low iron intake affect Wendy's athletic performance, as well as her academic performance?
3. What is Wendy's RDA for iron?
4. How can Wendy increase the absorption of iron in her diet?
5. What good food sources of iron could Wendy add to her diet?
6. What foods served in the school cafeteria are good sources of iron?
7. What snacks could Wendy choose that would provide iron in her diet?

Case Study #2

Jon, 16 years of age, is the 6' center on the basketball team. He is very active in school government and in the high school drama department. No wonder Jon has difficulty finding time to eat! Many of his meals are eaten at "fast food" restaurants. Because of the limited choice of foods at these restaurants, Jon's diet lacks variety. Unfortunately, this may result in his diet being low in certain nutrients, one of them being Vitamin C. Can you help Jon?

1. What is Jon's RDA for Vitamin C?
2. Would large doses of Vitamin C (ten times greater than the RDA) be beneficial to Jon?
3. What foods could Jon choose to increase his intake of Vitamin C?
4. Consider Jon's present eating patterns. What suggestions could you give Jon to help him include a wider variety of foods in his diet?

Case Study #3

Michelle, 14 years of age, recently joined the high school gymnastic team. She feels that maintaining an appropriate body weight is important to her athletic performance. Michelle has decided that she needs to lose 3 to 5 pounds. She has spent a great deal of time planning a low-calorie-meal pattern which includes a variety of foods. It looks fairly good...but wait a minute! Michelle doesn't plan to drink any milk. She says that milk is "fattening". There are very few other dairy products included in her diet. Where is Michelle going to get the calcium she needs in her diet? Can you help Michelle?

1. Why does Michelle need calcium in her diet?
2. How could a low intake of calcium affect Michelle's athletic performance?
3. What is Michelle's RDA for calcium?
4. What are the best food sources of calcium?

   Are there any other foods which contribute some calcium to the diet?
5. What suggestions could you give Michelle concerning the inclusion of milk products in a weight-reducing diet?

REFERENCE: From Teens, Foods, Fitness & Sports. John J.B. Anderson, Project Director, funded under a grant from Nutrition Education and Training Program, administered by the North Carolina Department of Public Instruction, Division of Child Nutrition, 1979.

ANSWERS TO SELECTED CASE STUDY QUESTIONS:

Case Study #1 (Questions 1-5)

1. Iron is essential to the oxygen carrying capacity of normal hemoglobin in the blood.

2. Iron-deficiency anemia: insufficient oxygen is delivered to body tissues

   -fatigue
   -loss of strength and endurance
   -shortened attention span

3. RDA for iron = 18 mg

4. Iron absorption is increased when Vitamin C and certain amino acids are eaten with the iron-rich food.

5. Meats (especially organ meats), fish, eggs, legumes (beans), whole-grain breads and cereals, dark-green-leafy vegetables, dried fruits.

Case Study #2 (Questions 1, 3)

1. RDA for Vitamin C = 60 mg

3. Good sources of Vitamin C: citrus fruits, raw-green-leafy vegetables, tomatoes, strawberries, melon, cabbage, broccoli, green peppers, potatoes.

Case Study #3 (Questions 1, 3, 4)

1. Calcium is necessary for: proper bone and tooth formation; muscle contraction; blood clotting; activation of enzymes.

3. RDA for calcium = 1200 mg

4. Best food sources of calcium are milk and milk products; other foods which contribute some calcium to the diet include dark-green-leafy vegetables and legumes.

HIGH CARBOHYDRATE DAILY FOOD GAME-PLANS

High Carbohydrate Daily Food Game-Plan Number 1 contains approximately 2755 calories, 440 gms of carbohydrate, 90 gms of protein and 70 gms of fat. Carbohydrates supply about 65% of the calories while fat provides 20%. The plan provides approximately 160% of the protein Recommended Dietary Allowance (RDA) and the total calorie RDA for a 154 lb. male doing light activity. Examples of light activity are walking casually, carpentry, golf, table tennis, and volleyball.

Breakfast

1 c. orange juice
1 c. bran flakes with raisins
1 c. 2% milk
2 sl. whole-wheat toast
2 tsp. jelly

Lunch

1 c. 2% milk
2 beef tacos
1 c. Spanish rice
5 carrot sticks
5 celery sticks
1 oatmeal cookie

Dinner

1 c. 2% milk
1 c. tossed salad
2 tbsp. low-calorie French dressing
1 sl. French bread
1 pat margarine
1½ c. macaroni and cheese
2 c. watermelon or ¼ cantaloupe

Snack

1 banana
1 apple
4 graham crackers

High Carbohydrate Plan Number 2 contains approximately 2650 calories, 500 gm of carbohydrate, 90 gms of protein, and 60 gms of fat. Carbohydrate provides about 75% of the calories while fat contributes about 20% of the calories. This plan provides 160% of the protein RDA and the total calorie RDA for a 154 lb. male doing light activity.

Breakfast

1½ c. orange juice
3 buttermilk pancakes
4 tbsp syrup
2 sl. bacon

Lunch

2 pcs. cheese pizza
1½ c. tossed salad
1 peach or apple
1 c. 2% milk

Snack

1 bagel
2 pats margarine
1 c. grapefruit

Dinner

1 baked chicken leg
1 c. rice
2 corn on the cob
1 pc. angel food cake

Snack

10 grapes
1 pear
1 bran muffin
1 c. 2% milk

High Carbohydrate Plan Number 3 is a lacto-ovo vegetarian food plan. It contains approximately 2650 calories, 75 gms of protein, 460 gms of carbohydrate, and 60 gms of fat. About 70% of the calories are provided by carbohydrate, while fat supplies about 20% of the calories. The plan provides approximately 135% of the protein RDA and almost the total recommended calorie needs for a 154 lb. male doing light activity.

Breakfast

3/4 c. orange juice
1 bagel
2 tsp. jelly
1 c. ready-to-eat-flaked cereal
1 c. 2% milk

Lunch

3/4 c. apple juice
2 c. cooked rice
3/4 c. stir-fried vegetables
3 pcs. tofu
1 c. fruit cocktail in heavy syrup

Snack

2 oatmeal-raisin cookies
1 c. 2% milk
1 banana

Dinner

1 c. tossed salad
2 tsp. low-calorie French dressing
2 c. spaghetti with tomato sauce and grated cheese
2 sl. Italian bread
2 tsp. margarine
1 c. 2% milk
1 peach

High Carbohydrate Plan Number 4 contains about 2700 calories, 400 gms carbohydrate, 80 gms protein, and 90 gms of fat. Sixty percent of the calories are provided by carbohydrate with fat providing about 30% of the calories. This menu provides 145% of the protein RDA and all of the recommended calorie needs for a 154 lb. male doing light activity.

Breakfast

6 oz. apple juice
2 poached or baked eggs
2 sl. whole-wheat toast
2 tsp. margarine
1 c. 2% milk
3/4 c. ready-to-eat cereal

Lunch

3/4 c. orange juice
½ c. tossed salad
2 tbsp. low-calorie French dressing
2 sl. cheese pizza

Snack

1 banana
1 c. 2% milk

Dinner

6 oz. apple juice
2 bean tostadas
1 c. Spanish rice
1 flour tortilla

Snack

2 oatmeal & raisin cookies

Legend

c = cups	sl = slice	16 tbsp = 1 cup
gms = grams	tbsp = tablespoon	3 tsp = 1 tablespoon
pcs = pieces	tsp = teaspoon	8 oz = 1 cup
oz = ounces		

These food game plans would provide the recommended calories for females who do two hours of moderate activities a day. Moderate activities include fast walking, cycling, skiing, tennis, and dancing.

These food plans can be easily altered to meet individual calorie needs. To increase calories, eat larger servings of grains, fruits, vegetables and sweets. To decrease calories, cut down serving sizes of all foods, especially fats, sweets, and alcohol - if you drink alcohol.

*The nutritional content of these high carbohydrate food plans was determined using the U.S.D.A. Home and Garden Bulletin Handbook No. 172 - Nutritive Value of Foods, and the Nutrient Analysis of Arizona Foods published by the Arizona Cooperative Extension Service. The nutrient content of each menu represents average values. Keep in mind that the condition of food, food preparation, and cooking may alter the nutrient content of foods. If you would like more information on planning a food plan for yourself or your athletes, contact a registered dietitian.

RECOMMENDED DIETARY ALLOWANCE (RDA) FOR ADOLESCENTS*

NUTRIENT	MALES			FEMALES		
	11-14	15-18	19-22	11-14	15-18	19-22
Recommended Dietary Allowances, 1980.[1]						
Energy (Kcal)[2]	2700	2800	2900	2200	2100	2100
Protein, gm	45	56	56	46	46	44
Vitamin A, µg R.E. (IU)	1000 (5000)	1000 (5000)	1000 (5000)	800 (4000)	800 (4000)	800 (4000)
Vitamin D, µg	10	10	7.5	10	10	7.5
Vitamin E, mg ∝-TE	8	10	10	8	8	8
Vitamin C, mg	50	60	60	50	60	60
Thiamin, mg	1.4	1.4	1.5	1.1	1.1	1.1
Riboflavin, mg	1.6	1.7	1.7	1.3	1.3	1.3
Niacin, mg, N.E.	18	18	19	15	14	14
Vitamin B_6, mg	1.8	2.0	2.2	1.8	2.0	2.0
Volacin, µg	400	400	400	400	400	400
Vitamin B_{12}, µg	3.0	3.0	3.0	3.0	3.0	3.0
Calcium, mg	1200	1200	800	1200	1200	800
Phosphorus, mg	1200	1200	800	1200	1200	800
Magnesium, mg	350	400	350	300	300	300
Iron, mg	18	18	10	18	18	18
Zinc, mg	15	15	15	15	15	15
Iodine, µg	150	150	150	150	150	150

Key: µg = micrograms, mg = milligrams, ∝-TE = alpha tocopherol equivalents, NE = niacin equivalents, RE = retinol equivalents, IU = International Units

*See Sports-Nutrition Fitness Guide Poster for RDA for all age groups.

[1]Adapted from Food and Nutrition Board, National Research Council: Recommended Dietary Allowances. Edition 9. Washington, D.C., National Academy of Sciences, 1980.

[2]Energy recommendations represent average approximate needs; actual energy needs will vary depending on degree of physical activity.

Estimated Safe and Adequate Daily Dietary Intakes, Food and Nutrition Board:

Vitamin K, µg	50-100	Chromium, mg	0.05-0.2
Biotin, µg	100-200	Selenium, mg	0.05-0.2
Pantothenic acid, mg	4-7	Molybdenum, mg	0.15-0.5
Copper, mg	2.0-3.0	Sodium, mg	900-2700
Manganese, mg	2.5-5.0	Potassium, mg	1525-4575
Fluoride, mg	1.5-2.5	Chloride, mg	1400-4200

Adapted from Teens, Foods, Fitness & Sports. John J.B. Anderson, Project Director funded under a grant from Nutrition Education and Training Program, administered by the North Carolina Department of Public Instruction, Division of Child Nutrition, 1979.

Cooperative Extension Service

Nutrition-Fitness: A Winning Combination

The University of Arizona · College of Agriculture · Tucson, Arizona 85721

Linda Houtkooper, M.S., R.D., Cooperative Extension Service, Food and Nutrition Consultant

We all like to be winners! But, many Americans are losing the fitness game. Since the beginning of this century America has changed from a physically active, rural-based society into a nation of sedentary spectators. Modern technology has made it possible for us to live comfortably without having to lift a finger. Driving has replaced walking. Elevators and escalators have made stairways look like deserted fire escapes. Work itself, for most people, involves relatively little, if any, vigorous physical activity. Recreation for many people means being a spectator not a participant. Television keeps many of us glued to our easy chair for hours.

Physical inactivity has led to a decline in fitness for Americans of all ages. Within the past decade, however, there has been a promising increase of interest in shaping up. A 1977 Gallup Poll reported that nearly half of American adults said that they exercise regularly to keep fit (8). Millions play tennis, bicycle, swim, dance and do calisthenics and other kinds of exercise. Running, in particular, has become a very popular pastime even though it is confined to a relatively small and highly visible portion of the population. For the millions of healthy exercise enthusiasts who derive great pleasure and satisfaction from their efforts, there are tens of millions of people whose ventures into the world of exercise are only a memory. To these millions of Americans, the rise in fitness fever is dismissed as a health fad.

The fitness boom of the past few years is really a smart reaction to the reality that sedentary living is here to stay. It has become clear to many wise Americans that at a certain point, effortless living and good health are not compatible. These Americans realize that to be healthy in the future they are going to have to imitate physically active lifestyles of the past. The exercise that our ancestors got on the job we must get after hours. Basic foods were all that our ancestors had to eat. Today we must consciously choose foods to meet our nutrient needs from among thousands available 24 hours a day in supermarkets, fast food restaurants and vending machines.

Fit vs Fat

For thousands of years our ancestors had to struggle for survival. They learned that what felt good also helped them survive. It followed that they learned to function on the principle of pleasure. Today that principle lives on, but now we have an abundant supply of food, alcohol, tobacco, drugs, cars, easy-chairs and a host of other worldly delights with which to indulge ourselves. We are pleasure-seeking creatures living amid abundant pleasures that are not always healthful to pursue. Overindulgence is prematurely killing many Americans.

To be healthy in a world of television, electric toothbrushes, doors that automatically open, 24-hour-a-day supermarkets and spectator sports, we need to develop clever fitness game plans that include a variety of minimally processed foods, adequate exercise and a winning attitude.

Most of us take pleasure where we can find it. We seem to have a "minimum daily requirement" for things that give us comfort and make us feel good, so we treat ourselves to a banana split after religiously following a "diet" for a few days. We pour a couple of stiff drinks after a tough day at work and reach for a cigarette during times of stress. Our pleasure principle is saying to us, "I've experienced some tough things, I need to treat myself." Can we have both pleasure and good health? Yes. The secret to real enjoyment is learning to find pleasure in things that both feel good and are good for us.

Fitness Firsts

If we want to feel good, we must fit fitness into our lives.

Here is some practical advice that can help make fitness a pleasure.

- Tackle your fitness plan one step at a time. You want evolution not a revolution! Try a healthy substitute for an eating or exercise habit you want to change. For example, when stress starts to mount, reach for something other than a few drinks or a bag of cookies and the easy chair. Instead reach for a pair of comfortable shoes and take a walk, alone or with a family member or friend.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Roy S. Rauschkolb, Director, Cooperative Extension Service, College of Agriculture, The University of Arizona.

- Take a trip to the closest swimming pool. Turn on the radio and listen to some relaxing music and do a few minutes of stretching or breathing exercises. Seek out friends who are active. Plan a pot-luck meal and volleyball game in a local park. The healthy pleasures in life don't just happen, you have to choose them and experience them frequently until they replace your old, unwanted habits.
- Before you can quit or cut down on an activity you need something pleasurable and satisfying to put in its place. If you turned down an invitation to go someplace for a delicious lunch because you're on a diet and later that day eat an "I earned it" bag of potato chips while watching TV or maybe even a "what the heck, I'm going to be skipping breakfast tomorrow, aren't I" chocolate sundae before bed, what have you gained? You'd have been better off if you had gone to lunch and enjoyed a delicious salad with a scoop of your favorite ice cream for desert. Compensation can be fattening.
- Don't take relapses personally. Remember, changing habits takes time. We often bite off more than we can chew. By criticizing yourself, you bruise your ego and lower the very self esteem you need to enjoy yourself and succed in the long run.

What Exercise Can Do for You

Exercise can do a great deal for both the body and the mind. People who exercise regularly say they feel better, have more energy and often need less sleep. Regular exercisers often lose excess fat as well as improve muscle strength and flexibility. Many also experience psychological benefits including improved self-esteem, greater self-reliance, decreased anxiety and relief from mild depression (8, 9). Fitness-minded people usually adopt the pleasures of a healthier lifestyle and in the process abandon smoking, excessive drinking and risky nutritional habits.

Research shows that regular sustained exercise improves the efficiency of the heart (9). Compared to non-exercisers, people who are physically active regularly have been observed to have one-and-a-half to two times lower risk of developing cardiovascular disease, and an even lower risk of sudden death (8). Another example of growing evidence supporting the association between exercise and reduced cardiovascular disease risk comes from a study of 17,000 Harvard alumni. The physically active among them had significantly fewer heart attacks than the more sedentary. Those who used less than 500 calories a week in exercise developed heart disease at about twice the rate of those using 2,000 or more calories a week. Regular vigorous exercise was found to reduce risk of heart disease independently of other risk factors such as cigarette smoking or high blood pressure (8). While not yet definitely proven, the role of exercise in preventing heart disease is attractive and plausible. The following chart summarizes the number of calories required by different activities (4).

Activity Calorie Requirements

1 calorie a minute:
Sleeping.

Very Light Exercise (2 calories a minute)
Doing office work; riding in a car, bus or truck; riding a motorcycle; sewing; sitting to read, watch TV, study telephone, type, play the piano or play cards.

Light Exercise (2-5 calories a minute)
Doing housework; shopping; playing golf or croquet; riding horseback at a walk; sewing; playing volleyball; walking slowly; fishing; painting; playing shuffleboard; hammering.

Moderate Exercises (5-7 calories a minute)
Walking fast; bowling; playing tennis; playing ping pong; gardening; skiing downhill; bicycling slowly; hiking; dancing slowly; leisurely swimming; scrubbing; playing baseball.

Heavy Exercise (7-12 calories a minute)
Playing basketball; weight lifting; playing hockey; running; bicycle racing; playing football; playing squash; skiing cross country; boxing; horseback riding at a gallop; country or folk dancing; climbing.

Keys to Enjoying Exercise

Variety, conditioning, flexibility and medical clearance are the keys to enjoyable exercise.

Variety is the spice of exercise. Try many types of activities to stave off exercise boredom. Include friends and family in your activities.

Proper conditioning is another key to pleasurable exercising. Easing into exercise prevents sore muscles and exhaustion. Start off slowly and gradually increase the intensity and length of time you regularly exercise. A giant leap from the easy chair to an all-out exercise effort is foolish and dangerous and is not likely to accomplish a great deal except make you feel bad.

Keep your exercise time flexible. If you have a cold or feel rotten skip a day or a few days of exercise. Your body is trying to tell you something and it may be nothing more than slow down and rest. Exercise plans that are flexible help make exercise fun not torture.

If you have any health problems or are over 40 be sure to get a thorough physical examination and medical clearance before you start vigorous exercise (8). Knowing it is safe to exercise, gradually working up your exercise level for a variety of activities and keeping your exercise time flexible add up to fun and fitness.

Another key to making exercising enjoyable is good equipment. Luckily, most simple exercise does not require a big expense. Good shoes are basic to most activities. Spend the time and the money to buy the best shoes you can afford.

Exercise — How Much Is Enough for Fitness?

Exercising once a week is almost equivalent to starting from ground zero each time. If exercise is to be of maximum value for tuning up your body, you should exercise regularly and vigorously. Most experts suggest a reasonable goal is 20 to 40 minutes of exercise at least three times a week. Less often than this will be unlikely to achieve adequate physical conditioning for fitness. Regularity is also important because your body rapidly reverts to its pre-exercise condition when you trade activity for the easy chair (9).

Before strenuous exercise be sure to spend 5-10 minutes warming up your muscles by stretching and doing light exercise that gives all your muscles a chance to get ready for some work. Warm up exercises are good insurance for preventing muscle sprains, strains and other injuries.

After you are through exercising it is also a good prevention practice to cool down your muscles for 5-15 minutes by slowing down your rate of activity and doing stretching exercises. If you are driving 55 miles an hour you wouldn't think of turning off your car engine and immediately stopping your car. So, don't abuse your body by abruptly stopping heavy exercise. Cool down first.

What Is the Best Exercise?

A variety of activities can help improve your strength, coordination, flexibility and endurance. The kind of physical activity most beneficial for endurance and maintaining cardiovascular fitness is called aerobic exercise. Your working cells — heart, legs, arms — require large amounts of oxygen to release energy to fuel aerobic exercise. Aerobic exercises help improve the utilization of oxygen in the body cells (9). Brisk walking, dancing, running, bicycling, hiking and swimming are some examples of aerobic exercises. Most research indicates that 20-40 minutes of aerobic exercise done 3-4 days per week is the amount and frequency of exercise necessary for tuning-up your cardiovascular system (11). This cardiovascular system tune up can help lower your risk of heart disease.

"Just how hard do I need to push myself when I do aerobic exercise?" is probably the next question on your mind as you start to exercise. This is a very important question because if you don't exercise hard enough or with enough intensity there is little benefit for your heart and blood vessels. On the other hand, if you work too hard or intensely it can be dangerous to your cardiovascular system, especially if you have been sedentary for several years.

The talk test is a simple guide to gauge the intensity of your aerobic exercise or how hard you are working. You should be able to carry on a conversation while doing aerobic exercise. If you cannot, slow down. Your pulse rate can also be used to monitor the intensity of exercise. To benefit from aerobic exercise your heart must be working hard enough to be within your training heart rate range. Your training heart rate range can be roughly estimated using the following formula (9, 11).

Training Heart Rate Range

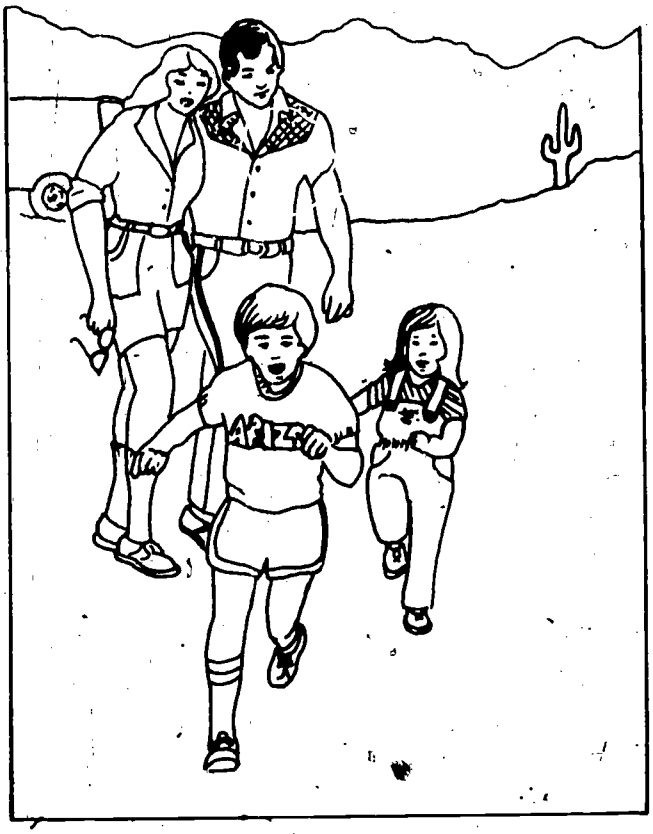
Upper Level = (220 minus your age) x .80
Example: Age 35 (220 - 35) = 185 x .80 = 148 beats per minute
Lower Level = (220 minus your age) x .65
Example: Age 35 (220 - 35) = 185 x .65 = 120 beats per minute

Your aerobic exercise is of adequate intensity if your pulse rate is within this training heart range. Remember, this is an estimate. You can more accurately determine your training heart rate by having a professionally administered exercise stress test on a treadmill or bicycle (11).

Regular sustained aerobic exercise may decrease your cardiovascular risk in several ways. Such activity may cause the blood pressure of a hypertensive individual to fall an average of 10 points and may also lower serum cholesterol while raising the level of desirable high-density lipoproteins. It can also get rid of excess fat.

Aerobic exercise, when carefully prescribed, has been found useful for patients with angina or chest pain and those recovering from heart attacks, enabling them to increase the amount of activity they can do without any chest pain. Such exercise has also been shown to be useful in treatment of other diseases. Asthmatics and people with chronic obstructive lung disease often can improve their respiratory capacity. Diabetics can lower their blood sugar levels and insulin requirements, and overweight adults who have become diabetic often are freed of any symptoms of the disease when they achieve normal weight through exercise and diet (8).

Non-aerobic activities, such as walking, volleyball, yoga, weightlifting, gardening, bowling, softball, golf or calis-



Recommended Dietary Allowances

Age years	Protein g	Vitamins A µg RE	D mg	E mg α-TE	C mg	Thi mg	Rib mg	Nia mg NE	B_6 mg	Fol µg	B_{12} µg	Minerals Ca mg	P mg	Mg mg	Fe mg	Zn mg	I µg
Males																	
11-14	45	1,000	10	8	50	1.4	1.6	18	1.8	400	3.0	1,200	1,200	350	18	15	150
15-18	56	1,000	10	10	60	1.4	1.7	18	2.0	400	3.0	1,200	1,200	400	18	15	150
19-22	56	1,000	7.5	10	60	1.5	1.7	19	2.2	400	3.0	800	800	350	10	15	150
23-50	56	1,000	5	10	60	1.4	1.6	18	2.2	400	3.0	800	800	350	10	15	150
51+	56	1,000	5	10	60	1.2	1.4	16	2.2	400	3.0	800	800	350	10	15	150
Females																	
11-14	46	800	10	8	50	1.1	1.3	15	1.8	400	3.0	1,200	1,200	300	18	15	150
15-18	46	800	10	8	60	1.1	1.3	14	2.0	400	3.0	1,200	1,200	300	18	15	150
19-22	44	800	7.5	8	60	1.1	1.3	14	2.0	400	3.0	800	800	300	18	15	150
23-50	44	800	5	8	60	1.0	1.2	13	2.0	400	3.0	800	800	300	18	15	150
51+	44	800	5	8	60	1.0	1.2	13	2.0	400	3.0	800	800	300	10	15	150
Pregnant	+30	+200	+5	+2	+20	+0.4	+0.3	+2	+0.6	+400	+1.0	+400	+400	+150	+30-60	+5	+25
Lactating	+20	+400	+5	+3	+40	+0.5	+0.5	+5	+0.5	+100	+1.0	+400	+400	+150	+30-60	+10	+25

Abbreviations: C = ascorbic acid, Fol = folacin, Nia = niacin, Rib = riboflavin, Thi = thiamin, Ca = calcium, P = phosphorous, I = iodine, Fe = iron, Mg = magnesium, Zn = zinc, µg = micrograms, mg = milligrams, α-TE = alpha tocopherol equivalents, NE = niacin equivalents, RE = retinol equivalents.

thenics are very good for enhancing your muscle tone, strength, flexibility, coordination and relaxation. But they are not vigorous enough to reduce your cardiovascular disease risk effectively. Non-aerobic exercises are also good because they add variety. Try the exercises that appeal to you. Change what you do to stave off boredom and to keep exercise fun.

The Nutrition Component

Now that you have the ground rules for starting an activity plan for fitness and feeling good, let's look at the latest recommended eating guidelines for fitness.

A nutritionally adequate diet is one that provides enough of the six major nutrients—protein, fat, carbohydrate, vitamins, minerals, water—and energy to enable your body to work at its optimal level (3). Except for energy, nutritional needs are basically the same for people who exercise for fun and health, athletes and sedentary people (9).

Eliminating any one of the six major nutrients from your diet will eventually cause a decline in fitness and health. The Recommended Dietary Allowances (RDAs) are one set of guidelines nutritionists or dietitians use to determine a nutritionally adequate diet for any age, sex and activity level. Although the RDAs are standards for population groups rather than individuals, the needs of most healthy people will not exceed them (4, 9).

The *Fitness Food Plan* on page 7 has been developed by nutritionists for athletes and fitness buffs as an easy guide for helping them choose minimum amounts of a variety of foods that can supply the right amounts of the six major nutrients needed for good health and fitness.

In their quest to be winners, the fitness-minded often have fallen for "miracle" diet schemes, vitamin and mineral supplement claims or "wonder" foods. The claims for these products often sound too good to be true. Taking this quick nutrition-fitness quiz and then checking the correct answers will help you see how your nutrition and fitness knowledge measures up.

Nutrition-Fitness Quiz

	True	False
1. Athletes and other people who exercise regularly have special needs for extra protein.	____	____
2. Exercise uses so few calories that it is not helpful in weight control.	____	____
3. Running a mile burns more calories than walking a mile.	____	____
4. Carbohydrate is the nutrient in foods that is the best energy source for exercise.	____	____
5. Eating a candy bar right before you exercise will give you a long lasting energy boost.	____	____
6. People who exercise need vitamin and mineral supplements even if they do eat right.	____	____
7. Salt tablets are not necessary even when you exercise strenuously and sweat a lot.	____	____
8. Drinking water or any other fluid during exercise makes you water-		

logged and impairs your performance. ____ ____

9. Full strength commercial sports drinks are not a good way to get fluids when you exercise. ____ ____

10. Meals eaten before heavy exercise should be high in carbohydrate and eaten at least 3 hours before starting the exercise. ____ ____

1. False. Protein is an essential nutrient in everyone's diet. It is a major part of all body tissue—cells, skin, muscle, blood, hair. Because protein is vital to growth and repair of our body cells, many myths have sprung up regarding its superiority as a nutrient. Protein rich foods are abundantly available to most Americans. In fact, the average American eats foods containing 3-4 times as much protein as the body needs. Protein is an inefficient source of energy—calories—and is used for energy only when the more efficient sources—carbohydrate and fat—are not readily available (10, 11). Not only is this excess protein unnecessary, it is expensive, requires extra work for the body to process and can actually be harmful (9, 10, 11). If athletes and fitness buffs eat the minimum number of servings of minimally processed food recommended in the *Fitness Food Plan* they will be getting all of the protein needed for feeling good and giving peak performance.

2. False. Losing weight by exercise alone takes longer than weight loss by severe calorie restriction, but exercise is an effective way to help control weight for four major reasons:

First, when you are physically active you use up more calories than if you're sedentary. There are approximately 3,500 calories of potential body fuel energy in a pound of body fat. A 150-pound (68 kilogram) person will use up about 60 calories more to walk one mile than if he sat still for the time that walk required. The same person would have to walk about 60 miles to use the calories in one pound of body fat. However, in walking two miles a day, at the end of 30 days, 3,500 calories would have been used. In a year, without changing the typical amount of food eaten, this person could use up enough calories to equal about 12 pounds of fat (5, 11).

Second, appetite control and thus food intake, appears to be partially regulated by physical activity. Without enough activity, the body seems to lose the ability to fine tune the appetite. As a result, many people eat food that contains more calories than they need to balance their energy output (11).

Third, research has shown that body composition affects weight control. For example, an obese 150-pound person will use fewer calories sitting or exercising than a lean, muscular 150-pound person. Fat tissue simply doesn't use many calories. On the other hand, muscle uses many calories even during inactivity. Developing and maintaining strong muscles through exercise will enable your body to use more calories at rest and when you exercise and thus help prevent obesity (5).

Fourth, your body requires a minimum amount of energy to function whether you are asleep, awake, just sitting or exercising. This basic energy requirement is your basal metabolism or energy requirement at rest. Basal meatbolism includes the energy needed to keep your heart beating and blood flowing, to digest food and to breathe. The amount of energy needed to maintain your basal metabolism decreases with age (11). Regular, vigorous aerobic exercise increases your basal metabolic rate. Therefore, your body needs more calories just to stay alive. This is a real plus for weight control at any age!

The key to using exercise to lose weight is to make exercise a regular part of your lifestyle just as eating is. This means regularly enjoying a variety of physical activities and foods.

3. False. You will use the same number of calories whether you walk, jog or run a mile. It is a myth that the faster you cover any given distance the more calories you will use. It takes about 100 calories to travel one mile. The jogger and brisk walker will travel about six miles in an hour while the slow walker will only travel three miles. If both the jogger and slow walker exercise for an hour the jogger will use more calories than the slow walker simply because he or she has traveled a longer distance. But if both the jogger and the slow walker travel three miles, regardless of the time involved, they will use about the same number of calories. If your goal is to use exercise to control body fat, you will need to concentrate on the distance you travel not how fast you can go (5).

4. False. Carbohydrate and fat provide fuel for muscle activity. This energy fuel is measured in calories. Pure carbohydrate contains four calories per gram. Carbohydrate is stored in the liver and muscles in a form called glycogen Glycogen is converted to glucose or blood sugar and can then be used as energy or fuel for muscle activity. Pure fat contains nine calories per gram. Fat is stored throughout the body and is converted to substances called free fatty acids which can then supply fuel for body activity.

Unlike stores of fat, glycogen stores are limited. For example, a 154-pound (70 kilogram) man of average build has approximately 50,000 to 100,000 calories of energy stored as fat but only 1,000 to 1,400 calories stored as carbohydrate, in the form of muscle or liver glycogen (3). This amount of glycogen would provide enough energy for no more than 1-2 hours of moderately heavy exercise (11).

When you exercise for a long time—walking, jogging, bicycling—at a light or moderate aerobic level fat and carbohydrate supply energy (1). Research reports show that fat supplies 50%-60% of energy for light-to-moderate-inten-

sity exercise. Carbohydrate from glycogen stores and blood glucose supplies the remaining 40%-50% of energy fuel. In long-term moderate-level aerobic activity, fat supplies up to 70% of the energy fuel and carbohydrate supplies the remaining 30%. On the other hand, carbohydrate is the main fuel source for the more strenuous activity—sprinting, basketball, high speed swimming—where maximum-effort short-term aerobic exercise is required.

When muscle glycogen stores are depleted, muscles cannot contract and they quit working. Liver glycogen becomes depleted along with muscle glycogen. When liver glycogen is used up, the blood glucose level falls, causing exercise-induced hypoglycemia, which impairs the functions of the nervous system, muscles and red blood cells (1). In effect, when glycogen stores are used up, your body runs out of fuel and as a result stops working. This is usually not a problem for most casual athletes and fitness buffs but it is often one of the reasons people collapse after they run a marathon race.

Although alcohol contains seven calories per gram and is a ready source of energy, it is not recommended as an energy source before exercising. Alcohol is a depressant to the central nervous system. The amount of alcohol in two drinks can interfere with the nervous system by slowing reaction time, interfering with reflexes, increasing fatigue and reducing coordination and reaction time. Alcohol also has a diuretic effect that increases water loss and thus contributes to dehydration (9).

5. **False.** The "quick energy" from a candy bar, soft drink or other concentrated sweets eaten before exercising can decrease endurance. When you eat something very sweet 30-40 minutes before exercise the simple carbohydrate—sugar—stimulates the release of insulin which quickly decreases your blood glucose and reduces the ability of your muscles to use fat for energy. Remember, fat is a major fuel source for light or moderate exercise (1).

6. **False.** Numerous research studies have been conducted to determine the effects of vitamin and mineral supplements on physical performance. A number of studies indicate there is some improvement in performance with specific vitamin supplements, but there are almost an equal number of studies which essentially show no such benefits. What improvement there is from most vitamin and mineral supplementation appears to be very small (11). The mineral iron is an exception. Supplements of iron may be necessary for women since it is usually very difficult to get adequate amounts of iron in a typical diet.

Vitamins function primarily as regulators, governing the hundreds of biochemical reactions involved in organ function, growth and energy metabolism. They do not contribute significantly to body structure nor are they a direct source of body energy. Vitamins are widely distributed in the foods that make up the American food supply. As a rule, vitamins are eaten in proportion to the total calorie intake. Therefore, if you eat enough minimally processed foods to maintain your weight you will be getting the vitamins and minerals needed to effectively help use the calories in the food you eat and to keep your body working properly (9).

No one food contains sufficient levels of all the vitamins and minerals you need to meet your body's needs. Following the *Fitness Food Plan* and regularly eating the recommended number of servings from a variety of minimally processed foods will help insure that you will have an adequate supply of all nutrients including vitamins and minerals needed for top level fitness (9, 10).

Many fitness buffs and athletes have questions about vitamin and mineral supplements. They often wonder if excess quantities of vitamins can be harmful. Fitness experts say this depends on the vitamins involved. The B vitmains and vitamin C are water soluble and are not stored in the body, so supplementation will not significantly increase body stores. Consuming large amounts of B vitamins, with the exception of niacin, appears to be relatively safe (4). However, excesses can cause problems. For example, one study reported that excess niacin can increase the use of muscle glycogen stores for energy and simultaneously decreases the body's ability to break down stored fat for energy fuel (1). This can interfere with reducing excess fat stores.

Vitamin C (ascorbic acid) is generally considered nontoxic (4), but individual tolerances of large doses varies greatly. Excess levels can lead to a number of problems such as gastrointestinal upset and diarrhea (1, 7).

Excess intake of fat-soluble vitamins—A, D, E, K—can present a greater health hazard than overuse of the water-soluble vitamins—B and C—mainly because the body stores excess fat-soluble vitamins in the liver and fat tissue. Chronic megadoses of vitamins A and D may have toxic effects on the body and can decrease your fitness level (1).

A daily low-dosage multivitamin supplement is generally considered safe and may be beneficial, especially for those who have trouble regularly eating the variety of nutrient-rich foods outlined in the *Fitness Food Plan*. Indiscriminant use of megavitamin or megamineral supplements is potentially harmful and has not been shown to improve physical performance significantly (1, 11).

7. **True.** At one time it was theorized that supplementation of salt through salt tablets was essential to replace salt lost through sweat. It is now recognized that most people get sufficient salt in their diets to replace the salt lost in the sweat even in hot and humid weather when the volume of sweat lost each day is very high. In fact, Americans generally get more salt than they need. One of the basic adaptations the body makes to heat stress is to reduce the salt content of the sweat, thus conserving salt. Salt tablets are not recommended because they can cause loss of potassium, stomach upset and dehydration of the muscles by drawing water into the small intestine (3, 9, 10, 11).

8. False. Drinking small amounts of water regularly before, during and after exercise is essential to prevent dehydration. Research has shown that dehydration affects how you feel and decreases performance (9, 10). Next to oxygen, water is the most essential nutrient for the maintenance of life. Water makes up 50%-70% of your body weight (11).

Average-sized persons can lose most of their carbohydrate and fat stores and half of their protein with up to a 40-pound weight loss and survive. A water loss of 3% of body weight can impair performance; a 5% loss can result in some signs of heat exhaustion; a 7% loss may cause hallucinations; a 10% loss can lead to heat stroke and circulatory collapse (9).

Fitness Food Plan

Water

Drink plenty of water every day. The hotter the weather and the more active you are, the more water or fluids you need. One quick way to tell if you are getting enough water is to check the color of your urine. It should be light yellow. If it's not, keep drinking.

---

4 Servings

Fruit and Vegetable Servings

A serving is ½ cup of a medium-size fruit or vegetable.

Regularly eat Vitamin C rich ones—citrus fruits, berries, tomatoes, potatoes—and Vitamin A rich ones—dark green or deep yellow fruits or vegetables. Eat unpeeled fruits and vegetables for extra fiber. Fruits and vegetables are low in sodium and fat unless these are added during preparation.

---

4 Servings

Grain, Bread or Cereal Servings

A serving is one slice of bread, tortilla or pancake; ½ cup cooked pasta, cereal, rice or grits; or one ounce ready-to-eat cereal.

Whole grains or enriched servings are the best choices. Smart eaters read labels to check on the sugar, sodium and fat content of these foods.

2-4 Servings

Milk and Cheese Servings

A serving is one cup milk or plain yogurt, a two-inch cube of cheese, two cups of cottage cheese or 1½ cups of ice cream or milk.

Skim and low fat milk, cheese or yogurt have as much protein and calcium as whole milk but are lower in fat. Flavored yogurt, ice cream, and ice milk are high in sugar. Adults need two servings; children need three servings; and teenagers, pregnant women and lactating women need four servings from this group every day.

---

2 Servings

Meat — Poultry — Fish — Bean Servings

A serving is two ounces lean cooked meat, poultry or fish, two eggs, one cup cooked dried beans or peas, ¼ cup peanut butter or ½-1 cup nuts or seeds.

Fatty meats are high in fat and calories. Turkey, chicken, fish, veal and some beef and pork cuts are lean and, therefore, low in fat and calories.

?

Sweets, Fats and Alcohol

Foods in this group include candy, soft drinks, sugar, honey, sweet toppings, cake, salad dressings, butter, margarine, wine, beer, and liquor. These foods give you calories from sugar, fat, and alcohol and very few vitamins, minerals, fiber, water or protein which your body needs to use these calories efficiently.

Fill up on 4 — 4 — 3 — 2 foods first. Eat ? foods as treats with caution!

Water also is the solvent for all cell activities. It plays a vital role in nutrient digestion, absorption, circulation and excretion. It is critical to regulation of body temperature. Body heat production is greatly increased during physical activity. The only way the body cools itself is through sweating and evaporation (11). Heat stroke results from uncontrolled increases in body temperature to levels that prevent the regular functioning of body cells. A lack of adequate body water can prevent the body from adequately cooling itself by sweating and evaporation (10). Be alert for symptoms of impending heat stroke—chilling, throbbing pressures in the head, unsteadiness, nausea and dry skin. Prevent heat stroke by drinking water or fluids before, during and after exercise, especially when it is hot.

9. True. Electrolytes, particularly the minerals sodium and potassium, also are lost in sweat. Electrolytes are essential for maintaining proper balance of fluids outside of the body cells. The kidneys efficiently conserve electrolytes, making replacement unnecessary during most exercise, but some people like to replace electrolytes as a preventive measure. Commercial sports drinks like Gatorade, Sportade and fruit juices supply water and electrolytes (9). They are also concentrated sources of sugar and should be diluted. If the liquid used to replace body water loss is too concentrated, fluid will be drawn out of the body into the small intestine, which can cause diarrhea and nausea. The formula for diluting sport drinks or juice is one part drink to one part water. The simplest way to replace fluid and electrolytes is to drink cold water or cold diluted fruit juice.

10. False. Because digestion requires 3-4 hours and muscle glycogen formation in the liver and muscles takes at least 46 hours, what you eat before any physical activity is not used to fuel that activity. Your exercise fuel comes mainly from nutrients in foods you ate about two days before the exercise and stored as glycogen or fat (1).

Gastrointestinal upsets are minimized if the stomach is essentially empty when heavy exercise begins. Since it takes about three hours for the stomach to empty, the meal you eat before exercising should mainly be easily digested carbohydrate, a small amount of protein and just enough fat for a feeling of satisfaction (9). A meal high in protein and fat could cause indigestion, especially if you are tense before competition or heavy exercise. Aim for a meal that has about 500 calories. Be sure to include plenty of fluids to start preventing dehydration. Some good pregame meals might include tortillas, pasta products like spaghetti with meat sauce, cereals, pancakes and toast. Combine these with fruits, fruit juices and vegetables. Try to avoid gas forming foods (10).

You may want to drink your meal before starting heavy exercise. There are commercial liquid meals on the market or you may want to make your own. Although some people may feel that liquid meals help them perform better, no evidence shows that liquid meals actually promote better performance than solid meals (6, 9). However, these meals are quick and convenient and add to fluid as well as nutrient needs.

References

1. Askew, W.: "Nutrition for Top Sports Performance." *Dietetic Currents*. Ross Laboratories. Columbus, Ohio. Vol. 8 – No. 3, May-June, 1981.

2. Astrand, P.: "Nutrition and Physical Performance" in: *World Review of Nutrition and Dietetics*. Vol. 16. Rechcigl, M. (Ed.). Washington: S. Karger, 1973.

3. Astrand, P. O., and Rodahl, K.: *Textbook of Work Physiology*. New York: McGraw-Hill Book Company, 1970.

4. Committee on Dietary Allowances: *Recommended Dietary Allowances, 1980*. Washington, D. C.: Food and Nutrition Board, National Academy of Sciences—National Research Council, 1980.

5. "Exercise Wise." *The Health Letter*: Lawrence E. Lamb, M.D. (Ed.), San Antonio, Texas, Vol. XV, No. 12, June, 1980.

6. Fox, E., *et. al.*: "Multiple Daily Exercise: Solid vs Liquid," abstracted. *Medical Science Sports*. Vol. 11, 1979.

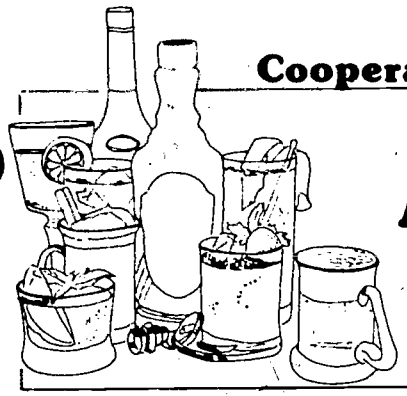
7. Hoyt, C. J.: "Diarrhea from Vitamin C." *The Journal of the American Medical Association*. Vol. 244, 1980.

8. *Healthy People*. The Surgeon General's Report on Health Promotion and Disease Prevention. U.S. Department of Health, Education and Welfare. Public Health Service. DHEW (PHS) Publication No. 79-5507, 1979.

9. Nutrition and Physical Fitness. A Statement by the American Dietetic Association. *Journal of the American Dietetic Association*. Vol. 76, 1980.

10. Smith, N. J.: *Food for Sport*. Bull Publishing Co: California, 1976.

11. Wilmore, J. H.: *The Wilmore Fitness Program*. Simon and Schuster: New York, 1981.



Cooperative Extension Service

Alcohol Ups and Downs

The University of Arizona • College of Agriculture • Tucson, Arizona 85721

Linda Houtkooper, M.S., R.D., Cooperative Extension Service Food and Nutrition Consultant

Beyond the familiar "pop" of a wine bottle cork or a beer can flip top, how much do you know about the favorite American social drink—alcohol?

Americans drink alcohol in many different ways and for many different reasons. All varieties of wines, beers and liquors contain alcohol. We drink at home, in bars, in restaurants and at parties. We drink to quench our thirst, to cool off, to relax, to celebrate, to forget. Today, Americans drink more alcohol than ever before.

How Much Alcohol Do Americans Drink?

Alcohol consumption statistics from the Department of Health, Education and Welfare show that enough alcohol is consumed in the United States each year to provide every person over the age of 14 with 2.6 gallons of alcohol. This is 30% more alcohol than the average person drank 15 years ago. To consume this much alcohol you would need to drink 28 gallons of beer, 2.25 gallons of wine plus 2.5 gallons of liquor (9).

Alcohol contains seven calories per gram or about 200 calories per ounce—there are eight ounces in one cup. So alcohol provides people over 14 years old with about 66,560 calories a year. Since one pound of body fat is equal to 3,500 calories, the calories a person gets from drinking alcohol in one year would be equal to the calories in 19 pounds of fat. However, only 20% - 40% of the alcohol calories can be used to supply the energy needs for the body's cells (1).

Who Drinks Alcohol?

Drinking is common in the younger years and declines after the age of 50 (9). A 1975 study showed that nationwide more than half of all seventh graders had tried alcohol at least once during the sixth grade (8). About 80% of 12-17 year olds report having had a drink. More than half drink at least once a month, almost 3% drink daily (9). Nearly 90% of all college students drink and a third or more get drunk more than once a month (8). About 100 million adults in the United States drink and nine million are estimated to be alcoholics (6).

How Is Alcohol Made?

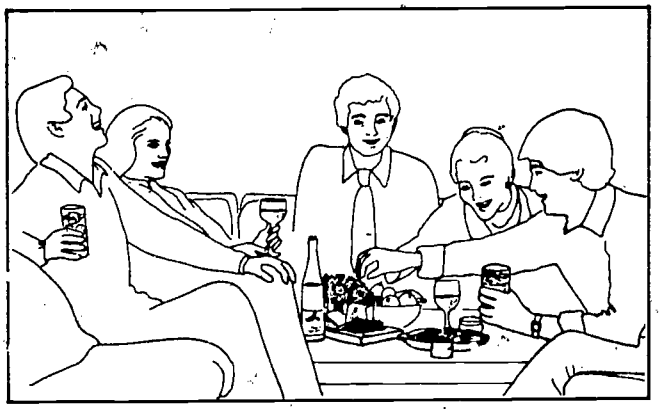
Alcohol is made by the action of yeast on carbohydrate in a process called fermentation. This food-processing technique has been mastered by people around the world. Fermentation starting material may be fruit, palm or cactus juice, molasses, honey or sugar, potatoes or cereal grains like barley. The flavor of the final product—beer, wine or liquor—will depend on the starting material and ingredients added during processing, but the alcohol produced is always the same simple compound, ethyl alcohol or ethanol.

Beer, wine and liquor vary in their alcohol content. Beer and wine contain less than 20% alcohol. Hard liquor—like whiskey, rum, tequila, bourbon, gin—contains more than 40% alcohol. Yeast cannot live if the concentration of alcohol during fermentation becomes excessive—over 20%. So hard liquors are produced by a process called distillation, which concentrates the alcohol produced by fermentation and separates it from the yeast and starting materials.

Since they don't require distillation, beer and wine contain alcohol and water plus the ingredients in their starting materials. Liquors contain alcohol, water and small amounts of impurities that are left over from the starting materials. During processing other ingredients may be added to beer, wine and liquor to given them their flavor.

What Happens When You Drink?

Ethyl alcohol is the active ingredient in all beverages that contain alcohol. This type of alcohol is a drug that quickly enters the body fluids after you have a drink. Alcohol is absorbed through the stomach and small intestine and is



Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Roy S. Hauschkolb, Director, Cooperative Extension Service, College of Agriculture, The University of Arizona.

carried in the blood to all of your body organs. However, your liver is the only organ that can detoxify and process alcohol. Whenever alcohol is in your bloodstream, your liver must give it top-priority treatment. Other energy nutrients—protein, fat and carbohydrates (sugars and starches)—have to wait to have their calories processed until after the alcohol has been metabolized. Your liver cells are the only cells in your body that can metabolize the calories in alcohol. If these calories are not needed for your body's immediate energy needs, your liver promptly turns them into fat.

Your liver processes alcohol at a constant rate. It takes about one hour for the average 150-pound person to detoxify and metabolize one-half ounce of alcohol (4). This is the amount of alcohol in either a 12-ounce beer, a four-ounce glass of wine or a drink made with one ounce of 86 proof liquor. If you weigh less than 150 pounds it will take a little longer for you to process the same amount of alcohol and processing will take a little less time if you weigh more than 150 pounds.

If you overload your system with alcohol by drinking more than your liver can process right away, the alcohol travels around in your bloodstream waiting its turn to be metabolized. While alcohol is circulating in your bloodstream, it affects every body organ, including your brain.

The Pick-me-up That Lets You Down

Alcohol in your body undergoes a dose-related metamorphosis. In very small amounts, alcohol is a central nervous system stimulant. In slightly larger amounts it becomes a relaxant, but in larger quantities it becomes a depressant. That's what ultimately makes you feel bad.

When your blood is carrying a small amount of alcohol, the first effect on your brain is a slowdown in the area that controls reasoning and judgement. As a result you are less inhibited and feel relaxed. Social drinkers enjoy this free and easy feeling. If you have another drink, additional alcohol enters the blood before the liver has time to process the alcohol from the first couple of drinks. As a result, your blood alcohol level rises, impairing speech and vision centers of the brain. At the same time the area that controls reasoning becomes more incapacitated. At this point your body has been assaulted by alcohol to the point that you will probably have a hangover in the morning. If you were to continue drinking your voluntary muscles would be affected. As a result you would stagger when you tried to walk. Finally, the brain centers that control heartbeat and breathing would be anesthetized. At this stage a person usually passes out. Breathing and heartbeat continue while the liver steadily detoxifies and processes the circulating alcohol (4).

Blood alcohol level goes up .025% for every one-half ounce of pure alcohol you drink. The following chart summarizes the effect increasing amounts of alcohol in the bloodstream have on the brain and body for a 150 pound person. If you weigh more than 150 pounds your blood alcohol level will be slightly lower and if you weigh less it will be a bit higher (6).

Amount of Alcohol	Blood Level of Alcohol**	Effect on You
2 drinks*	.05%	Your judgement is impaired but you feel mellow.
4 drinks	.10%	Your reaction time slows and you're less cautious than normal. If you reach this level too quickly, you will probably activate the vomiting reflex in your body.
6 drinks	.15%	Your muscle coordination and reflexes are impaired. Your reaction time is much slower than normal and things are beginning to spin around you. You're drunk.
8 drinks	.20%	Your vision is impaired. You have trouble speaking or walking in a straight line. You're very drunk.
12 drinks	.30%	More of the above, only worse. You're totally out of control.
14 drinks	.35%	You've reached the point of surgical anesthesia. Anything beyond this point is likely to be lethal.
more	.50% - .60%	Total amnesia, finally death.

*1 drink is defined as ½ ounce of pure ethyl alcohol. This is the amount of alcohol in one 12-ounce beer, 4 ounces of wine or 1 ounce of 86 proof liquor.

**Subtract .025% for each 60 minutes you are drinking. This adjusts for the average rate of liver alcohol metabolism during that time for a 150-pound person. Remember, you will need to adjust this figure according to your weight.

Drinking and Health

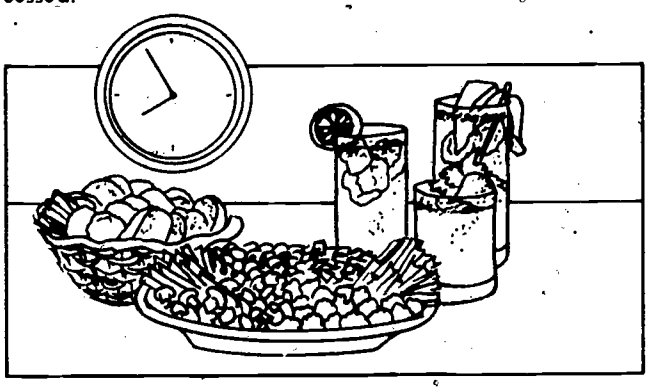
Much remains to be learned about other effects of alcohol on your health. Researchers still don't know why some people become uncontrolled drinkers (alcoholics) whereas others can drink in moderation for years without any apparent bad effects and sometimes even potentially good effects.

Alcohol is a drug. With an understanding of the way it works, however, most people can drink moderate amounts of alcohol safely and enjoy its desirable effects without suffering from its potentially bad effects.

Alcohol misuse is a factor in more than 10% of all deaths in the United States—about 200,000 a year. It is associated with half of traffic deaths. Accidents involve both the social drinker who is temporarily out of control and the alcoholic (9). Many people go to a party with every intention of having only a couple of drinks and letting the effects wear off before driving home. However, as you just learned, after a drink or two their "judgment" is impaired by alcohol. As a result, they often have another drink or two for the road. They still feel they are perfectly coordinated and that they can drive normally. They cannot. Their reaction time and coordination are significantly slowed.

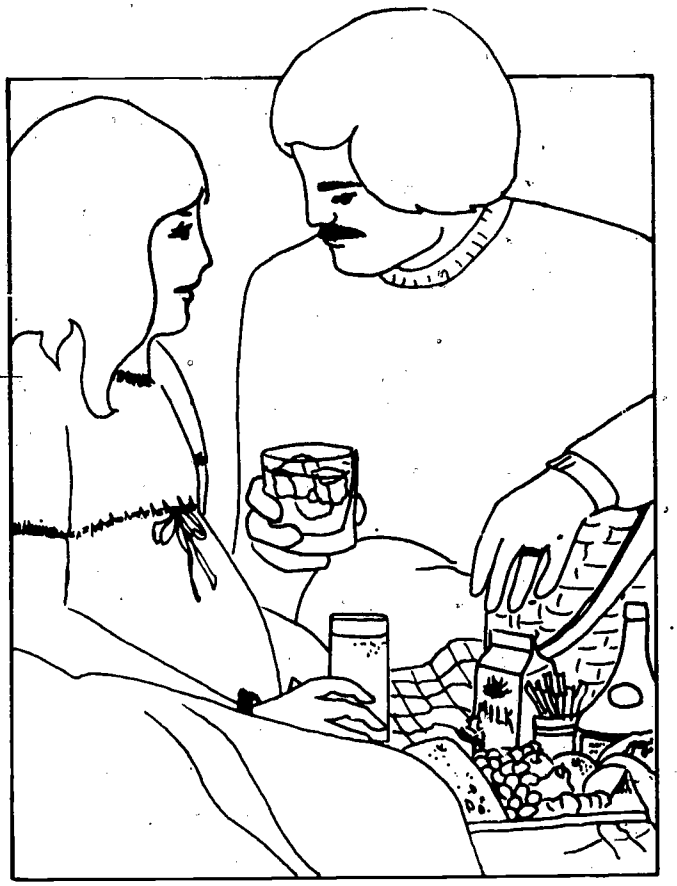
Sobering Up

There is no way to sober up quickly. Your liver metabolizes alcohol at a constant rate. Nothing can speed up this process for a single night. Only after regular heavy drinking does the liver learn to process alcohol at a faster, but still constant rate. Many people think that coffee and a cold shower are quick ways to sober up. If you have too much to drink, a shower and a cup of coffee will merely make you a clean and more awake drunk! Your reaction time and judgment will still be impaired until the alcohol is all processed.



All this information boils down to some practical advice: Drink alcohol at a rate that keeps your blood alcohol low. This means sipping your drinks. Eat something before and while you are drinking. Most people are less likely to drink too fast if they are not hungry, and, moreover, the presence of fat or protein in the stomach will slow down the rate of alcohol absorption into the bloodstream (6).

An additional piece of lifesaving advice is: Don't drive if you drink and don't let your friends drive if they have been drinking. Legally your ability to drive is considered to be impaired when the percentage of alcohol in your blood is above .10%. Driving after excessive drinking is dangerous and punishable by law. If you drink and then drive, know and stay within your own personal limits. Beware. . .the legal limit for intoxication may not be the same as your own personal safe limit.



Does Alcohol Cause Disease?

Cirrhosis of the liver, which is one of the 10 leading causes of death in this country, is usually caused by excessive alcohol consumption. Alcohol use is also associated with cancer of the liver, esophagus and mouth. Primary liver cancer is mainly attributed to alcohol consumption. People who drink and smoke cigarettes have even greater incidence of esophageal cancer (9).

Excessive drinking during pregnancy can cause babies to develop severe permanent abnormalities such as mental retardation. Excessive alcohol intake also irritates the stomach, interferes with absorption of nutrients, particularly vitamins and minerals and causes diarrhea (3, 6).

Alcohol can also make responses to some drugs stronger than normal. Drinking while taking medicine can be deadly. Be sure to check with your doctor before you drink to make sure there will be no dangerous interaction with any medication you take.

Can Good Nutrition Prevent Alcohol's Bad Effects?

Your body needs to be well nourished in order to handle alcohol with a minimum of damage. This means having a nutritionally adequate diet that supplies the right balance of protein, carbohydrate, fat, water, minerals, vitamins and fiber to meet your body's needs. The B vitamins, especially thiamin and niacin, are needed in larger than normal quantities in order for your body to handle regular alcohol consumption. Although being well nourished can help your

body effeciently handle alcohol or any other drug, it cannot protect you against damage from chronic, heavy drinking. Daily or frequent drinking of large amounts of alcohol damages every organ in your body, even if you eat "the perfect diet." Good nutrition promotes good health but cannot maintain it against overwhelming odds (6).

Do Drinking and Dieters Mix?

Most dieters are keenly aware that alcohol contains calories. To budget calories from alcohol into a nutritionally adequate diet requires planning and effort. If you drink, it is particularly important for you to note that it is almost impossible to get a nutritionally adequate diet within a budget less than 1,200 calories a day. The following chart will give you a guideline for approximately how many calories a day an average person needs (5).

Guideline for Calorie Needs

Category	Age (years)	Average Calories	Range
Males	15-18	2800	2100-3900
	19-22	2500	2500-3300
	23-50	2700	2300-3100
	51-75	2400	2000-2800
	76+	2050	1650-2450
Females	15-18	2100	1200-3000
	19-22	2100	1700-2500
	23-50	2000	1600-2400
	51-75	1800	1400-2200
	76+	1600	1200-2000

People in the United States, on the average, get 210 calories per day from alcohol (11). So, you can see that people who drink and are not active or who are older will have considerable problems meeting their nutritional needs while staying within their calorie budget.

Alcohol also has a relaxing effect and stimulates your appetite. As a result, you may eat more when you are drinking. A sure fire disaster for calorie counters! Balance your alcohol calories with exercise.

How Many Calories Are in a Drink?

The calorie content of alcoholic beverages depends on the amount of alcohol in the drink and the calorie content of what the alcohol is mixed with. The alcohol content of regular beer ranges from 3.2% to 6%. Light beer contains 2.5% to 3.5% alcohol. In wine the alcohol content usually varies from 10% to 14%. Wines also contain sugar, which adds to their calorie content. The sweeter the wine, the more calories it will contain. Liquors vary in their alcohol content too. Since the percentage of alcohol is 50% of the proof, you can figure out the percentage of alcohol in a liquor by dividing the proof by two. For example, most beer liquor is 86 proof and therefore is 43% alcohol. So, one ounce of liquor that is 43% alcohol contains a little less than one half ounce of alcohol or ethanol.

Remember, whatever you mix with a liquor will also add to the calorie content of your drink. The following table lists the calorie content of various alcoholic beverages (2 3).

Generally speaking, it is a good idea to dilute your liquor drinks with a mixer, but heavily sugared mixers can add 60 to 70 calories to each drink. Plain water or soda water are good mixers for dieters because they don't contain calories.

If you are watching your calories and you want to drink, do so in moderation and make sure that you are eating a

Percentage of Alcohol in Beverages

Beverage	Approximate % Alcohol (by weight)
Beers and ales	2.5-6
Wine	10-14
Fortified wine (*e.g.* sherry, port)	20
Distilled liquor (*e.g.*, rum, brandy, gin, whiskey, etc.)	
80 proof	43
100 proof	50
150 proof	75

Alcoholic Beverages Calorie Count

Distilled Liquors	Approximate Measure	Energy Calories
Liquers		
Annisette, Sambucca	1 oz. glass	100
Apricot Brandy	1 oz. glass	87
Benedictine	1 oz. glass	93
Creme de menthe	1 oz. glass	93
Curacao, Triple sec	1 oz. glass	87
Brandy or Cognac	1 oz. glass	75
Gin		
Rum		
Tequila	1 oz. 86 proof	75
Whiskey	1 oz. 90 proof	79
Bourbon		
Rye		
Scotch		
Wines		
table wine, red or white	4 oz. glass	97
Champagne, domestic	4 oz. glass	85
Port or Muscatel	4 oz. glass	183
Sherry, dry, domestic	4 oz. glass	170
Vermouth, sweet	4 oz. glass	194
Vermouth, dry	4 oz. glass	120
Malt Liquors (American)		
Ale, mild	12 oz. bottle	150
Beer, average	12 oz. bottle	175
Light Beer	12 oz. bottle	70-135

Calorie Content of Soft Drinks—Mixers

Type	Amount	Energy (calories)
Club Soda	12 oz.	0
Coffee, black	6 oz.	2
Cola Type	12 oz.	140
Eggnog	8 oz.	235
Fruit-flavored Sodas	12 oz.	170
Ginger Ale	12 oz.	110
Lemonade	12 oz.	126
Quinine Water	12 oz.	110
Rootbeer	12 oz.	150

variety of foods that will help you meet all of your nutrient needs first. If you need only 1,200 calories or fewer a day, you will need to be very active to afford the extra calories from alcohol. For example, a 150-pound person will need to bicycle for 30 minutes or walk for one hour in order to burn up the 150 calories in a 12-ounce can of beer.

Why Does Drinking Make You Thirsty?

Drinking alcohol can make you thirsty because it disturbs the fluid balance in and around your cells, which in turn triggers an area in your brain that makes you thirsty. Alcohol also inhibits your body's production of a hormone that enables your kidneys to return water to your bloodstream. Without this hormone your kidneys release more water into your urine than normally (6). As a result, you feel thirsty.

Many people have another beverage or cocktail to try to quench their thirst. This extra drink may fool their mouths by giving immediate satisfaction but the alcohol in the drink will cause additional water imbalance and more thirst. To avoid this problem, if you drink be sure to avoid highly salted foods and have plenty of water before drinking alcohol and/or have a drink with a high water content like beer, wine or cocktails that contain a lot of water. If you drink short, straight drinks such as martinis or manhattans, have a water chaser to get your needed fluid.

Good News about Alcohol?

There have been several studies in the past 10 years in which the results suggest that alcoholic beverages might be beneficial for institutionalized geriatric patients. Specialists in this area of medicine feel that alcohol's greatest benefit for this group is that it makes them more relaxed and sociable (4).

Research studies in heart disease have been turning up some surprising data on the benefits of moderate drinking. For a long time, most alcohol researchers took for granted that drinking was bad for your heart. After all, if alcohol is murder on your liver and your stomach, doesn't it seem reasonable that it is hard on your heart as well?

Recent interest in the effects of alcohol on the heart has evolved partly in response to the finding that drinking moderate amounts of alcohol--two ounces or about 60 milliliters per day--from beer, wine or liquor appears to be associated with a decreased risk of heart disease. In fact, the risk of heart attacks among non-drinkers in one study was about 30% higher than the risk among moderate drinkers regardless of sex, age or previous medical history (10).

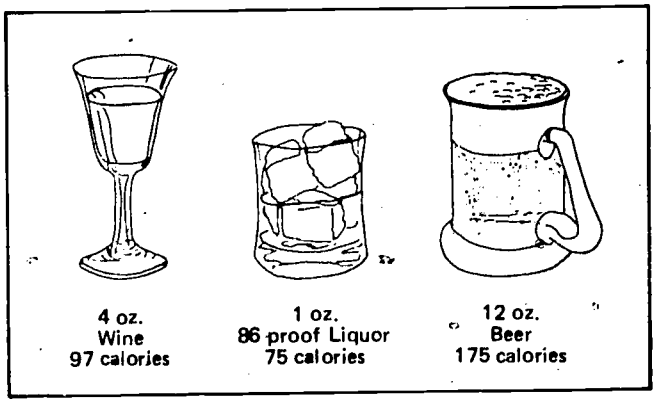
Other recent research has demonstrated a surprising direct relationship between alcohol and a fatty substance in your blood known as high-density lipoproteins (HDL). What these recent data show is that people with high blood levels of HDL appear to have a smaller risk of heart attacks than people with low levels of HDL. HDL is a form of cholesterol—one of the suspected culprits in heart disease—but it is different from other forms of cholesterol in that it does not cling to the walls of the heart's arteries. On the contrary, HDL seems to have the ability to carry fat to your liver where it can be changed into a form your body can use for energy. Therefore, less fat is around to build up and clog your arteries (4).

Researchers have also combined data from various studies that have been done over the past 30 years to try to find out what factors contribute to a high level of HDL in the blood. They found that exercise and alcohol were both factors. Exercise and drinking both raised HDL. In general, people who drink alcohol had relatively more HDL in their blood than non-drinkers. It is much too early to draw any definite conclusions from the recent studies suggesting that by increasing the production of HDL alcohol can be a protective factor against heart attacks (10, 12). Undoubtedly, in the near future we will be hearing a lot more about the relationship between alcohol, HDL and heart disease.

In the meantime, it is safe to say that whatever other problems alcohol may cause in your body, in moderate amounts its impact on your heart is not harmful. However, there is no doubt that the dangers of excessive occasional or frequent drinking far outweigh any beneficial effects of alcohol (9).

Is Beer More Nutritious Than Liquor?

Some beer drinkers think that beer is a highly nutritious drink and less intoxicating than wine or liquor. Let's look at the facts. All alcoholic beverages—beer, wine and liquor—are low nutrient density beverages, like soft drinks. A low nutrient density food or beverage contains primarily calories and few other nutrients that help your body use those calories. A man would have to drink at least a six-pack of 12-ounce beers to meet the recommended dietary allowance (RDA) for niacin—a B vitamin. He would have to drink nine six-packs of 12-ounce beers to meet his protein needs. Those nine six-packs would contain 8,100 calories, almost three times his RDA for calories. The calories in beer come from alcohol and carbohydrates. Alcohol has seven calories per gram or 196 per ounce and carbohydrate contains four calories per gram or 112 calories per ounce. Remember, a 12-ounce bottle or can of beer, a 4-ounce glass of table wine and a 1-ounce glass of 86-proof liquor all contain about the same amount of alcohol—approximately ½ ounce.



As for being intoxicating, the alcohol in beer is diluted with water and will therefore enter your bloodstream more slowly than the same amount of alcohol taken straight or carbonated. Carbonation of beverages or wine increases the speed of alcohol absorption so these drinks raise blood alcohol level quickly. The amount you drink, plus the speed at which you drink, the concentration of alcohol in what you drink, what else you eat or drink, your weight, state of health, stress level and mood will all influence how intoxicating alcohol from beer, wine or liquor will be for you.

Who Should Not Drink?

If you are taking any medication—check with your doctor to make sure that it is safe to drink alcohol before you have a drink. Remember, alcohol and other drugs don't mix! A safe level of alcohol intake during pregnancy has not been established. Moderate intake of alcohol—two drinks per day—has been associated with low birthweight babies and heavy alcohol consumption with birth defects (7). One out of 10 people who drink seems destined to become an alcohol addict—an alcoholic. Such a person should not drink.

How to Be a Responsible Host

By using the practical knowledge and advice reviewed in this pamphlet, nine out of 10 alcohol users can drink and enjoy the mild, temporary relaxed feeling it produces. Many people, however, prefer not to drink—to help control their weight and for many other reasons. People who do not drink alcoholic beverages sometimes have a hard time on social occasions, when drinking is often not only accepted but even almost forced on guests. We hope our discussion of alcohol has shed some light on the importance of not pressuring people to drink. It is difficult to resist an insistent friend, spouse, relative or host. Good sense dictates that considerate people and social groups provide non-alcoholic beverages—fruit juices, punch, soda water—for their non-drinking guests. When people drink at your home, you can help them drink safely by serving food, not pushing strong drinks or too many drinks and providing things other than beer, wine and liquor for your guests to enjoy.

So, as long as you are not pregnant, not taking medication, not severely restricting your calorie intake or are not an alcoholic, moderate amounts of beer, wine or liquor will not cause major nutritional problems.

References

1. Boeker, E.A.: "Metabolism of Ethanol." *Journal of the American Dietetic Association*. Vol. 76, 1980.

2. Bowes, C.F. and Church, H.N.: *Food Values of Portions Commonly Used*. 12th ed. Philadelphia, PA, J.B. Lippincott Co., 1975.

3. Briggs, G.M. and Calloway, D.H.: *Nutrition and Physical Fitness*. W.B. Saunders, Philadelphia, PA., 1979.

4. Calloway, D.H. and K.O. Carpenter: *Nutrition and Health*. Saunders College Publishing. Philadelphia, PA, 1981.

5. Committee on Dietary Allowances and The Food and Nutrition Board: *Recommended Dietary Allowances*, 9th Revised Edition. National Academy of Sciences. Washington, D.C., 1980.

6. Hamilton, E.M., and E.N. Whitney: *Nutrition Concepts and Controversies*. West Publishing Co., St. Paul, MN, 1979.

7. Streissgath, A.P.: "Teratogenic Effects of Alcohol in Humans and Laboratory Animals." *Science*. Vol. 209, 1980.

8. U.S. Department of Health, Education and Welfare: *Alcohol Health and Research*. World Publication No. ADM 75-157. Washington D.C.: U.S. Government Printing Office, 1979.

9. U.S. Department of Health, Education and Welfare: *Healthy People—The Surgeon General's Report on Health Promotion and Disease*. Prevention Publication No. 79-55071, Washington, D.C.: U.S. Government Printing Office, 1979.

10. Unresolved Issue, "Do Drinkers Have Less Coronary Heart Disease?" *The Journal of the American Medical Association*. Vol. 242, 1979.

11. Van[illegible], T.B.: *Obesity: The American Disease*. Paper presented during the Institute of Food Technology Division Program. "Role of Nutrition in Chronic Diseases." (Presented in cooperation with National Dairy Council) 39th Annual Meeting of Institute of Food Technology, 1979.

12. Willett, W., *et. al.*: "Alcohol Consumption, HDL Cholesterol Levels and Activity." *The New England Journal of Medicine*. Vol 303, 1980.

81105/2m

Cooperative Extension Service

VEGETARIANISM

The University of Arizona · College of Agriculture · Tucson, Arizona 85721

Linda Houtcooper, M.S., R.D., Cooperative Extension Service, Food and Nutrition Consultant

Vegetarian diets are eaten by the vast majority of people around the world today. However, until the last few decades they were not part of the eating style of most Americans. Now increasing numbers of Americans are adopting a variety of vegetarian eating styles.

Vegetarian Diet Styles

There are several variations of the vegetarian diet. The vegan vegetarian eats only plant food and does not eat any animal flesh or animal products. Lacto-vegetarians eat milk and milk products as well as plant food. Ovo-vegetarians eat plant foods and eggs. Lacto-ovo-vegetarians only exclude animal flesh from their diets (4, 5).

Vegetarians have been extensively studied by nutritionists who are interested in answering the question "Are vegetarian diets nutritionally sound?" The answer generally has been yes -if the vegetarian knows what he or she is doing. Well-planned vegetarian diets are nutritious and economical in terms of fuel and land use as well as personal food costs. An increasing number of studies also seem to indicate that vegetarian diets may be related to the prevention of certain diseases such as tooth decay, obesity, osteoporosis, heart disease, and breast and colon cancer (5).

Well-nourished vegetarians are nutrition conscious. They realize that there is more to being a well-nourished vegetarian than just excluding meat or animal products from their diet. In the American culture, the person becoming a first-generation vegetarian does not have the benefit of centuries of established vegetarian food traditions to emulate. Therefore, knowledge and preparation of vegetarian foods are not automatically acquired during childhood; they must be consciously learned.

The most common nutritional problems for vegan vegetarians usually involve two major nutrient groups—minerals and vitamins. Calcium, iron and zinc are three minerals that can be difficult to consume in adequate amounts in a vegan diet. The two vitamins which frequently create problems for vegans are riboflavin and B_{12} (3). The vegan diet is not recommended for children without the guidance of nutrition experts (5). Lacto-ovo vegetarians, who only exclude animal flesh from their diet, find that calcium, riboflavin and B_{12} are not a problem if foods are selected using vegetarian diet guidelines recommended by nutritionists (3). However, obtaining adequate amounts of iron and zinc is as difficult for lacto-ovo vegetarians as it is for vegans.

Vegetarian Nutrition Basics

Let's take a look at the food and nutrition information a vegetarian needs to know and practice in order to be well nourished. Vegetarians need the same nutrients—protein, carbohydrate, fat, vitamins, minerals and water—as people who eat meat. Protein is the nutrient essential for cell structure in every part of the body—skin, organs, blood, muscles, bones, hair, nails, hormones, enzymes and antibodies. Carbohydrate and fat are the two nutrients that are the major sources of energy which fuels all the body functions. If there is not enough carbohydrate or fat to supply energy, the body can use protein as an energy source. The energy in food is measured in a unit called a calorie. If you eat foods that contain more calories than your body needs, the extra calories, whether they come from fat, carbohydrate or protein, are mainly stored as fat; a small amount is stored in a form of carbohydrate called glycogen. Vitamins and minerals are necessary primarily to help regulate and run all of our body processes: digestion, breathing, thinking, movement and blood circulation, for example. Minerals also form the structure of our bones and teeth. Water is the solvent for all the other nutrients and is essential for cooling the body. Without adequate water in the body nothing else will work properly.

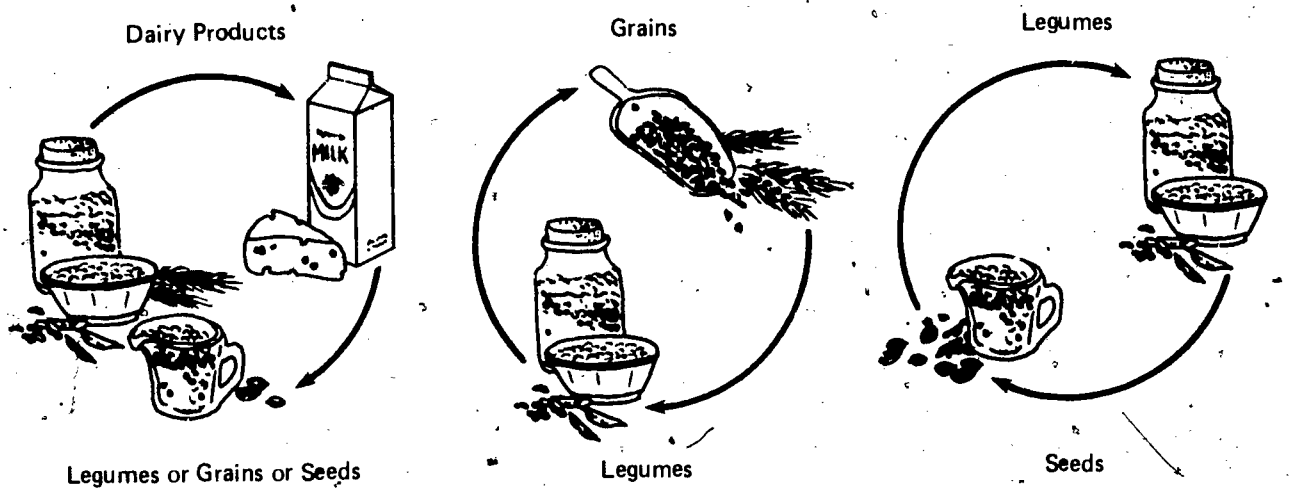
Protein is the nutrient that seems to be of greatest concern to most new vegetarians. Studies show, however, that almost all vegetarians who follow the vegetarian food group guides and who eat enough food to meet their energy or calorie needs also get adequate amounts of protein (1,3).

Protein—Complete and Incomplete

Protein is made from amino acids, which are chemical chains of carbon, hydrogen, oxygen and nitrogen. Fat and carbohydrate also are made from carbon, hydrogen and oxygen but do not contain nitrogen. The nitrogen of amino acids makes it possible for them to link to one another and form long intricate structures called protein, which are used in building living tissue. Just as the 26 letters of the alphabet can be combined to form millions of different words, the 21 known amino acids in the body combine to form countless varieties of protein (8).

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Roy S. Rauschkolb, Director, Cooperative Extension Service, College of Agriculture, The University of Arizona.

Protein Partners



Dairy Products	Grains	Legumes	Seeds
Milk	Bread	Peanuts	Sunflower Seeds
Buttermilk	Pasta	Split Peas	Sesame Seeds
Yogurt	Tortillas	Lentils	Alfalfa Seeds
Cheese	Flour	Pinto Beans	Alfalfa Sprouts
	Rice	Kidney Beans	
	Oats	Navy Beans	
	Corn	Soybeans	
		Soymilk	
		Bean Sprouts	
		Tofu	

All living tissue, both plant and animal, contains protein. During digestion the protein in food is broken down into its component amino acids. These enter the body through the small intestine to join the amino acids from the turnover of body proteins to form a common amino acid pool. The body draws on this pool 24 hours a day to get the amino acids it needs to make new protein for growth and repair of body tissue. In order to make this new protein, the necessary amino acids must all be present at the same time in the pool.

About half the known amino acids can be assembled in the body from almost any food source of nitrogen, carbon, hydrogen and oxygen. There are nine amino acids which the body cannot make in adequate amounts to meet its needs (6). These are called essential amino acids, because the only way they can be obtained is from what we eat. A short supply of any one of these essential amino acids can limit how much new protein the body can make (8). If the body cannot form new protein tissue, tissue decay is inevitable.

The protein in animal products is called complete protein because it contains all the essential amino acids in the right proportions to meet the body's protein needs. Most plant foods contain incomplete protein because they are short one or more of the essential amino acids. By combining plant foods that have complementary essential amino acid mixtures, incomplete plant proteins can be combined to form complete proteins that supply all of the essential amino acids found naturally in animal products. The chart above summarizes examples of plant food combinations that create complete protein. Small amounts of animal protein from dairy products such as milk, cheese, yogurt or eggs combined with other plant foods will form an adequate balance of amino acids to supply complete proteins for the lacto-ovo vegetarian or lacto vegetarian.

Unlike fat and carbohydrate, excess protein from food you eat cannot be effectively stored in the body for later use; it is simply broken down and burned for energy or converted to fat. The nitrogen in the amino acids is released during this breakdown and is removed from the body in the urine. When protein is in short supply, however, its nitrogen is carefully conserved for tissue building as long as there are enough calories from fat or carbohydrate in food and body energy stores to meet energy needs. When there is not enough protein in the diet, or not enough calories to keep the protein you do eat from being burned as fuel, the body begins to break down protein from its tissue in order to obtain the needed body fuel and amino acids. This

protein breakdown can lead to the destruction of all body tissue because they are losing the protein essential for their structure (4, 8).

Vegetarian Food Guides

The vegetarian four food group guides are designed to provide a simple eating plan that includes a variety of foods in large enough amounts to supply an adequate amount of complete protein plus the more than 40 other nutrients needed for a nutritionally adequate diet. An easy guide to eating an adequate diet can be prepared by categorizing food into groups based on similar nutrient content and specifying quantities to be regularly eaten from each group. Such a guide provides for variety and nutrient

The Vegetarian 4 Food Goups Fitness Plan listed below is a guide to a nutritious diet. Follow the plan each day for good nutrition if you choose to eat vegetarian style.

Vegan

Legumes

1/3 cup beans
PLUS
3 cups soy milk fortified with calcium and Vitamin B_{12} for teens and children (2 cups for adults)
OR
1¼ cup beans plus other sources of calcium and Vitamin B_{12}

Grains, Nuts and Seeds

4 slices whole-grain bread
PLUS
1 serving nuts or seeds
PLUS
3-5 servings of grains, nuts and seeds

Vegetables

4 or more servings
(2 servings should be dark leafy greens)

Fruits

1-4 servings
(1 serving should be a Vitamin C rich food)

Lacto-Ovo

Milk and Eggs

3-4 servings for teens and children
(2 servings for adults)

One Serving =
1 cup milk or yogurt
1½ ounces of cheese
1½ cups cottage cheese
Eggs are optional – up to 4 per week

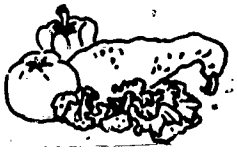
Grains, Legumes, Nuts and Seeds

4 slices whole-grain bread
PLUS
1 serving of beans
PLUS
¼ cup nuts or seeds.

One Serving = 1 slice bread, tortilla or pancake; 1 cup oats or rice; 1/3 cup beans of ¼ cup nuts or seeds.

Vegetables

3 or more servings
(1 serving should be dark leafy greens)

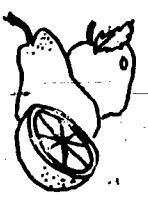


Dark Leafy Greens = Romaine lettuce, loose leaf lettuce, broccoli, kale, beet or collard or mustard or dandelion greens.

One Serving = ½ cup vegetables; ¾ cup salad.

Fruits

1-4 servings
(1 serving should be a Vitamin C rich food)



One Serving = 1 medium size fruit or ½ cup; ½ cup juice; ¼ medium melon.

balance in food selections to help insure that what you eat is nutritionally first-rate.

A generalization as broad as grouping all foods into four categories leaves room for misinterpretation. One could possibly choose foods from each group and still come up with a nutritionally inadequate diet unless enough of these foods is eaten in the right combinations. It therefore is essential to follow the details of either the lacto-ovo or the vegan vegetarian diet four food group guides regularly. If you need more calories than are provided in the number of servings in the four food group guides selected, you can simply eat more food from any of the groups or you can add a little oil to bring out the flavor and appeal of foods.

The diet of the vegan is the vegetarian diet in its purest form, made up exclusively of plant foods. In the absence of animal foods, legumes must become a staple in the vegan diet because legume protein is necessary for combining with grain protein to form high quality complete protein like that found in animal products. Therefore, the four food groups for the vegan are different from those of the lacto-ovo vegetarian (8).

The vegan must eat the recommended amounts of foods from all of the groups to have a nutritionally adequate diet. Following this guide will give sufficient variety and amount of plant foods to insure consuming enough of the nutrients that are usually supplied by milk in lacto-ovo vegetarian diets—complete protein, the mineral calcium and the B-vitamin riboflavin. Vitamin B_{12} is not found in plant food and must be provided in the vegan diet by a supplement or from either fortified soy milk or meat analogs (5,8). Vitamin D is also not found in plant foods and must be obtained from exposure to sunlight or from a supplement (5).

In order to meet protein needs most vegetarians, especially vegans, have to consume more protein-containing vegetable foods than meat eaters. For instance, a cup of cooked legumes provides only about half as much protein as a 2-ounce serving of meat, so you have to eat two cups of legumes to equal the protein of a meat serving. One cup of cooked beans contains about 200 calories and 14 grams of protein. An ounce of lean meat contains approximately 55 calories and seven grams of protein. Thus it is necessary to eat 400 bulky calories of legumes to get the same amount of protein available in 110 calories of lean meat. Since no one food or small group of foods contains all of the needed nutrients, fewer calories can be spent on the variety of other foods needed to supply such nutrients as vitamins and minerals.

Vegans are advised to avoid eating low-nutrient density foods that supply calories but little, if any, protein, vitamins or minerals. These include foods such as soft drinks, candy, beer, wine, mixed drinks, sugar or honey. Vegetarians need to concentrate on eating a variety of unrefined plant food. In fact, the calories spent on grains should go for whole grains, with all the accompanying vitamins and minerals they provide rather than for relatively low-nutrient density of enriched breads (7).

Paradoxically, vegetarians tend to consume fewer calories and to be thinner than meat eaters because most vegetarians concentrate on eating protein rich vegetarian foods that are bulky. These bulky foods are so filling that the vegetarian cannot physically accommodate large amounts of them and is likely to eat fewer total calories than meat eaters. This is particularly true for vegans (5, 8).

For this reason vegan vegetarians may have difficulty eating enough foods to meet their energy needs. While this may be good for adults who are trying to cut down on their calorie intake, or have low energy needs, it may be a problem for young children, teenagers and pregnant and breast-feeding women who have increased needs for protein, minerals and vitamins as well as energy (1, 5). Vegan diets are not recommended for members of these groups except under the supervision of a qualified dietitian or other health care professional (5).

Vegans also should carefully select a variety of minimally processed foods to insure their getting adequate calcium, iron and zinc. Generous amounts of these minerals are required in the diet because they are not well absorbed from vegetable foods. Riboflavin and vitamin B_{12} or cyanocobalamin are also likely to be in short supply in the vegan diet. Vegans also will need to make a conscious effort regularly to eat foods that are rich sources of riboflavin and vitamin B_{12}. Vitamin B_{12} is found only in animal products. The best way a vegan in this country can get adequate amounts of vitamin B_{12} is through the regular use of vitamin B_{12} fortified soymilk or a vitamin B_{12} supplement (1, 5).

Lacto-ovo vegetarians who regularly follow their vegetarian food group guide should have no problems including enough riboflavin, B_{12} and calcium in their diets since dairy products are rich sources of these vitamins and mineral. However, getting enough iron and zinc in the diet will still be a problem (1). It is a good idea to include a food high in vitamin C in each meal to improve iron absorption (5). Ovo-vegetarians will have to concentrate on getting enough calcium, riboflavin, iron and zinc in their diets.

The following charts can help you select foods in the vegetarian four food group guides to help meet your vitamin and mineral needs (8).

Pregnancy

During pregnancy whatever you eat, or don't eat, will affect not only you but your developing baby too. The need for all of the nutrients—protein, carbohydrate, fat, vitamins, minerals and water—increases during pregnancy. The mother-to-be who is well nourished before pregnancy will be in the best position to nourish her unborn baby. The developing baby has first priority for any nutrients in the body. Pregnant women must regularly eat foods to supply those nutrients or their body stores of those nutrients will be depleted. Pregnant women eating vegetarian diets will have even greater needs for the nutrients that can be in short supply in vegetarian diets.

Minerals

Calcium Sources

Adult Recommended Daily Allowance (RDA) is 800 mg. Pregnant women need 1,200 mg. Spinach, chard, sorrel, beet greens, lambsquarters, parsley, chocolate, rhubarb, and wheat bran are not included since their calcium is poorly utilized, due to their oxalic acid content.

Mg.	Food
400	skim milk powder, ¼ cup
360	collard leaves, 1 cup cooked
350	low-fat milk, 1 cup
300	buttermilk, 1 cup
290	whole milk, 1 cup
280	blackstrap molasses, 2 Tbs.
270	sesame seed meal, ¼ cup
270	yogurt, 1 cup
270	Parmesan cheese, ¼ cup grated
260	Swiss cheese, 1 ounce
250	bok choy, 1 cup cooked
230	cottage cheese, 1 cup
220	edam cheese, 1 ounce
210	cheddar cheese, 1 ounce
200	kale, 1 cup cooked
180	mustard greens, 1 cup cooked
160	broccoli, cooked, 1 stalk
150	okra, cooked, 1 cup slices
150	tofu, 4 ounce piece
150	dandelion greens, 1 cup cooked
140	Masa Harina, 1 cup dry
130	soybeans, 1 cup cooked
120	tortillas, 2
120	carob flour, ¼ cup
100	rutabagas, 1 cup cooked

Other sources of calcium which can be utilized by the body include chalk, limestone, granite, eggshell, sea shells, and hard water.

Iron Sources

Adult RDA is 10-18 mg. Pregnant women need 30-60 mg.

Mg.	Food
10.5	prune juice, 1 cup
7.9	black beans, 1 cup cooked
6.9	garbanzo beans, 1 cup cooked
6.1	pinto beans, 1 cup cooked
5.1	navy beans, 1 cup cooked
5.1	lima beans, dry, 1 cup cooked
4.9	soybeans, 1 cup cooked
4.8	rice bran, ¼ cup
4.4	rice polishings, ¼ cup
4.3	lima beans, green, 1 cup cooked
4.2	lentils, 1 cup cooked
4.0	spinach, 1 cup cooked
3.9	peach halves, dried, 5
3.9	millet, ¼ cup dry
3.4	sunchokes, 4 small
3.4	split peas, green, 1 cup cooked
3.2	blackstrap molasses, 1 Tbs.
2.9	peas, fresh, 1 cup
2.8	beet greens, 1 cup cooked
2.6	raisins, ½ cup
2.6	chard, 1 cup cooked
2.4	dates, 10 medium
2.4	sesame meal, ¼ cup
2.3	tofu, 4 ounce piece
2.2	tomato juice, 1 cup
2.1	wheat berries, 1/3 cup dry
2.1	butternut squash, 1 cup baked
2.0	pumpkin seeds, 2 Tbs.
1.9	wheat bran, ¼ cup
1.9	wheat germ, ¼ cup
1.8	soybean milk, 1 cup
1.8	kale, 1 cup cooked
1.7	prunes, 5 cooked
1.7	acorn squash, ½ baked
1.7	brussels sprouts, 8 cooked
1.5	torula yeast, 1 Tbs.
1.5	strawberries, 1 cup
1.4	potato, cooked, large
1.4	oatmeal, 1 cup cooked

Zinc Sources

Adult RDA is 15 mg. Pregnant women need 20 mg.

Mg.	Food
	Legumes, Mature
1.8	beans, common, 1 cup cooked
3.0	black-eyed peas, 1 cup cooked
2.0	garbanzos, 1 cup cooked
2.0	lentils, 1 cup cooked
1.7	limas, 1 cup cooked
0.3	peanuts, roasted, 1 Tbs.
0.5	peanut butter, 1 Tbs.
2.1	peas, green, 1 cup cooked
	Grains and Grain Products
0.1	barley, whole, ¼ cup dry
0.4	bread, rye, 1 slice
0.2	bread, white, 1 slice
0.5	bread, whole wheat, 1 slice
1.3	buckwheat, whole 1/3 cup dry
0.7	corn grits, 1 cup dry
2.1	cornmeal, bolted, 1 cup dry
0.2	crackers, graham, 2
0.1	crackers, saltine, 10
0.6	granola, 1 ounce
0.7	macaroni, 1 cup cooked
0.9	millet, whole, ¼ cup dry
1.2	oatmeal, 1 cup cooked
3.1	rice bran, 1 cup
1.2	rice, brown, 1 cup cooked
0.6	rice, white, parboiled, 1 cup cooked
1.4	soy flour, 1 cup stirred
5.9	soy meal, 3½ ounces
1.0	soy protein, ¼ cup
2.3	wheat berries, hard, 1/3 cup dry
1.8	wheat berries, soft, 1/3 cup dry
1.5	wheat berries, white, 1/3 cup dry
1.8	wheat berries, durum, 1/3 cup dry
5.7	wheat bran, 1 cup
3.2	wheat germ, toasted, ¼ cup
2.9	whole wheat flour, 1 cup stirred
0.8	all-purpose wheat flour, 1 cup sifted
0.9	bread wheat flour, 1 cup sifted
0.3	cake wheat flour, 1 cup sifted
1.2	wheat cereal, whole-meal, 1 cup cooked
	Dairy Products and Eggs
0.2	butter, 1 cup
0.01	butter, 1 Tbs.
0.5	cheese, cheddar, 1 slice
0.5	egg, whole, 1 large
0.5	egg yolk, 1 large
0.01	egg white, 1 large
0.6	ice cream, 1 cup
0.9	milk, fluid, 1 cup
1.9	milk, canned, evaporated, 1 cup
3.1	milk, dry, nonfat, 1 cup
	Vegetables
0.4	beans, snap green, French-cut, 1 cup cooked
0.3	cabbage, common, shredded, 1 cup raw
0.6	cabbage, common, 1 cup boiled,
0.3	carrot, raw, 1 medium
0.5	carrot, 1 cup cooked, drained
0.7	corn, sweet yellow, 1 cup boiled,
0.4	lettuce, 1/6 head
0.2	lettuce, loose-leaf, 1 cup chopped
0.6	onions, mature, 1 cup chopped
0.3	onions, young green, 1 cup chopped
1.2	peas, green immature, 1 cup boiled
0.3	potato, 1 medium, pared
0.4	potato, 1 medium boiled in skin, drained, pared
0.5	spinach, raw, 1 cup chopped
1.3	spinach, 1 cup boiled, drained
0.2	tomato, raw, 1 medium
0.5	tomato, 1 cup boiled
0.5	tomato, 1 cup canned, with liquid
	Fruits
0.08	apple, 1 medium
0.3	applesauce, unsweetened, 1 cup
0.3	banana, 1 medium
0.2	orange, 1 medium
0.2	orange juice, canned, 1 cup
0.05	orange juice, fresh or frozen, 1 cup
0.2	peach, raw peeled, 1 medium
0.3	peach, canned, 1 cup slices
	Miscellaneous
0.01	beverages, carbonated, 12-ounce bottle
0.3	beverages, carbonated, 12-ounce can
1.6	cocoa, powder, 1 ounce
0.3	cocoa, powder, 1 Tbs.
0.05	coffee, 6 fluid ounces
0.5	margarine, 1 cup
0.03	margarine, 1 Tbs.
0.4	oil, salad or cooking, 1 cup
0.1	sugar, white granulated, 1 cup
0.04	tea, 6 fluid ounces
0.8	yeast, active dry, 1 Tbs.
0.4	yeast, brewer's, 1 Tbs.
0.8	yeast, torula, 1 Tbs.

Vitamins

Riboflavin Sources

Adult RDA is 1.2-1.7 mg. Pregnant women need 1.5-1.6 mg.

Mg.	Food
.61	cottage cheese, 1 cup
.51	low-fat milk, 1 cup
.44	yogurt, low-fat, 1 cup
.41	whole milk, 1 cup
.26	sorrel, 1 cup cooked
.25	spinach, 1 cup cooked
.23	avocado, ½ medium
.22	beet greens, 1 cup cooked
.22	brussels sprouts, 1 cup cooked
.22	millet, ¼ cup dry
.20	wheat germ, ¼ cup
.19	chard, 1 cup cooked
.18	split peas, green, 1 cup cooked
.18	pinto beans, 1 cup cooked
.40	torula yeast, 1 Tbs.
.38	collard greens, 1 cup cooked
.36	broccoli, cooked, 1 stalk
.34	brewer's yeast, 1 Tbs.
.32	mushrooms, 1 cup cut
.29	camembert cheese, 1 1/3 ounce
.29	okra, 1 cup cooked
.27	butternut squash, 1 cup baked
.26	almond meal, ¼ cup
.26	asparagus, 1 cup cooked
.26	cheddar cheese, 2 ounces

Vitamin B-12 Sources

Adult RDA is 3.0 micrograms. Pregnant women need 4.0 micrograms.

Mcg.	Food
1.2	cottage cheese, ½ cup packed
1.0	milk, whole or skin, 1 cup
1.0	egg, large
.95	dried skim milk, regular, ¼ cup
.54	buttermilk, 1 cup
.50	Swiss cheese, 1 ounce
.50	edam cheese, 1 ounce
.49	camembert cheese, 1 1/3 ounce
.39	bleu cheese, 1 ounce
.28	cheddar cheese, 1 ounce
.28	brick cheese, 1 ounce
.28	mozzarella cheese, 1 ounce
.28	whey, fluid, 7 Tbs.
.27	yogurt, 1 cup
.06	cream cheese, 1 ounce
.04	cream, light, 1 Tbs.

Energy or calorie needs during pregnancy must be met so that the protein in the food a pregnant woman eats won't be burned for fuel and can provide the raw materials—amino acids—the baby needs to grow. During pregnancy, an additional 30 grams of protein should be added to the regular daily protein needs (4, 8). Vitamin and mineral needs also increase during pregnancy. Calcium needs increase from 800 mg. to 1,200 mg. per day. Calcium is essential for forming bones and teeth. It is recommended that pregnant women drink four glasses of low-fat milk a day or get the equivalent in low-fat dairy products. This supplies a large amount of good-quality protein, important for the baby's rapidly growing tissues and insures that calcium, riboflavin and vitamin B_{12} needs also are met. The chart on the calcium content of foods clearly shows that vegan vegetarians or ovo-vegetarians who do not eat dairy foods will have problems getting the 1,200 mg. a day of calcium needed during pregnancy unless they carefully plan what they eat or use a calcium supplement.

A common nutritional problem during pregnancy is anemia. Anemia is usually due to a deficiency of either the mineral iron or the B vitamin folacin. Therefore, during pregnancy you should eat extra amounts of foods rich in these two nutrients. Whole grains and dark green vegetables are rich in iron and folacin. Use the lists of foods high in these nutrients to help choose foods that will supply these critical nutrients in adequate amounts in your diet (4, 8).

Gaining weight during pregnancy is essential! Weight gain during pregnancy varies from woman to woman. Young women, women in their first pregnancy and women who are fairly thin tend to gain more than older, heavier women or those who already have children. Ideally, if a woman begins her pregnancy at the appropriate weight for her height she should gain about 20 to 24 pounds, most of it in the last half of pregnancy. This may sound like a lot, but a look at the chart below that summarizes what usually happens to weight gain in a pregnant woman's body will show that all these pounds—from calories in a variety of minimally processed nutrient-dense foods—are needed to create healthy placenta, uterus, blood and breast growth for the mother as well as a strong normal weight 7½ pound baby (4). To achieve this weight gain a pregnant woman needs an additional 300 calories a day (6). These calories should come from high nutrient-density foods that contain protein, vitamins and minerals as well as calories. Low nutrient-density foods like candy, soft drinks, alcohol, cake and cookies should be avoided and emphasis should be placed on eating foods from the vegetarian food group guides.

Distribution of Weight Gain in Normal Pregnancy

Development	Weight Gain (pounds)
Infant at birth	7½
Placenta	1
Increase in mother's blood volume to supply placenta	4
Increase in size of mother's uterus and muscles to support it	2½
Increase in size of mother's breasts	3
Fluid to surround infant in amniotic sac	2
Mother's fat stores	4
Total	24

Pregnant lacto-ovo vegetarians usually do not have any problems getting enough calories or nutrients but vegans and ovo-vegetarian mothers-to-be do. Therefore, it is a smart idea to get professional advice to be sure of eating to meet the nutrient and calorie needs for two! This same

Folacin

Adult RDA is 400 micrograms. Pregnant women need 800 micrograms.

Mcg.	Food
	Grains and Grain Products
10	barley, pot. ¼ cup dry
11	bread, white, 1 slice
15	bread, whole wheat, 1 slice
26	bread, whole wheat, homemade, slice
7	bread, rye, dark, 1 slice
30	cornmeal, 1 cup dry
31	flour, all-purpose, 1 cup sifted
80	flour, whole wheat, 1 cup stirred
99	flour, rye, dark, 1 cup
12	macaroni, ¼ pound dry
34	oatmeal, quick, ¾ cup dry
37	rice, long-grain, ¼ cup dry
15	spaghetti, ¼ pound dry
28	wheat, cracked, 1/3 cup dry
17	wheat bran, ¼ cup
52	wheat germ, ¼ cup
	Dairy Products
6	cheddar cheese, mild, 1 ounce
3	egg white, 1 large
50	egg yolk, hard-cooked, 1 large
37	milk, whole, 1 cup
27	yogurt, 1 cup
	Legumes, Mature
125	garbanzos, ½ cup dry
122	kidney beans, ½ cup dry
102	lima beans, ½ cup dry
33	peas, ½ cup dry
132	white beans, ½ cup dry
236	soybeans, ½ cup dry
298	soy flour, 1 cup stirred
	Nuts
14	almonds, 15
19	cashews, 14 large
8	coconut, fresh, shredded, ¼ cup
10	filberts (hazelnuts), 10
13	peanut butter, 1 Tbs.
10	peanuts, 1 Tbs. chopped
4	pecans, 12 halves
9	pistachios, 30
10	walnuts, 8 large halves
	Miscellaneous
3	molasses, light, 1 Tbs.
286	yeast, active dry, 1 Tbs.
308	yeast, brewer's, 1 Tbs.
240	yeast, torula, 1 Tbs.
	Fruits
10	apple, 1 medium
4	apricots, ¼ cup dried halves
41	avocado, ½ medium
36	banana, 1 medium
9	blueberries, 1 cup
49	cantaloupe, 1 cup diced
6	cherries, 10
17	dates, 10 medium
3	figs, 2 small dried
10	grapes, blue, 1 cup
4	grapes, red, 1 cup
6	grape juice, 1 cup
15	grapefruit, white, ½ medium
13	grapefruit, pink, ½ medium
52	grapefruit juice, 1 cup
5	lemon, 1 medium
3	lime, 1 medium
7	nectarine, 1 medium
60	orange, 1 medium
164	orange juice, fresh, 1 cup
3	peach, 1 medium
19	pear, 1 medium
16	pineapple, 1 cup diced
1	plum, 1 yellow
2	prunes, 5 large
1	raisins, ¾ cup
24	strawberries, 1 cup
18	tangerine, 1 medium
5	watermelon, 1 cup diced
	Vegetables
64	asparagus, 5 to 6 spears
40	beans, wax, 1 cup pieces
44	beans, green, 1 cup pieces
93	beets, 2 medium
72	broccoli, 1 medium stalk
97	brussels sprouts, 3 large
69	cabbage, 1 cup shredded
15	carrot, 1 medium
31	cauliflowerets, 1 cup
5	celery
18	corn, 1 medium ear
27	cucumber, 1 small
13	eggplant, 2 slices
20	endive, 1 cup cut
102	lettuce, romaine, 1 cup cut
16	mushrooms, 3 large or 7 small
27	onion, Spanish, 1 cup chopped
2	onion, green bulb, 1 Tbs. chopped
14	pepper, green, 1 medium pod
38	pepper, red, fresh, 1 medium
21	potato, fresh, 1 medium
20	potato, after storage, 1 medium
11	radishes, 10 medium
463	spinach, ½ pound
31	squash, winter, 3½ ounces
84	sweet potato, 1 medium
7	tomato, 1 medium
26	turnip, 1 cup diced

advice goes for children who are rapidly growing and have increased needs for both calories and nutrients that must be supplied in the form of high nutrient-density foods.

Most people won't take chances driving a car without the proper kind of fuel or lubricants, or tune up a car unless certain of what they are doing! It is equally important not to take chances with one's body or those of family members.

For more information on how to keep a vegetarian diet properly tuned up and the body in top nutritional shape the following books are recommended

Laurel's Kitchen: A Handbook for Vegetarian Cookery and Nutrition. Laurel Robertson, Carol Flinders and Bronwen Godfrey. Berkley, California, Nilgiri Press, 1976.

Diet for a Small Planet. Frances Moore Lappe. 2nd Edition. New York, Ballantine Press, 1975.

Nutritive Value of Foods. Home and Garden Bulletin No. 72. Revised 1981. U.S. Department of Agriculture. U.S. Government Printing Office, Washington, D.C. 20402.

References

1. Carpenter, K. O. and Calloway, D. H.: *Nutrition and Health*. Saunders College Publishing. Philadelphia, 1981.

2. Erhard, D.: "The New Vegetarians, Part 1: Vegetarianism and its consequences." *Nutrition Today*. November/December, 1974.

3. Food and Nutrition Board, National Academy of Sciences. *Vegetarian Diets*. May, 1974. Cited in R. A. Seelig, Vegetarianism. A review, reprint by United Fresh Fruit and Vegetable Association, Washington, D. C.

(continued)

4. Hamilton, E. M. and E. Whitney. *Nutrition Concepts and Controversies*. West Publishing Company: St. Paul, Minnesota, 1979.

5. Position Paper on the Vegetarian Approach to Eating. *Journal of the American Dietetic Association*. 77, 1980.

6. *Recommended Dietary Allowances*. The National Research Council, 9th Revised Edition. National Academy of Sciences, Washington, D. C., 1980.

7. Register, V. D. and Sonnenberg: The Vegetarian Diet. *Journal of the American Dietetic Association*. 62, 1973.

8. Robertson, L., *et. al.: Laurel's Kitchen. A Handbook for Vegetarian Cookery and Nutrition*. Nilgiri Press, Berkeley, California, 1976.

9. Shands Teaching Hospital and Clinics, Food and Nutrition Service. *Vegetarian Food Choices*. University of Florida, Gainesville, 1976.

81147

NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS *

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amount)

Item No	Foods, approximate measures, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
								Fatty Acids												
				Water	Food energy	Protein	Fat	Saturated (total)	Unsaturated: Oleic	Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
			Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	DAIRY PRODUCTS (CHEESE, CREAM, IMITATION CREAM, MILK, RELATED PRODUCTS)																			
	Butter. See Fats, oils; related products, items 103-108.																			
	Cheese:																			
	Natural:																			
1	Blue	1 oz	28	42	100	6	8	5.3	1.9	0.2	1	150	110	0.1	73	200	0.01	0.11	0.3	0
2	Camembert (3 wedges per 4-oz container).	1 wedge	38	52	115	8	9	5.8	2.2	.2	Trace	147	132	.1	71	350	.01	.19	.2	0
	Cheddar:																			
3	Cut pieces	1 oz	28	37	115	7	9	6.1	2.1	.2	Trace	204	145	.2	28	300	.01	.11	Trace	0
4		1 cu in	17.2	37	70	4	6	3.7	1.3	.1	Trace	124	88	.1	17	180	Trace	.06	Trace	0
5	Shredded	1 cup	113	37	455	28	37	24.2	8.5	.7	1	815	579	.8	111	1,200	.03	.42	.1	0
	Cottage (curd not pressed down):																			
	Creamed (cottage cheese, 4% fat):																			
6	Large curd	1 cup	225	79	235	28	10	6.4	2.4	.2	6	135	297	.3	190	370	.05	.37	.3	Trace
7	Small curd	1 cup	210	79	220	26	9	6.0	2.2	.2	6	126	277	.3	177	340	.04	.34	.3	Trace
8	Low fat (2%)	1 cup	226	79	205	31	4	2.8	1.0	.1	8	155	340	.4	217	160	.05	.42	.3	Trace
9	Low fat (1%)	1 cup	226	82	165	28	2	1.5	.5	.1	6	138	302	.3	193	80	.05	.37	.3	Trace
10	Uncreamed (cottage cheese dry curd, less than 1/2% fat).	1 cup	145	80	125	25	1	.4	.1	Trace	3	46	151	.3	47	40	.04	.21	.2	0
11	Cream	1 oz	28	54	100	2	10	6.2	2.4	.2	1	23	30	.3	34	400	Trace	.06	Trace	0
	Mozzarella, made with—																			
12	Whole milk	1 oz	28	48	90	6	7	4.4	1.7	.2	1	163	117	.1	21	260	Trace	.08	Trace	0
13	Part skim milk	1 oz	28	49	80	8	5	3.1	1.2	.1	1	207	149	.1	27	180	.01	.10	Trace	0
	Parmesan, grated:																			
14	Cup, not pressed down	1 cup	100	18	455	42	30	19.1	7.7	.3	4	1,376	807	1.0	107	700	.05	.39	.3	0
15	Tablespoon	1 tbsp	5	18	25	2	2	1.0	.4	Trace	Trace	69	40	Trace	5	40	Trace	.02	Trace	0
16	Ounce	1 oz	28	18	130	12	9	5.4	2.2	.1	1	390	229	.3	30	200	.01	.11	.1	0
17	Provolone	1 oz	28	41	100	7	8	4.8	1.7	.1	1	214	141	.1	39	230	.01	.09	Trace	0
	Ricotta, made with—																			
18	Whole milk	1 cup	246	72	430	28	32	20.4	7.1	.7	7	509	389	.9	257	1,210	.03	.48	.3	0
19	Part skim milk	1 cup	246	74	340	28	19	12.1	4.7	.5	13	669	449	1.1	303	1,060	.05	.46	.2	0
20	Romano	1 oz	28	31	110	9	8	—	—	—	1	302	215	—	—	160	—	.11	Trace	0
21	Swiss	1 oz	28	37	105	8	8	5.0	1.7	.2	1	272	171	Trace	31	240	.01	.10	Trace	0
	Pasteurized process cheese:																			
22	American	1 oz	28	39	105	6	9	5.6	2.1	.2	Trace	174	211	.1	46	340	.01	.10	Trace	0
23	Swiss	1 oz	28	42	95	7	7	4.5	1.7	.1	1	219	216	.2	61	230	Trace	.08	Trace	0
24	Pasteurized process cheese food, American.	1 oz	28	43	95	6	7	4.4	1.7	.1	2	163	130	.2	79	260	.01	.13	Trace	0
25	Pasteurized process cheese spread, American.	1 oz	28	48	80	5	6	3.8	1.5	.1	2	159	202	.1	69	220	.01	.12	Trace	0
	Cream, sweet:																			
26	Half-and-half (cream and milk)	1 cup	242	81	315	7	28	17.3	7.0	.6	10	254	230	.2	314	260	.08	.36	.2	2
27		1 tbsp	15	81	20	Trace	2	1.1	.4	Trace	1	16	14	Trace	19	20	.01	.02	Trace	Trace
28	Light, coffee, or table	1 cup	240	74	470	6	46	28.8	11.7	1.0	9	231	192	.1	292	1,730	.08	.36	.1	2
29		1 tbsp	15	74	30	Trace	3	1.8	.7	.1	1	14	12	Trace	18	110	Trace	.02	Trace	Trace

* United States Department of Agriculture, Home and Garden Bulletin No. 72, Revised April 1981. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	Whipping, unwhipped (volume about double when whipped):																		
30	Light	1 cup	239	64	700	5	74	46.2	18.3	1.5	7	166	146	0.1	231	2,690	0.06	0.30	0.1	1
31		1 tbsp	15	64	45	Trace	5	2.9	1.1	.1	Trace	10	9	Trace	15	170	Trace	.02	Trace	Trace
32	Heavy	1 cup	238	58	820	5	88	54.8	22.2	2.0	7	154	149	.1	179	3,500	.05	.26	.1	1
33		1 tbsp	15	58	80	Trace	6	3.5	1.4	.1	Trace	10	9	Trace	11	220	Trace	.02	Trace	Trace
34	Whipped topping, (pressurized)	1 cup	60	61	155	2	13	8.3	3.4	.3	7	61	54	Trace	88	550	.02	.04	Trace	0
35		1 tbsp	3	61	10	Trace	1	.4	.2	Trace	Trace	3	3	Trace	4	30	Trace	Trace	Trace	0
36	Cream, sour	1 cup	230	71	495	7	48	30.0	12.1	1.1	10	268	195	.1	331	1,820	.08	.34	.2	2
37		1 tbsp	12	71	25	Trace	3	1.6	.6	.1	1	14	10	Trace	17	90	Trace	.02	Trace	Trace
	Cream products, imitation (made with vegetable fat):																		
	Sweet:																		
	Creamers:																		
38	Liquid (frozen)	1 cup	245	77	335	2	24	22.8	.3	Trace	28	23	157	.1	467	[2]220	0	0	0	0
39		1 tbsp	15	77	20	Trace	1	1.4	Trace	0	2	1	10	Trace	29	[1]10	0	0	0	0
40	Powdered	1 cup	94	2	515	5	33	30.6	.9	Trace	52	21	397	.1	763	[1]190	0	[1].16	0	0
41		1 tsp	2	2	10	Trace	1	.7	Trace	0	1	Trace	8	Trace	16	[1]Trace	0	[1]Trace	0	0
	Whipped topping:																		
42	Frozen	1 cup	75	50	240	1	19	16.3	1.0	.2	17	5	6	.1	14	[1]650	8	0	0	0
43		1 tbsp	4	50	15	Trace	1	.9	.1	Trace	1	Trace	Trace	Trace	1	[1]30	0	0	0	0
44	Powdered, made with whole milk.	1 cup	80	67	150	3	10	8.5	.6	.1	13	72	69	Trace	121	[1]290	.02	.09	Trace	1
45		1 tbsp	4	67	10	Trace	Trace	.4	Trace	Trace	1	4	3	Trace	6	[1]10	Trace	Trace	Trace	Trace
46	Pressurized	1 cup	70	60	185	1	16	13.2	1.4	.2	11	4	13	Trace	13	[1]330	0	0	0	0
47		1 tbsp	4	60	10	Trace	1	.8	.1	Trace	1	Trace	1	Trace	1	[1]20	0	0	0	0
48	Sour dressing (imitation sour cream) made with nonfat dry milk.	1 cup	235	75	415	8	39	31.2	4.4	1.1	11	266	205	.1	380	[1]20	.09	.38	.2	2
49		1 tbsp	12	75	20	Trace	2	1.6	.2	.1	1	14	10	Trace	19	[1]Trace	.01	.02	Trace	Trace
	Ice cream. See Milk desserts, frozen (items 75-80).																		
	Ice milk. See Milk desserts, frozen (items 81-83).																		
	Milk:																		
	Fluid:																		
50	Whole (3.3% fat)	1 cup	244	88	150	8	8	5.1	2.1	.2	11	291	228	.1	370	[1]310	.09	.40	.2	2
	Lowfat (2%):																		
51	No milk solids added	1 cup	244	89	120	8	5	2.9	1.2	.1	12	297	232	.1	377	500	.10	.40	.2	2
	Milk solids added:																		
52	Label claim less than 10 g of protein per cup.	1 cup	245	89	125	9	5	2.9	1.2	.1	12	313	245	.1	397	500	.10	.42	.2	2
53	Label claim 10 or more grams of protein per cup (protein fortified).	1 cup	246	88	135	10	5	3.0	1.2	.1	14	352	276	.1	447	500	.11	.48	.2	3
	Lowfat (1%):																		
54	No milk solids added	1 cup	244	90	100	8	3	1.6	.7	.1	12	300	235	.1	381	500	.10	.41	.2	2
	Milk solids added:																		
55	Label claim less than 10 g of protein per cup.	1 cup	245	90	105	9	2	1.5	.6	.1	12	313	245	.1	397	500	.10	.42	.2	2
56	Label claim 10 or more grams of protein per cup (protein fortified).	1 cup	246	89	120	10	3	1.8	.7	.1	14	349	273	.1	444	500	.11	.47	.2	3
	Nonfat (skim):																		
57	No milk solids added	1 cup	245	91	85	8	Trace	.3	.1	Trace	12	302	247	.1	406	500	.09	.34	.2	2

[1]Vitamin A value is largely from beta-carotene used for coloring. Riboflavin value for items 40-41 apply to products with added riboflavin.
[2]Applies to product without added vitamin A. With added vitamin A, value is 500 International Units (I.U.).

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS - Continued

(Blanks (–) denote lack of reliable data for a constituent believed to be present in measurable amounts)

Item No.	Foods, approximate measures, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY															
				Water	Food energy	Protein	Fat	Fatty Acids: Saturated (total)	Fatty Acids: Unsaturated: Oleic	Fatty Acids: Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
			Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	DAIRY PRODUCTS (CHEESE, CREAM, IMITATION CREAM, MILK; RELATED PRODUCTS)—Con.																			
	Milk—Continued																			
	Fluid—Continued																			
	Nonfat (skim)—Continued																			
	Milk solids added:																			
58	Label claim less than 10 g of protein per cup.	1 cup	245	90	90	9	1	0.4	0.1	Trace	12	316	255	0.1	418	500	0.10	0.43	0.2	2
59	Label claim 10 or more grams of protein per cup (protein fortified).	1 cup	246	89	100	10	1	.4	.1	Trace	14	352	275	.1	446	500	.11	.48	.2	3
60	Buttermilk	1 cup	245	90	100	8	2	1.3	.5	Trace	12	285	249	.1	371	[3]80	.08	.38	.1	2
	Canned:																			
	Evaporated, unsweetened:																			
61	Whole milk	1 cup	252	74	340	17	19	11.6	5.3	0.4	25	657	510	.5	764	[3]610	.12	.80	.5	5
62	Skim milk	1 cup	255	79	200	19	1	.3	.1	Trace	29	738	497	.7	845	[4]1,000	.17	.79	.4	3
63	Sweetened, condensed	1 cup	306	27	980	24	27	16.8	6.7	.7	166	868	775	.6	1,136	[3]1,000	.28	1.27	.6	8
	Dried:																			
64	Buttermilk	1 cup	120	3	466	41	7	4.3	1.7	.2	59	1,421	1,119	.4	1,910	[3]260	.47	1.90	1.1	7
	Nonfat instant:																			
65	Envelope, net wt., 3.2 oz[5]	1 envelope	91	4	325	32	1	.4	.1	Trace	47	1,120	896	.3	1,552	[6]2,160	.38	1.99	.8	5
66	Cup[7]	1 cup	68	4	245	24	Trace	.3	.1	Trace	36	837	670	.2	1,160	[6]1,610	.28	1.19	.6	4
	Milk beverages:																			
	Chocolate milk (commercial):																			
67	Regular	1 cup	250	82	210	8	8	5.3	2.2	.2	26	280	251	.6	417	[3]300	.09	.41	.3	2
68	Lowfat (2%)	1 cup	250	84	180	8	5	3.1	1.3	.1	26	284	254	.6	422	500	.10	.42	.3	2
69	Lowfat (1%)	1 cup	250	86	160	8	3	1.5	.7	.1	26	287	257	.6	426	500	.10	.40	.2	2
70	Eggnog (commercial)	1 cup	254	74	340	10	19	11.3	5.0	.6	34	330	278	.5	420	890	.09	.48	.3	4
	Malted milk, home-prepared with 1 cup of whole milk and 2 to 3 heaping tsp of malted milk powder (about 3/4 oz):																			
71	Chocolate	1 cup of milk plus 3/4 oz of powder.	266	81	235	9	9	5.5	—	—	29	304	265	.5	500	330	.14	.43	.7	2
72	Natural	1 cup of milk plus 3/4 oz of powder.	265	81	235	11	10	6.0	—	—	27	347	307	.3	529	380	.20	.54	1.3	2
	Shakes, thick:[8]																			
73	Chocolate, container, net wt., 10.6 oz.	1 container	300	72	365	9	8	5.0	2.0	.2	63	396	378	.9	672	260	.14	.67	.4	0
74	Vanilla, container, net wt., 11 oz.	1 container	313	74	360	12	9	5.9	2.4	.2	56	457	361	.3	572	360	.09	.61	.5	0
	Milk desserts, frozen:																			
	Ice cream:																			
	Regular (about 11% fat):																			
75	Hardened	1/2 gal	1,064	61	2,155	38	115	71.3	28.8	2.6	254	1,406	1,075	1.0	2,062	4,340	.62	2.63	1.1	6
76		1 cup	133	61	270	5	14	8.9	3.6	.3	32	176	134	.1	257	540	.05	.33	.1	1
77		3-fl oz container	50	61	100	2	5	3.4	1.4	.1	12	66	51	Trace	96	200	.02	.12	.1	Trace
78	Soft serve (frozen custard)	1 cup	173	60	375	7	23	13.5	5.9	.6	38	236	199	.4	338	790	.08	.46	.2	1
79	Rich (about 16% fat), hardened.	1/2 gal	1,188	59	2,806	33	190	118.3	47.8	4.3	256	1,213	927	.8	1,771	7,200	.36	2.27	.9	5
80		1 cup	148	59	360	4	24	14.7	6.0	.5	32	151	115	.1	221	900	.04	.28	.1	1
	Ice milk:																			
81	Hardened (about 4.3% fat)	1/2 gal	1,048	69	1,470	41	46	28.1	11.3	1.0	232	1,409	1,036	1.5	2,117	1,710	.61	2.78	.9	6
82		1 cup	131	69	186	5	6	3.5	1.4	.1	29	176	129	.1	266	210	.08	.35	.1	1

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
83	Soft serve (about 2.6% fat)	1 cup	175	70	225	8	5	2.9	1.2	0.1	38	274	202	0.3	412	180	0.12	0.54	0.2	1
84	Sherbet (about 2% fat)	1/2 gal	1,542	66	2,160	17	31	19.0	7.7	.7	469	827	594	2.5	1,585	1,480	.26	.71	1.0	31
85		1 cup	193	66	270	2	4	2.4	1.0	.1	59	103	74	.3	198	190	.03	.09	.1	4
	Milk desserts, other:																			
86	Custard, baked	1 cup	265	77	305	14	15	6.8	5.4	.7	29	297	310	1.1	387	930	.11	.50	.3	1
	Puddings:																			
	From home recipe:																			
	Starch base:																			
87	Chocolate	1 cup	260	66	385	8	12	7.6	3.3	.3	67	250	255	1.3	445	390	.05	.36	.3	1
88	Vanilla (blancmange)	1 cup	255	76	285	9	10	6.2	2.5	.2	41	298	232	Trace	352	410	.08	.41	.3	2
89	Tapioca cream	1 cup	165	72	220	8	8	4.1	2.5	.5	28	173	180	.7	223	480	.07	.30	.2	2
	From mix (chocolate) and milk:																			
90	Regular (cooked)	1 cup	260	70	320	9	8	4.3	2.6	.2	59	265	247	.8	354	340	.05	.39	.3	2
91	Instant	1 cup	260	69	325	8	7	3.6	2.2	.3	63	374	237	1.3	335	340	.08	.39	.3	2
	Yogurt:																			
	With added milk solids:																			
	Made with lowfat milk:																			
92	Fruit-flavored[4]	1 container, net wt., 8 oz	227	75	230	10	3	1.8	.6	.1	42	343	269	.2	439	[10]120	.08	.40	.2	1
93	Plain	1 container, net wt., 8 oz	227	85	145	12	4	2.3	.8	.1	16	415	326	.2	531	[10]150	.10	.49	.3	2
94	Made with nonfat milk	1 container, net wt., 8 oz	227	85	125	13	Trace	.3	.1	Trace	17	452	355	.2	579	[10]20	.11	.53	.3	2
	Without added milk solids:																			
95	Made with whole milk	1 container, net wt., 8 oz	227	88	140	8	7	4.8	1.7	.1	11	274	213	.1	351	280	.07	.32	.2	1
	EGGS																			
	Eggs, large (24 oz per dozen):																			
	Raw:																			
96	Whole, without shell	1 egg	50	75	80	6	6	1.7	2.0	.6	1	28	90	1.0	65	260	.04	.15	Trace	0
97	White	1 white	33	88	15	3	Trace	0	0	0	Trace	4	4	Trace	45	0	Trace	.09	Trace	0
98	Yolk	1 yolk	17	49	65	3	6	1.7	2.1	.6	Trace	26	86	.9	15	310	.04	.07	Trace	0
	Cooked:																			
99	Fried in butter	1 egg	46	72	75	5	6	2.4	2.2	.6	1	26	80	.9	58	290	.03	.13	Trace	0
100	Hard-cooked, shell removed	1 egg	50	75	80	6	6	1.7	2.0	.6	1	28	90	1.0	65	260	.04	.14	Trace	0
101	Poached	1 egg	50	74	80	6	6	1.7	2.0	.6	1	28	90	1.0	65	260	.04	.13	Trace	0
102	Scrambled (milk added) in butter. Also omelet.	1 egg	64	76	95	6	7	2.8	2.3	.6	1	47	97	.9	85	310	.04	.16	Trace	0
	FATS, OILS, RELATED PRODUCTS																			
	Butter:																			
	Regular (1 brick or 4 sticks per lb):																			
103	Stick (1/2 cup)	1 stick	113	16	815	1	92	57.3	23.1	2.1	Trace	27	26	.2	29	[11]3,470	.01	.04	Trace	0
104	Tablespoon (about 1/8 stick).	1 tbsp	14	16	100	Trace	12	7.2	2.9	.3	Trace	3	3	Trace	4	[11]430	Trace	Trace	Trace	0
105	Pat (1 in square, 1/3 in high; 90 per lb).	1 pat	5	16	35	Trace	4	2.5	1.0	.1	Trace	1	1	Trace	1	[11]150	Trace	Trace	Trace	0
	Whipped (6 sticks or two 8-oz containers per lb).																			
106	Stick (1/2 cup)	1 stick	76	16	540	1	61	38.2	15.4	1.4	Trace	18	17	.1	20	[11]2,310	Trace	.03	Trace	0
107	Tablespoon (about 1/8 stick).	1 tbsp	9	16	65	Trace	8	4.7	1.9	.2	Trace	2	2	Trace	2	[11]290	Trace	Trace	Trace	0
108	Pat (1 1/4 in square, 1/3 in high; 120 per lb).	1 pat	4	16	25	Trace	3	1.9	.8	.1	Trace	1	1	Trace	1	[11]120	0	Trace	Trace	0

[1]Applies to product without vitamin A added.
[2]Applies to product with added vitamin A. Without added vitamin A, value is 20 International Units (I.U.).
[3]Yields 1 qt of fluid milk when reconstituted according to package directions.
[4]Applies to product with added vitamin A.
[5]Weight applies to product with label claim of 1 1/3 cups equal 3.2 oz.
[6]Applies to products made from thick shake mixes and that do not contain added ice cream. Products made from milk shake mixes are higher in fat and usually contain added ice cream.
[7]Content of fat, vitamin A, and carbohydrate varies. Consult the label when precise values are needed for special diets.
[10]Applies to product made with milk containing no added vitamin A.
[11]Based on year-round average.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS · Continued

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amount)

Item No.	Food, approximate measure, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
								Fatty Acids												
								Saturated	Unsaturated		Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
									Oleic	Linoleic										
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
			Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	FATS, OILS: RELATED PRODUCTS—Con.																			
109	Fats, cooking (vegetable shortenings).	1 cup	200	0	1,770	0	200	48.8	88.2	48.4	0	0	0	0	0	—	0	0	0	0
110		1 tbsp	13	0	110	0	13	3.2	5.7	3.1	0	0	0	0	0	—	0	0	0	0
111	Lard	1 cup	205	0	1,850	0	205	81.0	83.8	20.5	0	0	0	0	0	0	0	0	0	0
112		1 tbsp	13	0	115	0	13	5.1	5.3	1.3	0	0	0	0	0	0	0	0	0	0
	Margarine:																			
	Regular (1 brick or 4 sticks per lb):																			
113	Stick (1/2 cup)	1 stick	113	16	815	1	92	16.7	42.9	24.9	Trace	27	26	.2	29	[12]3,750	.01	.04	Trace	0
114	Tablespoon (about 1/8 stick)	1 tbsp	14	16	100	Trace	12	2.1	5.3	3.1	Trace	3	3	Trace	4	[12]470	Trace	Trace	Trace	0
115	Pat (1 in square, 1/3 in high; 90 per lb).	1 pat	5	16	35	Trace	4	.7	1.9	1.1	Trace	1	1	Trace	1	[12]170	Trace	Trace	Trace	0
116	Soft, two 8-oz containers per lb.	1 container	227	16	1,635	1	184	32.5	71.5	65.4	Trace	53	52	.4	59	[12]7,500	.01	.08	.1	0
117		1 tbsp	14	16	100	Trace	11	2.0	4.9	4.1	Trace	3	3	Trace	4	[12]470	Trace	Trace	Trace	0
	Whipped (6 sticks per lb):																			
118	Stick (1/2 cup)	1 stick	76	16	545	Trace	61	11.2	28.7	16.7	Trace	18	17	.1	20	[12]2,500	Trace	.03	Trace	0
119	Tablespoon (about 1/8 stick)	1 tbsp	9	16	70	Trace	8	1.4	3.6	2.1	Trace	2	2	Trace	2	[12]310	Trace	Trace	Trace	0
	Oils, salad or cooking:																			
120	Corn	1 cup	218	0	1,925	0	218	27.7	53.6	125.1	0	0	0	0	0	—	0	0	0	0
121		1 tbsp	14	0	120	0	14	1.7	3.3	7.8	0	0	0	0	0	—	0	0	0	0
122	Olive	1 cup	216	0	1,910	0	216	30.7	154.4	17.7	0	0	0	0	0	—	0	0	0	0
123		1 tbsp	14	0	120	0	14	1.9	9.7	1.1	0	0	0	0	0	—	0	0	0	0
124	Peanut	1 cup	216	0	1,910	0	216	37.4	98.5	67.0	0	0	0	0	0	—	0	0	0	0
125		1 tbsp	14	0	120	0	14	2.3	6.2	4.2	0	0	0	0	0	—	0	0	0	0
126	Safflower	1 cup	218	0	1,925	0	218	20.5	25.9	159.8	0	0	0	0	0	—	0	0	0	0
127		1 tbsp	14	0	120	0	14	1.3	1.6	10.0	0	0	0	0	0	—	0	0	0	0
128	Soybean oil, hydrogenated (partially hardened).	1 cup	218	0	1,925	0	218	31.8	93.1	75.6	0	0	0	0	0	—	0	0	0	0
129		1 tbsp	14	0	120	0	14	2.0	5.8	4.7	0	0	0	0	0	—	0	0	0	0
130	Soybean-cottonseed oil blend, hydrogenated.	1 cup	218	0	1,925	0	218	38.2	63.0	99.6	0	0	0	0	0	—	0	0	0	0
131		1 tbsp	14	0	120	0	14	2.4	3.9	6.2	0	0	0	0	0	—	0	0	0	0
	Salad dressings:																			
	Commercial:																			
	Blue cheese:																			
132	Regular	1 tbsp	15	32	75	1	8	1.6	1.7	3.8	1	12	11	Trace	6	30	Trace	.02	Trace	Trace
133	Low calorie (5 Cal per tsp)	1 tbsp	16	84	10	Trace	1	.5	.3	Trace	1	10	8	Trace	5	30	Trace	.01	Trace	Trace
	French:																			
134	Regular	1 tbsp	16	39	65	Trace	6	1.1	1.3	3.2	3	2	2	.1	13	—	—	—	—	—
136	Low calorie (5 Cal per tsp)	1 tbsp	16	77	15	Trace	1	.1	.1	.4	2	2	2	.1	13	—	—	—	—	—
	Italian:																			
136	Regular	1 tbsp	15	28	85	Trace	9	1.6	1.9	4.7	1	2	1	Trace	2	Trace	Trace	Trace	Trace	—
137	Low calorie (2 Cal per tsp)	1 tbsp	15	90	10	Trace	1	.1	.1	.4	Trace	Trace	1	Trace	2	Trace	Trace	Trace	Trace	—
138	Mayonnaise	1 tbsp	14	15	100	Trace	11	2.0	2.4	5.6	Trace	3	4	.1	5	80	Trace	.01	Trace	—
	Mayonnaise type:																			
139	Regular	1 tbsp	15	41	65	Trace	6	1.1	1.4	3.2	2	2	4	Trace	1	30	Trace	Trace	Trace	—
140	Low calorie (8 Cal per tsp)	1 tbsp	16	81	20	Trace	2	.4	.4	1.0	2	3	4	Trace	1	40	Trace	Trace	Trace	—
141	Tartar sauce, regular	1 tbsp	14	34	75	Trace	8	1.5	1.8	4.1	1	3	4	.1	11	30	Trace	Trace	Trace	Trace
	Thousand Island:																			
142	Regular	1 tbsp	16	32	80	Trace	8	1.4	1.7	4.0	2	2	3	.1	18	50	Trace	Trace	Trace	Trace
143	Low calorie (10 Cal per tsp)	1 tbsp	15	68	25	Trace	2	.4	.4	1.0	2	2	3	.1	17	50	Trace	Trace	Trace	Trace
	From home recipe:																			
144	Cooked type[13]	1 tbsp	16	68	25	1	2	.5	.6	.3	2	14	15	.1	19	80	.01	.03	Trace	Trace

(A)	(B)		(C)	(D)	(F)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	FISH, SHELLFISH, MEAT, POULTRY; RELATED PRODUCTS																		
	Fish and shellfish:																		
145	Bluefish, baked with butter or margarine.	3 oz----------	85	68	135	22	4	—	—	—	0	25	244	0.6	—	40	0.09	0.08	1.6	—
	Clams:																		
146	Raw, meat only----------	3 oz----------	85	82	65	11	1	—	—	—	2	59	138	5.2	154	90	.08	.15	1.1	8
147	Canned, solids and liquid-----	3 oz----------	85	86	45	7	1	0.2	Trace	Trace	2	47	116	3.5	119	—	.01	.09	.9	—
148	Crabmeat (white or king), canned, not pressed down.	1 cup----------	135	77	135	24	3	.6	0.4	0.1	1	61	246	1.1	149	—	.11	.11	2.6	—
149	Fish sticks, breaded, cooked, frozen (stick, 4 by 1 by 1/2 in).	1 fish stick or 1 oz-------	28	66	80	5	3	—	—	—	2	3	47	.1	—	0	.01	.02	.5	—
150	Haddock, breaded, fried[14]-------	3 oz----------	85	66	140	17	5	1.4	2.2	1.2	5	34	210	1.0	298	—	.03	.06	2.7	2
151	Ocean perch, breaded, fried[14]---	1 fillet----------	85	59	195	16	11	2.7	4.4	2.3	6	28	192	1.1	242	—	.10	.10	1.6	—
152	Oysters, raw, meat only (13-19 medium Selects).	1 cup----------	240	85	160	20	7	1.3	.2	.1	8	226	343	13.2	290	740	.34	.43	6.0	—
153	Salmon, pink, canned, solids and liquid.	3 oz----------	85	71	120	17	5	.9	.8	.1	0	[15]167	243	.7	307	60	.03	.16	6.8	—
154	Sardines, Atlantic, canned in oil, drained solids.	3 oz----------	85	62	175	20	9	3.0	2.5	.5	0	372	424	2.5	502	190	.02	.17	4.6	—
155	Scallops, frozen, breaded, fried, reheated.	6 scallops----------	90	60	175	16	8	—	—	—	9	—	—	—	—	—	—	—	—	—
156	Shad, baked with butter or margarine, bacon.	3 oz---------- ----------	85	64	170	20	10	—	—	—	0	20	264	.5	320	30	.11	.22	7.3	—
	Shrimp:																		
157	Canned meat----------	3 oz----------	85	70	100	21	1	.1	.1	Trace	1	98	224	2.6	108	50	.01	.03	1.5	—
158	French fried[16]----------	3 oz----------	85	57	190	17	9	2.3	3.7	2.0	9	61	162	1.7	195	—	.03	.07	2.3	—
159	Tuna, canned in oil, drained solids.	3 oz----------	85	61	170	24	7	1.7	1.7	.7	0	7	199	1.6	—	70	.04	.10	10.1	—
160	Tuna salad[17]----------	1 cup----------	205	70	350	30	22	4.3	6.3	6.7	7	41	291	2.7	—	590	.08	.23	10.3	2
	Meat and meat products:																		
161	Bacon, (20 slices per lb, raw), broiled or fried, crisp.	2 slices----------	15	8	85	4	8	2.5	3.7	.7	Trace	2	34	.5	35	0	.08	.05	.8	—
	Beef,[18] cooked:																		
	Cuts braised, simmered or pot roasted:																		
162	Lean and fat (piece, 2 1/2 by 2 1/2 by 3/4 in).	3 oz----------	85	53	245	23	16	6.8	6.5	.4	0	10	114	2.9	184	30	.04	.18	3.6	—
163	Lean only from item 162-----	2.5 oz----------	72	62	140	22	5	2.1	1.8	.2	0	10	108	2.7	176	10	.04	.17	3.3	—
	Ground beef, broiled:																		
164	Lean with 10% fat----------	3 oz or patty 3 by 5/8 in--	85	60	185	23	10	4.0	3.9	.3	0	10	196	3.0	261	20	.08	.20	5.1	—
165	Lean with 21% fat----------	2.9 oz or patty 3 by 5/8 in	82	54	235	20	17	7.0	6.7	.4	0	9	159	2.6	221	30	.07	.17	4.4	—
	Roast, oven cooked, no liquid added:																		
	Relatively fat, such as rib:																		
166	Lean and fat (2 pieces, 4 1/8 by 2 1/4 by 1/4 in).	3 oz----------	85	40	375	17	33	14.0	13.6	.8	0	8	158	2.2	189	70	.05	.13	3.1	—
167	Lean only from item 166---	1.8 oz----------	51	57	125	14	7	3.0	2.5	.3	0	6	131	1.8	161	10	.04	.11	2.6	—
	Relatively lean, such as heel of round:																		
168	Lean and fat (2 pieces, 4 1/8 by 2 1/4 by 1/6 in).	3 oz----------	85	62	165	25	7	2.8	2.7	.2	0	11	208	3.2	279	10	.06	.19	4.5	—

[12] Based on average vitamin A content of fortified margarine. Federal specifications for fortified margarine require a minimum of 15,000 International Units (I.U.) of vitamin A per pound.
[13] Fatty acid values apply to product made with regular-type margarine.
[14] Dipped in egg, milk or water, and breadcrumbs; fried in vegetable shortening.
[15] If bones are discarded, value for calcium will be greatly reduced.
[16] Dipped in egg, breadcrumbs, and flour or batter.
[17] Prepared with tuna, celery, salad dressing (mayonnaise type), pickle, onion, and egg.
[18] Outer layer of fat on the cut was removed to within approximately 1/2 in of the lean. Deposits of fat within the cut were not removed.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS - Continued

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amounts)

Item No.	Foods, approximate measures, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
								Fatty Acids												
				Water	Food energy	Protein	Fat	Saturated (total)	Unsaturated: Oleic	Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
			Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	FISH, SHELLFISH, MEAT, POULTRY; RELATED PRODUCTS—Con.																			
	Meat and meat products—Continued																			
	Beef,[10] cooked—Continued																			
	Roast, oven cooked, no liquid added—Continued																			
	Relatively lean such as heel of round—Continued																			
169	Lean only from item 168---	2.8 oz----------	78	65	125	24	3	1.2	1.0	0.1	0	10	199	3.0	268	Trace	0.06	0.18	4.3	—
	Steak:																			
	Relatively fat—sirloin, broiled:																			
170	Lean and fat (piece, 2 1/2 by 2 1/2 by 3/4 in).	3 oz----------	85	44	330	20	27	11.3	11.1	.6	0	9	162	2.5	220	50	.05	.15	4.0	—
171	Lean only from item 170---	2.0 oz----------	56	59	115	18	4	1.8	1.6	.2	0	7	146	2.2	202	10	.05	.14	3.6	—
	Relatively lean—round, braised:																			
172	Lean and fat (piece, 4 1/8 by 2 1/4 by 1/2 in).	3 oz----------	86	55	220	24	13	5.5	5.2	.4	0	10	213	3.0	272	20	.07	.19	4.8	—
173	Lean only from item 172---	2.4 oz----------	68	61	130	21	4	1.7	1.5	.2	0	9	182	2.5	238	10	.05	.16	4.1	—
	Beef, canned:																			
174	Corned beef----------	3 oz----------	86	59	185	22	10	4.9	4.5	.2	0	17	90	3.7	—	—	.01	.20	2.9	—
175	Corned beef hash----------	1 cup----------	220	67	400	19	25	11.9	10.9	.5	24	29	147	4.4	440	—	.02	.20	4.6	—
176	Beef, dried, chipped----------	2 1/2-oz jar----------	71	48	145	24	4	2.1	2.0	.1	0	14	287	3.6	142	—	.05	.23	2.7	0
177	Beef and vegetable stew----------	1 cup----------	245	82	220	16	11	4.9	4.5	.2	15	29	184	2.9	613	2,400	.15	.17	4.7	17
178	Beef potpie (home recipe), baked[9] (piece, 1/3 of 9-in diam. pie).	1 piece----------	210	55	515	21	30	7.9	12.8	6.7	39	29	149	3.8	334	1,720	.30	.30	5.5	6
179	Chili con carne with beans, canned.	1 cup----------	255	72	340	19	16	7.5	6.8	.3	31	82	321	4.3	594	150	.08	.18	3.3	—
180	Chop suey with beef and pork (home recipe).	1 cup----------	250	75	300	26	17	8.5	6.2	.7	13	60	248	4.8	425	600	.28	.38	5.0	33
181	Heart, beef, lean, braised------	3 oz----------	85	61	160	27	5	1.5	1.1	.6	1	5	154	5.0	197	20	.21	1.04	6.5	1
	Lamb, cooked:																			
	Chop, rib (cut 3 per lb with bone), broiled:																			
182	Lean and fat----------	3.1 oz----------	89	43	360	18	32	14.8	12.1	1.2	0	8	139	1.0	200	—	.11	.19	4.1	—
183	Lean only from item 182-----	2 oz----------	57	60	120	16	6	2.5	2.1	.2	0	6	121	1.1	174	—	.09	.15	3.4	—
	Leg, roasted:																			
184	Lean and fat (2 pieces, 4 1/8 by 2 1/4 by 1/4 in).	3 oz----------	85	54	235	22	16	7.3	6.0	.6	0	9	177	1.4	241	—	.13	.23	4.7	—
185	Lean only from item 184-----	2.5 oz----------	71	62	130	20	5	2.1	1.8	.2	0	9	169	1.4	227	—	.12	.21	4.4	—
	Shoulder, roasted:																			
186	Lean and fat (3 pieces, 2 1/2 by 2 1/2 by 1/4 in).	3 oz----------	86	50	285	18	23	10.8	8.8	.9	0	9	146	1.0	206	—	.11	.20	4.0	—
187	Lean only from item 186-----	2.3 oz----------	64	61	130	17	6	3.6	2.3	.2	0	8	140	1.0	193	—	.10	.18	3.7	—
188	Liver, beef, fried[10] (slice, 6 1/2 by 2 3/8 by 3/8 in).	3 oz----------	86	56	195	22	9	2.5	3.5	.9	5	9	406	7.5	323	[11]45,390	.22	3.56	14.0	23
	Pork, cured, cooked:																			
189	Ham, light cure, lean and fat, roasted (2 pieces, 4 1/8 by 2 1/6 by 1/6 in).[11]	3 oz----------	85	54	265	18	19	6.8	7.9	1.7	0	8	146	2.2	199	0	.40	.15	3.1	—
	Luncheon meat:																			
190	Boiled ham, slice (8 per 8-oz pkg.).	1 oz----------	28	59	65	5	5	1.7	2.0	.6	0	3	47	.8	—	0	.12	.04	.7	—
	Canned, spiced or unspiced:																			
191	Slice, approx. 3 by 2 by 1/2 in.	1 slice----------	60	66	175	9	15	5.4	6.7	1.0	1	5	66	1.3	133	0	.19	.13	1.8	—

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	Pork, fresh,[18] cooked:																		
	Chop, loin (cut 3 per lb with bone), broiled:																		
192	Lean and fat	2.7 oz	78	42	305	19	25	8.9	10.4	2.2	0	9	209	2.7	216	0	0.75	0.22	4.5	—
193	Lean only from item 192	2 oz	56	53	150	17	9	3.1	3.6	.8	0	7	181	2.2	192	0	.63	.18	3.8	—
	Roast, oven cooked, no liquid added:																		
194	Lean and fat (piece, 2 1/2 by 2 1/2 by 3/4 in).	3 oz	85	46	310	21	24	8.7	10.2	2.2	0	9	218	2.7	233	0	.78	.22	4.8	—
195	Lean only from item 194	2.4 oz	68	55	175	20	10	3.5	4.1	.8	0	9	211	2.6	224	0	.73	.21	4.4	—
	Shoulder cut, simmered:																		
196	Lean and fat (3 pieces, 2 1/2 by 2 1/2 by 1/4 in).	3 oz	85	46	320	20	26	9.3	10.9	2.3	0	9	118	2.6	158	0	.46	.21	4.1	—
197	Lean only from item 196	2.2 oz	63	60	135	18	6	2.2	2.6	.6	0	8	111	2.3	146	0	.42	.19	3.7	—
	Sausages (see also Luncheon meat (items 190-191)):																		
198	Bologna, slice (8 per 8-oz pkg.).	1 slice	28	56	85	3	8	3.0	3.4	.5	Trace	2	36	.5	65	—	.05	.06	.7	—
199	Braunschweiger, slice (6 per 6-oz pkg.).	1 slice	28	53	90	4	8	2.6	3.4	.8	1	3	69	1.7	—	1,850	.05	.41	2.3	—
200	Brown and serve (10-11 per 8-oz pkg.), browned.	1 link	17	40	70	3	6	2.3	2.8	.7	Trace	—	—	—	—	—	—	—	—	—
201	Deviled ham, canned	1 tbsp	15	51	45	2	4	1.5	1.8	.4	0	1	12	.3	—	0	.02	.01	.2	—
202	Frankfurter (8 per 1-lb pkg.), cooked (reheated).	1 frankfurter	56	57	170	7	15	5.6	6.5	1.2	1	3	57	.8	—	—	.08	.11	1.4	—
203	Meat, potted (beef, chicken, turkey), canned.	1 tbsp	13	61	30	2	2	—	—	—	0	—	—	—	—	—	Trace	.03	.2	—
204	Pork link (16 per 1-lb pkg.), cooked.	1 link	13	35	60	2	6	2.1	2.4	.5	Trace	1	21	.3	35	0	.10	.04	.5	—
	Salami:																		
205	Dry type, slice (12 per 4-oz pkg.).	1 slice	10	30	45	2	4	1.6	1.6	.1	Trace	1	28	.4	—	—	.04	.03	.5	—
206	Cooked type, slice (8 per 8-oz pkg.).	1 slice	28	51	90	5	7	3.1	3.0	.2	Trace	3	57	.7	—	—	.07	.07	1.2	—
207	Vienna sausage (7 per 4-oz can).	1 sausage	16	63	40	2	3	1.2	1.4	.2	Trace	1	24	.3	—	—	.01	.02	.4	—
	Veal, medium fat, cooked, bone removed:																		
208	Cutlet (4 1/8 by 2 1/4 by 1/2 in), braised or broiled.	3 oz	85	60	185	23	9	4.0	3.4	.4	0	9	196	2.7	258	—	.06	.21	4.6	—
209	Rib (2 pieces, 4 1/8 by 2 1/4 by 1/4 in), roasted.	3 oz	85	55	230	23	14	6.1	5.1	.6	0	10	211	2.9	259	—	.11	.26	6.6	—
	Poultry and poultry products:																		
	Chicken, cooked:																		
210	Breast, fried,[22] bones removed, 1/2 breast (3.3 oz with bones).	2.8 oz	79	58	160	26	5	1.4	1.8	1.1	1	9	218	1.3	—	70	.04	.17	11.6	—
211	Drumstick, fried,[23] bones removed (2 oz with bones).	1.3 oz	38	55	90	12	4	1.1	1.3	.9	Trace	6	89	.9	—	50	.03	.15	2.7	—
212	Half broiler, broiled, bones removed (10.4 oz with bones).	6.2 oz	176	71	240	42	7	2.2	2.5	1.3	0	16	355	3.0	483	160	.09	.34	15.5	—
213	Chicken, canned, boneless	3 oz	85	65	170	18	10	3.2	3.8	2.0	0	18	210	1.3	117	200	.03	.11	3.7	3
214	Chicken a la king, cooked (home recipe).	1 cup	245	68	470	27	34	2.7	14.3	3.3	12	127	358	2.5	404	1,130	.10	.42	5.4	12
215	Chicken and noodles, cooked (home recipe).	1 cup	240	71	365	22	18	5.9	7.1	3.5	26	26	247	2.2	149	430	.05	.17	4.3	Trace

[18] Outer layer of fat on the cut was removed to within approximately 1/2 in of the lean. Deposits of fat within the cut were not removed.
[19] Crust made with vegetable shortening and enriched flour.
[20] Regular-type margarine used.
[21] Value varies widely.
[22] About one-fourth of the outer layer of fat on the cut was removed. Deposits of fat within the cut were not removed.
[23] Vegetable shortening used.

209

210

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS - Continued

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amount)

Item No	Foods, approximate measures, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
				Water	Food energy	Protein	Fat	Fatty Acids: Saturated (total)	Fatty Acids: Unsaturated: Oleic	Fatty Acids: Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	
		Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams	
	FISH, SHELLFISH, MEAT, POULTRY; RELATED PRODUCTS—Con.																			
	Poultry and poultry products—Continued																			
	Chicken chow mein:																			
216	Canned	1 cup	250	89	95	7	Trace	—	—	—	18	45	35	1.3	416	150	0.05	0.10	1.0	13
217	From home recipe	1 cup	250	78	255	31	10	2.4	3.4	3.1	10	58	293	2.5	473	280	.08	.23	4.3	10
218	Chicken potpie (home recipe), baked, 1/9 piece (1/3 of 9-in diam. pie).	1 piece	232	57	545	23	31	11.3	10.9	5.6	42	70	232	3.0	343	3,090	.34	.31	5.5	5
	Turkey, roasted, flesh without skin:																			
219	Dark meat, piece, 2 1/2 by 1 5/8 by 1/4 in.	4 pieces	85	61	175	26	7	2.1	1.5	1.5	0	—	—	2.0	338	—	.03	.20	3.6	—
220	Light meat, piece, 4 by 2 by 1/4 in.	2 pieces	85	62	150	28	3	.9	.6	.7	0	—	—	1.0	349	—	.04	.12	9.4	—
	Light and dark meat:																			
221	Chopped or diced	1 cup	140	61	265	44	9	2.5	1.7	1.8	0	11	351	2.5	514	—	.07	.25	10.8	—
222	Pieces (1 slice white meat, 4 by 2 by 1/4 in with 2 slices dark meat, 2 1/2 by 1 5/8 by 1/4 in).	3 pieces	85	61	160	27	5	1.5	1.0	1.1	0	7	213	1.5	312	—	.04	.15	6.5	—
	FRUITS AND FRUIT PRODUCTS																			
	Apples, raw, unpeeled, without cores:																			
223	2 3/4-in diam. (about 3 per lb with cores).	1 apple	138	84	80	Trace	1	—	—	—	20	10	14	.4	152	120	.04	.03	.1	6
224	3 1/4 in diam. (about 2 per lb with cores).	1 apple	212	84	125	Trace	1	—	—	—	31	15	21	.6	233	190	.06	.04	.2	8
225	Applejuice, bottled or canned[2]*	1 cup	248	88	120	Trace	Trace	—	—	—	30	15	22	1.5	250	—	.02	.05	.2	[3]2
	Applesauce, canned:																			
226	Sweetened	1 cup	255	76	230	1	Trace	—	—	—	61	10	13	1.3	166	100	.05	.03	.1	[3]3
227	Unsweetened	1 cup	244	89	100	Trace	Trace	—	—	—	26	10	12	1.2	190	100	.05	.02	.1	[3]2
	Apricots:																			
228	Raw, without pits (about 12 per lb with pits).	3 apricots	107	85	55	1	Trace	—	—	—	14	18	25	.5	301	2,890	.03	.04	.6	11
229	Canned in heavy syrup (halves and syrup).	1 cup	258	77	220	2	Trace	—	—	—	57	28	39	.8	604	4,490	.05	.05	1.0	10
	Dried:																			
230	Uncooked (28 large or 37 medium halves per cup).	1 cup	130	25	340	7	1	—	—	—	86	87	140	7.2	1,273	14,170	.01	.21	4.3	16
231	Cooked, unsweetened, fruit and liquid.	1 cup	250	76	215	4	1	—	—	—	54	55	88	4.5	795	7,500	.01	.13	2.5	8
232	Apricot nectar, canned	1 cup	251	85	145	1	Trace	—	—	—	37	23	30	.5	379	2,380	.03	.03	.5	[3][4]36
	Avocados, raw, whole, without skins and seeds:																			
233	California, mid- and late-winter (with skin and seed, 3 1/8-in diam.; wt., 10 oz).	1 avocado	216	74	370	5	37	5.5	22.0	3.7	13	22	91	1.3	1,303	630	.24	.43	3.5	30
234	Florida, late summer and fall (with skin and seed, 3 5/8-in diam.; wt., 1 lb).	1 avocado	304	78	390	4	33	6.7	15 7	5.3	27	30	128	1.8	1,836	880	.33	.61	4.9	43
235	Banana without peel (about 2.6 per lb with peel).	1 banana	119	76	100	1	Trace	—	—	—	26	10	31	.8	440	230	.06	.07	.8	12
236	Banana flakes	1 tbsp	6	3	20	Trace	Trace	—	—	—	5	2	6	.2	92	50	.01	.01	.2	Trace

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
237	Blackberries, raw	1 cup	144	85	85	2	1	—	—	—	19	46	27	1.3	245	290	0.04	0.06	0.6	30
238	Blueberries, raw	1 cup	145	83	90	1	1	—	—	—	22	22	19	1.5	117	150	.04	.09	.7	20
	Cantaloup. See Muskmelons (item 271).																			
	Cherries:																			
239	Sour (tart), red, pitted, canned, water pack.	1 cup	244	88	105	2	Trace	—	—	—	26	37	32	.7	317	1,680	.07	.05	.5	12
240	Sweet, raw, without pits and stems.	10 cherries	68	80	45	1	Trace	—	—	—	12	15	13	.3	129	70	.03	.04	.3	7
241	Cranberry juice cocktail, bottled, sweetened.	1 cup	253	83	165	Trace	Trace	—	—	—	42	13	8	.8	25	Trace	.03	.03	.1	[27]81
242	Cranberry sauce, sweetened, canned, strained.	1 cup	277	62	405	Trace	1	—	—	—	104	17	11	.6	83	60	.03	.03	.1	6
	Dates:																			
243	Whole, without pits	10 dates	80	23	220	2	Trace	—	—	—	58	47	50	2.4	518	40	.07	.08	1.8	0
244	Chopped	1 cup	178	23	490	4	1	—	—	—	130	105	112	5.3	1,153	90	.16	.18	3.9	0
245	Fruit cocktail, canned, in heavy syrup.	1 cup	255	80	195	1	Trace	—	—	—	50	23	31	1.0	411	360	.05	.03	1.0	5
	Grapefruit:																			
	Raw, medium, 3 3/4-in diam. (about 1 lb 1 oz):																			
246	Pink or red	1/2 grapefruit with peel[28]	241	89	50	1	Trace	—	—	—	13	20	20	.5	166	540	.05	.02	.2	44
247	White	1/2 grapefruit with peel[28]	241	89	45	1	Trace	—	—	—	12	19	19	.5	159	10	.05	.02	.2	44
248	Canned, sections with syrup	1 cup	254	81	180	2	Trace	—	—	—	45	33	36	.8	343	30	.08	.05	.5	76
	Grapefruit juice:																			
249	Raw, pink, red, or white	1 cup	246	90	95	1	Trace	—	—	—	23	22	37	.5	399	([29])	.10	.05	.5	93
	Canned, white:																			
250	Unsweetened	1 cup	247	89	100	1	Trace	—	—	—	24	20	35	1.0	400	20	.07	.05	.5	84
251	Sweetened	1 cup	250	86	135	1	Trace	—	—	—	32	20	35	1.0	405	30	.08	.05	.5	78
	Frozen, concentrate, unsweetened:																			
252	Undiluted, 6-fl oz can	1 can	207	62	300	4	1	—	—	—	72	70	124	.8	1,250	60	.29	.12	1.4	286
253	Diluted with 3 parts water by volume.	1 cup	247	89	100	1	Trace	—	—	—	24	25	42	.2	420	20	.10	.04	.5	96
254	Dehydrated crystals, prepared with water (1 lb yields about 1 gal).	1 cup	247	90	100	1	Trace	—	—	—	24	22	40	.2	412	20	.10	.05	.5	91
	Grapes, European type (adherent skin), raw:																			
255	Thompson Seedless	10 grapes	50	81	35	Trace	Trace	—	—	—	9	6	10	.2	87	50	.03	.02	.2	2
256	Tokay and Emperor, seeded types	10 grapes[30]	60	81	40	Trace	Trace	—	—	—	10	7	11	.2	99	60	.03	.02	.2	2
	Grapejuice:																			
257	Canned or bottled	1 cup	253	83	165	1	Trace	—	—	—	42	28	30	.8	293	—	.10	.05	.5	[31]Trace
	Frozen concentrate, sweetened:																			
258	Undiluted, 6-fl oz can	1 can	216	53	395	1	Trace	—	—	—	100	22	32	.9	255	40	.13	.22	1.5	[31]32
259	Diluted with 3 parts water by volume.	1 cup	250	86	135	1	Trace	—	—	—	33	8	10	.3	85	10	.05	.08	.5	[31]10
260	Grape drink, canned	1 cup	250	86	135	Trace	Trace	—	—	—	35	8	10	.3	88	—	[32].03	[32].03	.3	([32])
261	Lemon, raw, size 165, without peel and seeds (about 4 per lb with peels and seeds).	1 lemon	74	90	20	1	Trace	—	—	—	6	19	12	.4	102	10	.03	.01	.1	39
	Lemon juice:																			
262	Raw	1 cup	244	91	60	1	Trace	—	—	—	20	17	24	.5	344	50	.07	.02	.2	112
263	Canned, or bottled, unsweetened	1 cup	244	92	55	1	Trace	—	—	—	19	17	24	.5	344	50	.07	.02	.2	102
264	Frozen, single strength, unsweetened, 6-fl oz can.	1 can	183	92	40	1	Trace	—	—	—	13	13	16	.5	258	40	.06	.02	.2	81
	Lemonade concentrate, frozen:																			
265	Undiluted, 6-fl oz can	1 can	219	49	425	Trace	Trace	—	—	—	112	9	13	.4	153	40	.05	.06	.7	66
266	Diluted with 4 1/3 parts water by volume.	1 cup	248	89	105	Trace	Trace	—	—	—	28	2	3	.1	40	10	.01	.02	.2	17

[28]Crust made with vegetable shortening and enriched flour.
[29]Also applies to pasteurized apple cider.
[31]Applies to product without added ascorbic acid. For value of product with added ascorbic acid, refer to label.
[26]Based on product with label claim of 45% of U.S. RDA in 6 fl oz.
[27]Based on product with label claim of 100% of U.S. RDA in 6 fl oz.
[30]Weight includes pool and membranes between sections. Without these parts, the weight of the edible portion is 123 g for item 246 and 118 g for item 247.
[29]For white-fleshed varieties, value is about 20 International Units (I.U.) per cup; for red-fleshed varieties, 1,080 I.U.
[30]Weight includes seeds. Without seeds, weight of the edible portion is 57 g.
[31]Applies to product without added ascorbic acid. With added ascorbic acid, based on claim that 6 fl oz of reconstituted juice contain 45% or 50% of the U.S. RDA, value in milligrams is 108 or 120 for a 6-fl oz can (item 258), 36 or 40 for 1 cup of diluted juice (item 259).
[32]For products with added thiamin and riboflavin but without added ascorbic acid, values in milligrams would be 0.60 for thiamin, 0.80 for riboflavin, and trace for ascorbic acid. For products with only ascorbic acid added, value varies with the brand. Consult the label.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS - Continued

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amount)

Item No	Foods, approximate measure, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
								Fatty Acids												
								Saturated	Unsaturated											
				Water	Food energy	Protein	Fat	Saturated (total)	Oleic	Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	FRUITS AND FRUIT PRODUCTS—Con.		Grams	Per cent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	Limeade concentrate, frozen:																			
267	Undiluted, 6-fl oz can	1 can	218	50	410	Trace	Trace	—	—	—	108	11	13	0.2	129	Trace	0.02	0.02	0.2	26
268	Diluted with 4 1/3 parts water by volume.	1 cup	247	89	100	Trace	Trace	—	—	—	27	3	3	Trace	32	Trace	Trace	Trace	Trace	6
	Limejuice:																			
269	Raw	1 cup	246	90	65	1	Trace	—	—	—	22	22	27	.5	256	20	.05	.02	.2	79
270	Canned, unsweetened	1 cup	246	90	65	1	Trace	—	—	—	22	22	27	.5	256	20	.05	.02	.2	52
	Muskmelons, raw, with rind, without seed cavity:																			
271	Cantaloup, orange-fleshed (with rind and seed cavity, 5-in diam., 2 1/3 lb).	1/2 melon with rind[3]-	477	91	80	2	Trace	—	—	—	20	38	44	1.1	682	9,240	.11	.08	1.6	90
272	Honeydew (with rind and seed cavity, 6 1/2-in diam., 5 1/4 lb).	1/10 melon with rind[3]-	226	91	50	1	Trace	—	—	—	11	21	24	.6	374	60	.06	.04	.9	34
	Oranges, all commercial varieties, raw:																			
273	Whole, 2 5/8-in diam., without peel and seeds (about 2 1/2 per lb with peel and seeds).	1 orange	131	86	65	1	Trace	—	—	—	16	54	26	.5	263	260	.13	.05	.5	66
274	Sections without membranes	1 cup	180	86	90	2	Trace	—	—	—	22	74	36	.7	360	360	.18	.07	.7	90
	Orange juice:										26									
275	Raw, all varieties	1 cup	248	88	110	2	Trace	—	—	—		27	42	.5	496	500	.22	.07	1.0	124
276	Canned, unsweetened	1 cup	249	87	120	2	Trace	—	—	—	28	25	45	1.0	496	500	.17	.06	.7	100
	Frozen concentrate:																			
277	Undiluted, 6-fl oz can	1 can	213	55	360	5	Trace	—	—	—	87	75	126	.9	1,500	1,620	.68	.11	2.8	360
278	Diluted with 3 parts water by volume.	1 cup	249	87	120	2	Trace	—	—	—	29	25	42	.2	503	540	.23	.03	.9	120
279	Dehydrated crystals, prepared with water (1 lb yields about 1 gal).	1 cup	248	86	115	1	Trace	—	—	—	27	25	40	.5	518	580	.20	.07	1.0	109
	Orange and grapefruit juice:																			
	Frozen concentrate:																			
280	Undiluted, 6-fl oz can	1 can	210	59	330	4	1	—	—	—	78	61	99	.8	1,308	800	.48	.06	2.3	302
281	Diluted with 3 parts water by volume.	1 cup	248	88	110	1	Trace	—	—	—	26	20	32	.2	439	270	15	.02	.7	102
282	Papayas, raw, 1/2-in cubes	1 cup	[illegible]	89	55	1	Trace	—	—	—	14	28	22	.4	328	2,450	.06	.06	.4	78
	Peaches:																			
	Raw:																			
283	Whole, 2 1/2-in diam., pealed, pitted (about 4 per lb with peels and pits).	1 peach	100	89	40	1	Trace	—	—	—	10	9	19	.5	202	[illegible]1,330	.02	.06	1.0	7
284	Sliced	1 cup	170	89	65	1	Trace	—	—	—	16	15	32	.9	343	[illegible]2,260	.03	.09	1.7	12
	Canned, yellow-fleshed, solids and liquid (halves or slices):																			
285	Sirup pack	1 cup	256	79	200	1	Trace	—	—	—	51	10	31	.8	333	1,100	.03	.05	1.5	8
286	Water pack	1 cup	244	91	75	1	Trace	—	—	—	20	10	32	.7	334	1,100	.02	.07	1.5	7
	Dried:																			
287	Uncooked	1 cup	160	25	420	5	1	—	—	—	109	77	187	9.6	1,520	6,240	.02	.30	8.5	29
288	Cooked, unsweetened, halves and juice.	1 cup	250	77	206	3	1	—	—	—	54	38	93	4.8	743	3,060	.01	.15	3.8	5

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	Frozen, sliced, sweetened:																		
289	10-oz container	1 container	284	77	250	1	Trace	—	—	—	64	11	37	1.4	352	1,850	0.03	0.11	2.0	[18]116
290	Cup	1 cup	250	77	220	1	Trace	—	—	—	57	10	33	1.3	310	1,630	.03	.10	1.8	[18]103
	Pears:																			
	Raw, with skin, cored:																			
291	Bartlett, 2 1/2-in diam. (about 2 1/2 per lb with cores and stems).	1 pear	164	83	100	1	1	—	—	—	25	13	18	.5	213	30	.03	.07	.2	7
292	Bosc, 2 1/2-in diam. (about 3 per lb with cores and stems).	1 pear	141	83	85	1	1	—	—	—	22	11	16	.4	83	30	.03	.06	.1	6
293	D'Anjou, 3-in diam. (about 2 per lb with cores and stems).	1 pear	200	83	120	1	1	—	—	—	31	16	22	.6	260	40	.04	.08	.2	8
294	Canned, solids and liquid, syrup pack, heavy (halves or slices).	1 cup	255	80	195	1	1	—	—	—	50	13	18	.5	214	10	.03	.05	.3	3
	Pineapple:																			
295	Raw, diced	1 cup	155	85	80	1	Trace	—	—	—	21	26	12	.8	226	110	.14	.05	.3	26
	Canned, heavy syrup pack, solids and liquid:																			
296	Crushed, chunks, tidbits	1 cup	255	80	190	1	Trace	—	—	—	49	28	13	.8	245	130	.20	.05	.5	18
	Slices and liquid:																			
297	Large	1 slice; 2 1/4 tbsp liquid.	105	80	80	Trace	Trace	—	—	—	20	12	5	.3	101	50	.08	.02	.2	7
298	Medium	1 slice; 1 1/4 tbsp liquid.	58	80	45	Trace	Trace	—	—	—	11	6	3	.2	56	30	.05	.01	.1	4
299	Pineapple juice, unsweetened, canned.	1 cup	250	86	140		Trace	—	—	—	34	38	23	.u	373	130	.13	.05	.5	[17]80
	Plums:																			
	Raw, without pits:																			
300	Japanese and hybrid (2 1/8-in diam., about 6 1/2 per lb with pits).	1 plum	66	87	30	Trace	Trace	—	—	—	8	8	12	.3	112	160	.02	.02	.3	4
301	Prune-type (1 1/2-in diam., about 15 per lb with pits).	1 plum	28	79	20	Trace	Trace	—	—	—	6	3	5	.1	48	80	.01	.01	.1	1
	Canned, heavy syrup pack (Italian prunes), with pits and liquid:																			
302	Cup	1 cup[16]	272	77	215	1	Trace	—	—	—	56	23	26	2.3	367	3,130	.05	.05	1.0	5
303	*Portion	3 plums; 2 3/4 tbsp liquid.[16]	140	77	110	1	Trace	—	—	—	29	12	13	1.2	189	1,610	.03	.03	.5	3
	Prunes, dried, "softenized," with pits:																			
304	Uncooked	4 extra large or 5 large prunes.[16]	49	28	110	1	Trace	—	—	—	29	22	34	1.7	298	690	.04	.07	.7	1
305	Cooked, unsweetened, all sizes, fruit and liquid.	1 cup[16]	250	66	255	2	1	—	—	—	67	51	79	3.8	695	1,590	.07	.15	1.5	2
306	Prune juice, canned or bottled	1 cup	256	80	195	1	Trace	—	—	—	49	36	51	1.8	602	—	.03	.03	1.0	5
	Raisins, seedless:																			
307	Cup, not pressed down	1 cup	145	18	420	4	Trace	—	—	—	112	90	146	5.1	1,106	30	.16	.12	.7	1
308	Packet, 1/2 oz (1 1/2 tbsp)	1 packet	14	18	40	Trace	Trace	—	—	—	11	9	14	.5	107	Trace	.02	.01	.1	Trace
	Raspberries, red:																			
309	Raw, capped, whole	1 cup	123	84	70	1	1	—	—	—	17	27	27	1.1	207	160	.04	.11	1.1	31
310	Frozen, sweetened, 10-oz container	1 container	284	74	220	2	1	—	—	—	70	37	48	1.7	284	200	.06	.17	1.7	60
	Rhubarb, cooked, added sugar:																			
311	From raw	1 cup	270	63	380	1	Trace	—	—	—	97	211	41	1.6	548	220	.05	.14	.8	16
312	From frozen, sweetened	1 cup	270	63	385	1	1	—	—	—	98	211	32	1.9	475	190	.05	.11	.5	16

[17]Based on product with label claim of 100% of U.S. RDA in 6 fl oz.
[16]Weight includes rind. Without rind, the weight of the edible portion is 272 g for item 271 and 149 g for item 272.
[15]Represents yellow-fleshed varieties. For white-fleshed varieties, value is 50 International Units (I.U.) for 1 peach, 90 I.U. for 1 cup of slices.
[18]Value represents products with added ascorbic acid. For products without added ascorbic acid, value in milligrams is 116 for a 10-oz container, 103 for 1 cup.
[16]Weight includes pits. After removal of the pits, the weight of the edible portion is 258 g for item 302, 133 g for item 303, 43 g for item 304, and 213 g for item 305.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS - Continued

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amount)

Item No.	Food, approximate measure, units, and weight (edible part unless footnotes indicate otherwise)		Water	Food energy	Protein	Fat	NUTRIENTS IN INDICATED QUANTITY: Fatty Acids			Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
							Saturated (total)	Unsaturated: Oleic	Unsaturated: Linoleic										
(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
		Grams	Per cent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	FRUITS AND FRUIT PRODUCTS—Con.																		
	Strawberries:																		
313	Raw, whole berries, capped	1 cup	149	90	55	1	1	—	—	—	13	31	31	1.5	244	90	0.04	0.10	0.9	88
	Frozen, sweetened:																		
314	Sliced, 10-oz container	1 container	284	71	310	1	1	—	—	—	79	40	48	2.0	318	90	.06	.17	1.4	151
315	Whole, 1-lb container (about 1 3/4 cups).	1 container	454	76	415	2	1	—	—	—	107	59	73	2.7	472	140	.09	.27	2.3	249
316	Tangerine, raw, 2 3/8-in diam., size 176, without peel (about 4 per lb with peels and seeds).	1 tangerine	86	87	40	1	Trace	—	—	—	10	34	15	.3	108	360	.05	.02	.1	27
317	Tangerine juice, canned, sweetened.	1 cup	249	87	125	1	Trace	—	—	—	30	44	35	.5	440	1,040	.15	.05	.2	54
318	Watermelon, raw, 4 by 8 in wedge with rind and seeds (1/16 of 32 2/3-lb melon, 10 by 16 in).	1 wedge with rind and seeds[37]	926	93	110	2	1	—	—	—	27	30	43	2.1	426	2,510	.13	.13	.9	30
	GRAIN PRODUCTS																		
	Bagel, 3-in diam.:																		
319	Egg	1 bagel	55	32	165	6	2	0.5	0.9	0.8	28	9	43	1.2	41	30	.14	.10	1.2	0
320	Water	1 bagel	55	29	165	6	1	.2	.4	.6	30	8	41	1.2	42	0	.15	.11	1.4	0
321	Barley, pearled, light, uncooked	1 cup	200	11	700	16	2	.3	.2	.8	158	32	378	4.0	320	0	.24	.10	6.2	0
	Biscuits, baking powder, 2-in diam. (enriched flour, vegetable shortening):																		
322	From home recipe	1 biscuit	28	27	105	2	5	1.2	2.0	1.2	13	34	49	.4	33	Trace	.08	.08	.7	Trace
323	From mix	1 biscuit	28	29	90	2	3	.6	1.1	.7	15	19	65	.6	32	Trace	.09	.08	.8	Trace
	Breadcrumbs (enriched):[38]																		
324	Dry, grated	1 cup	100	7	390	13	5	1.0	1.6	1.4	73	122	141	3.6	152	Trace	.35	.35	4.8	Trace
	Soft. See White bread (items 349-350).																		
	Breads:																		
325	Boston brown bread, canned, slice, 3 1/4 by 1/2 in.[39]	1 slice	45	45	95	2	1	.1	.2	.2	21	41	72	.9	131	[39]0	.06	.04	.7	0
	Cracked-wheat bread (3/4 enriched wheat flour, 1/4 cracked wheat):[38]																		
326	Loaf, 1 lb	1 loaf	454	35	1,195	39	10	2.2	3.0	3.9	236	399	581	9.5	608	Trace	1.52	1.13	14.4	Trace
327	Slice (18 per loaf)	1 slice	25	35	65	2	1	.1	.2	.2	13	22	32	.5	34	Trace	.08	.06	.8	Trace
	French or vienna bread, enriched:[38]																		
328	Loaf, 1 lb	1 loaf	454	31	1,315	41	14	3.2	4.7	4.6	251	195	386	10.0	408	Trace	1.80	1.10	15.0	Trace
	Slice:																		
329	French (5 by 2 1/2 by 1 in)	1 slice	35	31	100	3	1	.2	.4	.4	19	15	30	.8	32	Trace	.14	.08	1.2	Trace
330	Vienna (4 3/4 by 4 by 1/2 in).	1 slice	25	31	75	2	1	.2	.3	.3	14	11	21	.6	23	Trace	.10	.06	.8	Trace
	Italian bread, enriched:																		
331	Loaf, 1 lb	1 loaf	454	32	1,250	41	4	.6	.3	1.5	256	77	349	10.0	336	0	1.80	1.10	15.0	0
332	Slice, 4 1/2 by 3 1/4 by 3/4 in.	1 slice	30	32	85	3	Trace	Trace	Trace	.1	17	5	23	.7	22	0	.12	.07	1.0	0
	Raisin bread, enriched:[38]																		
333	Loaf, 1 lb	1 loaf	454	35	1,190	30	13	3.0	4.7	3.9	243	322	385	10.0	1,057	Trace	1.70	1.07	10.7	Trace
334	Slice (18 per loaf)	1 slice	25	35	65	2	1	.2	.3	.2	13	18	22	.6	58	Trace	.09	.06	.6	Trace

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	Rye Bread:																		
	American, light (2/3 enriched wheat flour, 1/3 rye flour):																		
335	Loaf, 1 lb	1 loaf	454	36	1,100	41	5	0.7	0.5	2.2	236	340	667	9.1	658	0	1.35	0.98	12.9	0
336	Slice (4 3/4 by 3 3/4 by 7/16 in)	1 slice	25	36	60	2	Trace	Trace	Trace	.1	13	19	37	.5	36	0	.07	.06	.7	0
	Pumpernickel (2/3 rye flour, 1/3 enriched wheat flour):																		
337	Loaf, 1 lb	1 loaf	454	34	1,115	41	5	.7	.5	2.4	241	381	1,039	11.8	2,059	0	1.30	.93	8.5	0
338	Slice (5 by 4 by 3/8 in)	1 slice	32	34	80	3	Trace	.1	Trace	.2	17	27	73	.8	145	0	.09	.07	.6	0
	White bread, enriched:[39]																		
	Soft-crumb type:																		
339	Loaf, 1 lb	1 loaf	454	36	1,225	39	15	3.4	5.3	4.6	229	381	440	11.3	476	Trace	1.80	1.10	15.0	Trace
340	Slice (18 per loaf)	1 slice	25	36	70	2	1	.2	.3	.3	13	21	24	.6	26	Trace	.10	.06	.8	Trace
341	Slice, toasted	1 slice	22	25	70	2	1	.2	.3	.3	13	21	24	.6	26	Trace	.08	.06	.6	Trace
342	Slice (22 per loaf)	1 slice	20	36	55	2	1	.2	.2	.2	10	17	19	.5	21	Trace	.08	.05	.7	Trace
343	Slice, toasted	1 slice	17	25	55	2	1	.2	.2	.2	10	17	19	.5	21	Trace	.06	.05	.7	Trace
344	Loaf, 1 1/2 lb	1 loaf	680	36	1,835	59	22	5.2	7.9	6.9	343	571	660	17.0	714	Trace	2.70	1.66	22.5	Trace
345	Slice (24 per loaf)	1 slice	28	36	75	2	1	.2	.3	.3	14	24	27	.7	29	Trace	.11	.07	.9	Trace
346	Slice, toasted	1 slice	24	25	75	2	1	.2	.3	.3	14	24	27	.7	29	Trace	.09	.07	.9	Trace
347	Slice (28 per loaf)	1 slice	24	36	65	2	1	.2	.3	.2	12	20	23	.6	25	Trace	.10	.06	.8	Trace
348	Slice, toasted	1 slice	21	25	65	2	1	.2	.3	.2	12	20	23	.6	25	Trace	.08	.06	.8	Trace
349	Cubes	1 cup	30	36	80	3	1	.2	.3	.3	15	25	29	.8	32	Trace	.12	.07	1.0	Trace
350	Crumbs	1 cup	45	36	120	4	1	.3	.5	.5	23	38	44	1.1	47	Trace	.18	.11	1.5	Trace
	Firm-crumb type:																		
351	Loaf, 1 lb	1 loaf	454	35	1,245	41	17	3.9	5.9	5.2	228	435	463	11.3	549	Trace	1.80	1.18	15.0	Trace
352	Slice (20 per loaf)	1 slice	23	35	65	2	1	.2	.3	.3	12	22	23	.6	28	Trace	.09	.06	.8	Trace
353	Slice, toasted	1 slice	20	24	65	2	1	.2	.3	.3	12	22	23	.6	28	Trace	.07	.06	.8	Trace
354	Loaf, 2 lb	1 loaf	907	35	2,495	82	34	7.7	11.8	10.4	455	871	925	22.7	1,097	Trace	3.60	2.20	30.0	Trace
355	Slice (34 per loaf)	1 slice	27	35	75	2	1	.2	.3	.3	14	26	28	.7	33	Trace	.11	.06	.9	Trace
356	Slice, toasted	1 slice	23	24	75	2	1	.2	.3	.3	14	26	28	.7	33	Trace	.09	.06	.9	Trace
	Whole-wheat bread:																		
	Soft-crumb type:[39]																		
357	Loaf, 1 lb	1 loaf	454	36	1,095	41	12	2.2	2.9	4.2	224	381	1,152	13.6	1,161	Trace	1.37	.45	12.7	Trace
358	Slice (16 per loaf)	1 slice	28	36	65	3	1	.1	.2	.2	14	24	71	.8	72	Trace	.09	.03	.8	Trace
359	Slice, toasted	1 slice	24	24	65	3	1	.1	.2	.2	14	24	71	.8	72	Trace	.07	.03	.8	Trace
	Firm-crumb type:[39]																		
360	Loaf, 1 lb	1 loaf	454	36	1,100	48	14	2.5	3.3	4.9	216	449	1,034	13.6	1,238	Trace	1.17	.54	12.7	Trace
361	Slice (18 per loaf)	1 slice	25	36	60	3	1	.1	.2	.3	12	25	57	.8	68	Trace	.06	.03	.7	Trace
362	Slice, toasted	1 slice	21	24	60	3	1	.1	.2	.3	12	25	57	.8	68	Trace	.05	.03	.7	Trace
	Breakfast cereals:																		
	Hot type, cooked:																		
	Corn (hominy) grits, degermed:																		
363	Enriched	1 cup	245	87	125	3	Trace	Trace	Trace	.1	27	2	25	.7	27	[40]Trace	.10	.07	1.0	0
364	Unenriched	1 cup	245	87	125	3	Trace	Trace	Trace	.1	27	2	25	.2	27	[40]Trace	.05	.02	.5	0
365	Farina, quick-cooking, enriched	1 cup	245	89	105	3	Trace	Trace	Trace	.1	22	147	[41]113	([42])	25	0	.12	.07	1.0	0
366	Oatmeal or rolled oats	1 cup	240	87	130	5	2	.4	.8	.9	23	22	137	1.4	146	0	.19	.05	.2	0
367	Wheat, rolled	1 cup	240	88	180	5	1	—	—	—	41	19	182	1.7	202	0	.17	.07	2.2	0
368	Wheat, whole-meal	1 cup	245	88	110	4	1	—	—	—	23	17	127	1.2	118	0	.15	.05	1.5	0
	Ready-to-eat:																		
369	Bran flakes (40% bran), added sugar, salt, iron, vitamins	1 cup	35	3	105	4	1	—	—	—	28	19	125	5.6	137	1,540	.46	.52	6.2	0
370	Bran flakes with raisins, added sugar, salt, iron, vitamins	1 cup	50	7	145	4	1	—	—	—	40	28	146	7.9	154	[43]2,200	([44])	([44])	([44])	0

[39]Weight includes rind and seeds. Without rind and seeds, weight of the edible portion is 426 g.
[40]Made with vegetable shortening.
[41]Applies to product made with white cornmeal. With yellow cornmeal, value is 30 International Units (I.U.).
[42]Applies to white varieties. For yellow varieties, value is 150 International Units (I.U.).
[43]Applies to products that do not contain di-sodium phosphate. If di-sodium phosphate is an ingredient, value is 162 mg.
[44]Value may range from less than 1 mg to about 8 mg depending on the brand. Consult the label.

[45]Applies to product with added nutrient. Without added nutrient, value is trace.

[46]Value varies with the brand. Consult the label.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS – Continued

Blanks (–) denote lack of reliable data for a constituent believed to be present in measurable amount.

Item No.	Foods, approximate measure, units, and weight (edible part unless footnote indicates otherwise)		Water	Food energy	Protein	Fat	Fatty Acids: Saturated (total)	Fatty Acids: Unsaturated: Oleic	Fatty Acids: Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	GRAIN PRODUCTS—Con.	Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	Breakfast cereals—Continued																		
	Ready-to-eat—Continued																		
	Corn flakes:																		
371	Plain, added sugar, salt, iron, vitamins.	1 cup	25	4	95	2	Trace	—	—	—	21	(**)	9	(**)	30	(**)	(**)	(**)	(**)	**13
372	Sugar-coated, added salt, iron, vitamins.	1 cup	40	2	155	2	Trace	—	—	—	37	1	10	(**)	27	1,760	.53	.60	7.1	**21
373	Corn, oat flour, puffed, added sugar, salt, iron, vitamins.	1 cup	20	4	80	2	1	—	—	—	16	4	18	5.7	—	880	.26	.30	3.5	11
374	Corn, shredded, added sugar, salt, iron, thiamin, niacin.	1 cup	25	3	95	2	Trace	—	—	—	22	1	10	.6	—	0	.33	.05	4.4	13
375	Oats, puffed, added sugar, salt, minerals, vitamins.	1 cup	25	3	100	3	1	—	—	—	19	44	102	4.0	—	1,100	.33	.38	4.4	13
	Rice, puffed:																		
376	Plain, added iron, thiamin, niacin.	1 cup	15	4	60	1	Trace	—	—	—	13	3	14	.3	15	0	.07	.01	.7	0
377	Presweetened, added salt, iron, vitamins.	1 cup	28	3	115	1	0	—	—	—	26	3	14	(**)	43	**1,240	(**)	(**)	(**)	**15
378	Wheat flakes, added sugar, salt, iron, vitamins.	1 cup	30	4	105	3	Trace	—	—	—	24	12	83	4.8	81	1,320	.40	.45	5.3	16
	Wheat, puffed:																		
379	Plain, added iron, thiamin, niacin.	1 cup	15	3	55	2	Trace	—	—	—	12	4	48	.6	51	0	.08	.03	1.2	0
380	Presweetened, added salt, iron, vitamins.	1 cup	38	3	140	3	Trace	—	—	—	33	7	52	(**)	63	1,680	.50	.57	6.7	**20
381	Wheat, shredded, plain	1 oblong biscuit or 1/2 cup spoon-size biscuits.	25	7	90	2	1	—	—	—	20	11	97	.9	87	0	.06	.03	1.1	0
382	Wheat germ, without salt and sugar, toasted.	1 tbsp	6	4	25	2	1	—	—	—	3	3	70	.5	57	10	.11	.05	.3	1
383	Buckwheat flour, light, sifted	1 cup	98	12	340	6	1	0.2	0.4	0.4	78	11	86	1.0	314	0	.08	.04	.4	0
384	Bulgur, canned, seasoned	1 cup	136	56	245	8	4	—	—	—	44	27	263	1.9	151	0	.08	.05	4.1	0
	Cake icings. See Sugars and Sweets (items 532-536).																		
	Cakes made from cake mixes with enriched flour:**																		
	Angelfood:																		
385	Whole cake (9 3/4-in diam. tube cake).	1 cake	635	34	1,645	36	1	—	—	—	377	603	756	2.5	381	0	.37	.96	3.6	0
386	Piece, 1/12 of cake	1 piece	53	34	135	3	Trace	—	—	—	32	50	63	.2	32	0	.03	.08	.3	0
	Coffeecake:																		
387	Whole cake (7 3/4 by 6 5/8 by 1 1/4 in).	1 cake	430	30	1,306	27	41	11.7	16.3	8.8	225	262	748	6.9	469	690	.82	.91	7.7	1
388	Piece, 1/6 of cake	1 piece	72	30	230	5	7	2.0	2.7	1.5	38	44	125	1.2	78	120	.14	.15	1.3	Trace
	Cupcakes, made with egg, milk, 2 1/2-in diam.:																		
389	Without icing	1 cupcake	25	26	90	1	3	.8	1.2	.7	14	40	59	.3	21	40	.05	.06	.4	Trace
390	With chocolate icing	1 cupcake	36	22	130	2	5	2.0	1.6	.6	21	47	71	.4	42	60	.06	.06	.4	Trace
	Devil's food with chocolate icing:																		
391	Whole, 2 layer cake (8- or 9-in diam.).	1 cake	1,107	24	3,755	49	136	50.0	44.9	17.0	645	653	1,162	16.6	1,439	1,660	1.06	1.65	10.1	1
392	Piece, 1/16 of cake	1 piece	69	24	235	3	8	3.1	2.8	1.1	40	41	72	1.0	90	100	.07	.10	.6	Trace
393	Cupcake, 2 1/2-in diam.	1 cupcake	36	24	120	2	4	1.6	1.4	.5	20	21	37	.5	46	50	.03	.06	.3	Trace

[A]	[B]		[C]	[D]	[E]	[F]	[G]	[H]	[I]	[J]	[K]	[L]	[M]	[N]	[O]	[P]	[Q]	[R]	[S]
	Gingerbread:																		
394	Whole cake (8-in square)	1 cake	570	37	1,575	18	39	9.7	16.6	10.0	291	513	570	8.6	1,562	Trace	.84	1.00	7.4	Trace
395	Piece, 1/9 of cake	1 piece	63	37	175	2	4	1.1	1.8	1.1	32	57	63	.9	173	Trace	.09	.11	.8	Trace
	White, 2 layer with chocolate icing:																		
396	Whole cake (8- or 9-in diam.)	1 cake	1,140	21	4,000	44	122	48.2	46.4	20.0	716	1,129	2,041	11.4	1,322	680	1.50	1.77	12.5	2
397	Piece, 1/16 of cake	1 piece	71	21	250	3	8	3.0	2.9	1.2	45	70	127	.7	82	40	.09	.11	.8	Trace
	Yellow, 2 layer with chocolate icing:																		
398	Whole cake (8- or 9-in diam.)	1 cake	1,108	26	3,735	45	125	47.8	47.8	20.3	638	1,008	2,017	12.2	1,208	1,550	1.24	1.67	10.6	2
399	Piece, 1/16 of cake	1 piece	69	26	235	3	8	3.0	3.0	1.3	40	63	126	.8	75	100	.08	.10	.7	Trace
	Cakes made from home recipes using enriched flour:[47]																		
	Boston cream pie with custard filling:																		
400	Whole cake (8-in diam.)	1 cake	825	35	2,490	41	78	23.0	30.1	15.2	412	553	833	8.2	[48]734	1,730	1.04	1.27	9.6	2
401	Piece, 1/12 of cake	1 piece	69	35	210	3	6	1.9	2.5	1.3	34	46	70	.7	[48]61	140	.09	.11	.8	Trace
	Fruitcake, dark:																		
402	Loaf, 1-lb (7 1/2 by 2 by 1 1/2 in).	1 loaf	454	18	1,720	22	69	14.4	33.5	14.8	271	327	513	11.8	2,250	540	.72	.73	4.9	2
403	Slice, 1/30 of loaf	1 slice	15	18	55	1	2	.5	1.1	.5	9	11	17	.4	74	20	.02	.02	.2	Trace
	Plain, sheet cake:																		
	Without icing:																		
404	Whole cake (9-in square)	1 cake	777	25	2,830	35	108	29.5	44.4	23.9	434	497	793	8.5	[48]614	1,320	1.21	1.40	10.2	2
405	Piece, 1/9 of cake	1 piece	86	25	315	4	12	3.3	4.9	2.6	48	55	88	.9	[48]68	150	.13	.15	1.1	Trace
	With uncooked white icing:																		
406	Whole cake (9-in square)	1 cake	1,096	21	4,020	37	129	42.2	49.5	24.4	694	548	822	8.2	[48]669	2,190	1.22	1.47	10.2	2
407	Piece, 1/9 of cake	1 piece	121	21	445	4	14	4.7	5.5	2.7	77	61	91	.8	[48]74	240	.14	.16	1.1	Trace
	Pound:[49]																		
408	Loaf, 8 1/2 by 3 1/2 by 3 1/4 in.	1 loaf	565	16	2,725	31	170	42.9	73.1	39.6	273	107	418	7.9	345	1,410	.90	.99	7.3	0
409	Slice, 1/17 of loaf	1 slice	33	16	160	2	10	2.5	4.3	2.3	16	6	24	.5	20	80	.05	.06	.4	0
	Spongecake:																		
410	Whole cake (9 3/4-in diam. tube cake)	1 cake	790	32	2,345	60	45	13.1	15.8	5.7	427	237	885	13.4	687	3,560	1.10	1.64	7.4	Trace
411	Piece, 1/12 of cake	1 piece	66	32	195	5	4	1.1	1.3	.5	36	20	74	1.1	57	300	.09	.14	.6	Trace
	Cookies made with enriched flour:[50] [51]																		
	Brownies with nuts:																		
	Home-prepared, 1 3/4 by 1 3/4 by 7/8 in:																		
412	From home recipe	1 brownie	20	10	95	1	6	1.5	3.0	1.2	10	8	30	.4	38	40	.04	.03	.2	Trace
413	From commercial recipe	1 brownie	20	11	85	1	4	.9	1.4	1.3	13	9	27	.4	34	20	.03	.02	.2	Trace
414	Frozen, with chocolate icing,[52] 1 1/2 by 1 3/4 by 7/8 in.	1 brownie	25	13	105	1	5	2.0	2.2	.7	15	10	31	.4	44	50	.03	.03	.2	Trace
	Chocolate chip:																		
415	Commercial, 2 1/4-in diam., 3/8 in thick.	4 cookies	42	3	200	2	9	2.8	2.9	2.2	29	16	48	1.0	56	50	.10	.17	.9	Trace
416	From home recipe, 2 1/3-in diam.	4 cookies	40	3	205	2	12	3.5	4.5	2.9	24	14	40	.8	47	40	.06	.06	.5	Trace
417	Fig bars, square (1 5/8 by 1 5/8 by 3/8 in) or rectangular (1 1/2 by 1 3/4 by 1/2 in).	4 cookies	56	14	200	2	3	.8	1.2	.7	42	44	34	1.0	111	60	.04	.14	.9	Trace
418	Gingersnaps, 2-in diam., 1/4 in thick.	4 cookies	28	3	90	2	2	.7	1.0	.6	22	20	13	.7	129	20	.08	.06	.7	0
419	Macaroons, 2 3/4-in diam., 1/4 in thick.	2 cookies	38	4	180	2	9	—	—	—	25	10	32	.3	176	0	.02	.06	.2	0
420	Oatmeal with raisins, 2 5/8-in diam., 1/4 in thick.	4 cookies	52	3	235	3	8	2.0	3.3	2.0	38	11	53	1.4	192	30	.15	.10	1.0	Trace

[48] Value varies with the brand. Consult the label.
[49] Applies to product with added nutrient. Without added nutrient, value is trace.
[50] Excepting angelfood cake, cakes were made from mixes containing vegetable shortening; icings, with butter.
[47] Excepting spongecake, vegetable shortening used for cake portion; butter, for icing. If butter or margarine used for cake portion, vitamin A values would be higher.
[48] Applies to product made with a sodium aluminum-sulfate type baking powder. With a low-sodium type baking powder containing potassium, value would be about twice the amount shown.
[51] Equal weights of flour, sugar, eggs, and vegetable shortening.
[52] Products are commercial unless otherwise specified.
[51] Made with enriched flour and vegetable shortening except for macaroons which do not contain flour or shortening.
[52] Icing made with butter.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS · Continued

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amounts)

Item No.	Foods, approximate measure, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
								Fatty Acids												
				Water	Food energy	Protein	Fat	Saturated (total)	Unsaturated: Oleic	Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
			Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	GRAIN PRODUCTS—Con.																			
	Cookies made with enriched flour[15 17]—Continued																			
421	Plain, prepared from commercial chilled dough, 2 1/2-in diam., 1/4 in thick.	4 cookies	48	5	240	2	12	3.0	5.2	2.9	31	17	35	0.6	23	30	0.10	0.08	0.9	0
422	Sandwich type (chocolate or vanilla), 1 3/4-in diam., 3/8 in thick.	4 cookies	40	2	200	2	9	2.2	3.9	2.2	28	10	16	.7	15	0	.06	.10	.7	0
423	Vanilla wafers, 1 3/4-in diam., 1/4 in thick.	10 cookies	40	3	185	2	6	—	—	—	30	16	25	.6	29	50	.10	.09	.8	0
	Cornmeal:																			
424	Whole-ground, unbolted, dry form.	1 cup	122	12	435	11	5	.5	1.0	2.5	90	24	312	2.9	346	[13]620	.46	.13	2.4	0
425	Bolted (nearly whole-grain), dry form.	1 cup	122	12	440	11	4	.5	.9	2.1	91	21	272	2.2	303	[13]590	.37	.10	2.3	0
	Degermed, enriched:																			
426	Dry form	1 cup	138	12	500	11	2	.2	.4	.9	108	8	137	4.0	166	[13]610	.61	.36	4.8	0
427	Cooked	1 cup	240	88	120	3	Trace	Trace	.1	.2	26	2	34	1.0	38	[13]140	.14	.10	1.2	0
	Degermed, unenriched:																			
428	Dry form	1 cup	138	12	500	11	2	.2	.4	.9	108	8	137	1.5	166	[13]610	.19	.07	1.4	0
429	Cooked	1 cup	240	88	120	3	Trace	Trace	.1	.2	26	2	34	.5	38	[13]140	.05	.02	.2	0
	Crackers:[18]																			
430	Graham, plain, 2 1/2-in square	2 crackers	14	6	55	1	1	.3	.5	.3	10	6	21	.5	55	0	.02	.08	.5	0
431	Rye wafers, whole-grain, 1 7/8 by 3 1/2 in.	2 wafers	13	6	45	2	Trace	—	—	—	10	7	50	.5	78	0	.04	.03	.2	0
432	Saltines, made with enriched flour.	4 crackers or 1 packet	11	4	50	1	1	.3	.5	.4	8	2	10	.5	13	0	.05	.05	.4	0
	Danish pastry (enriched flour), plain without fruit or nuts:[19]																			
433	Packaged ring, 12 oz	1 ring	340	22	1,435	25	80	24.3	31.7	16.5	155	170	371	6.1	381	1,050	.97	1.01	8.6	Trace
434	Round piece, about 4 1/4-in diam. by 1 in.	1 pastry	65	22	275	5	15	4.7	6.1	3.2	30	33	71	1.2	73	200	.18	.19	1.7	Trace
435	Ounce	1 oz	28	22	120	2	7	2.0	2.7	1.4	13	14	31	.5	32	90	.08	.08	.7	Trace
	Doughnuts, made with enriched flour:[18]																			
436	Cake type, plain, 2 1/2-in diam., 1 in high.	1 doughnut	25	24	100	1	5	1.2	2.0	1.1	13	10	48	.4	23	20	.05	.05	.4	Trace
437	Yeast-leavened, glazed, 3 3/4-in diam., 1 1/4 in high.	1 doughnut	50	26	205	3	11	3.3	5.8	3.3	22	16	33	.6	34	25	.10	.10	.8	0
	Macaroni, enriched, cooked (cut lengths, elbows, shells):																			
438	Firm stage (hot)	1 cup	130	64	190	7	1	—	—	—	39	14	85	1.4	103	0	.23	.13	1.8	0
	Tender stage:																			
439	Cold macaroni	1 cup	105	73	115	4	Trace	—	—	—	24	8	53	.9	64	0	.15	.08	1.2	0
440	Hot macaroni	1 cup	140	73	155	5	1	—	—	—	32	11	70	1.3	85	0	.20	.11	1.5	0
	Macaroni (enriched) and cheese:																			
441	Canned[20]	1 cup	240	80	230	9	10	4.2	3.1	1.4	26	199	182	1.0	139	260	.12	.24	1.0	Trace
442	From home recipe (served hot)[16]	1 cup	200	58	430	17	22	8.9	8.8	2.9	40	362	322	1.8	240	860	.20	.40	1.8	Trace
	Muffins made with enriched flour:[18]																			
	From home recipe:																			
443	Blueberry, 2 3/8-in diam., 1 1/2 in high.	1 muffin	40	39	110	3	4	1.1	1.4	.7	17	34	53	.6	46	90	.09	.10	.7	Trace
444	Bran	1 muffin	40	35	105	3	4	1.2	1.4	.8	17	57	162	1.5	172	90	.07	.10	1.7	Trace
445	Corn (enriched degermed cornmeal and flour), 2 3/8-in diam., 1 1/2 in high.	1 muffin	40	33	125	3	4	1.2	1.6	.9	19	42	68	.7	54	[17]120	.10	.10	.7	Trace

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
446	Plain, 3-in diam., 1 1/2 in high.	1 muffin	40	38	120	3	4	1.0	1.7	1.0	17	42	60	0.6	50	40	0.09	0.12	0.9	Trace
	From mix, egg, milk:																			
447	Corn, 2 3/8-in diam., 1 1/2 in high.[56]	1 muffin	40	30	130	3	4	1.2	1.7	.9	20	96	152	.6	44	[57]100	.08	.09	.7	Trace
448	Noodles (egg noodles), enriched, cooked.	1 cup	160	71	200	7	2	—	—	—	37	16	94	1.4	70	110	.22	.13	1.9	0
449	Noodles, chow mein, canned	1 cup	45	1	220	6	11	—	—	—	26	—	—	—	—	—	—	—	—	—
	Pancakes, (4-in diam.):[58]																			
450	Buckwheat, made from mix (with buckwheat and enriched flours), egg and milk added.	1 cake	27	58	55	2	2	.8	.9	.4	6	59	91	.4	66	60	.04	.05	.2	Trace
	Plain:																			
451	Made from home recipe using enriched flour.	1 cake	27	50	60	2	2	.5	.8	.5	9	27	38	.4	33	30	.06	.07	.5	Trace
452	Made from mix with enriched flour, egg and milk added.	1 cake	27	51	60	2	2	.7	.7	.3	9	58	70	.3	42	70	.04	.06	.2	Trace
	Pies, piecrust made with enriched flour, vegetable shortening (9-in diam.):																			
	Apple:																			
453	Whole	1 pie	945	48	2,420	21	105	27.0	44.5	25.2	360	76	208	6.6	756	280	1.06	.79	9.3	9
454	Sector, 1/7 of pie	1 sector	135	48	345	3	15	3.9	6.4	3.6	51	11	30	.9	108	40	.15	.11	1.3	2
	Banana cream:																			
455	Whole	1 pie	910	54	2,010	41	85	26.7	33.2	16.2	279	601	746	7.3	1,847	2,280	.77	1.51	7.0	9
456	Sector, 1/7 of pie	1 sector	130	54	285	6	12	3.8	4.7	2.3	40	86	107	1.0	264	330	.11	.22	1.0	1
	Blueberry:																			
457	Whole	1 pie	945	51	2,285	23	102	24.8	43.7	25.1	330	104	217	9.5	614	280	1.03	.80	10.0	28
458	Sector, 1/7 of pie	1 sector	135	51	325	3	15	3.5	6.2	3.6	47	15	31	1.4	88	40	.15	.11	1.4	4
	Cherry:																			
459	Whole	1 pie	945	47	2,465	25	107	28.2	45.0	25.3	363	132	236	6.6	992	4,160	1.09	.84	9.8	Trace
460	Sector, 1/7 of pie	1 sector	135	47	350	4	15	4.0	6.4	3.6	52	19	34	.9	142	590	.16	.12	1.4	Trace
	Custard:																			
461	Whole	1 pie	910	58	1,985	56	101	33.9	38.5	17.5	213	874	1,028	8.2	1,247	2,090	.79	1.92	5.6	0
462	Sector, 1/7 of pie	1 sector	130	58	285	8	14	4.8	5.5	2.5	30	125	147	1.2	178	300	.11	.27	.8	0
	Lemon meringue:																			
463	Whole	1 pie	840	47	2,140	37	86	26.1	33.8	16.4	317	118	412	6.7	420	1,430	.61	.84	5.2	25
464	Sector, 1/7 of pie	1 sector	120	47	305	4	12	3.7	4.8	2.3	45	17	59	1.0	60	200	.09	.12	.7	4
	Mince:																			
465	Whole	1 pie	945	43	2,560	24	109	28.0	45.9	25.2	389	261	359	13.3	1,682	20	.96	.86	9.8	9
466	Sector, 1/7 of pie	1 sector	135	43	365	3	16	4.0	6.6	3.6	56	38	51	1.9	240	Trace	.14	.12	1.4	1
	Peach:																			
467	Whole	1 pie	945	48	2,410	24	101	24.8	43.7	25.1	361	95	274	8.5	1,408	6,900	1.04	.97	14.0	28
468	Sector, 1/7 of pie	1 sector	135	48	345	3	14	3.5	6.2	3.6	52	14	39	1.2	201	990	.15	.14	2.0	4
	Pecan:																			
469	Whole	1 pie	825	20	3,450	42	189	27.8	101.0	44.2	423	388	850	25.6	1,015	1,320	1.80	.95	6.9	Trace
470	Sector, 1/7 of pie	1 sector	118	20	495	6	27	4.0	14.4	6.3	61	55	122	3.7	145	190	.26	.14	1.0	Trace
	Pumpkin:																			
471	Whole	1 pie	910	59	1,920	36	102	37.4	37.5	16.6	223	464	628	7.3	1,456	22,480	.78	1.27	7.0	Trace
472	Sector, 1/7 of pie	1 sector	130	59	275	5	15	5.4	5.4	2.4	32	66	90	1.0	208	3,210	.11	.18	1.0	Trace
473	Piecrust (home recipe) made with enriched flour and vegetable shortening, baked.	1 pie shell, 9-in diam.	180	15	908	11	60	14.8	26.1	14.9	79	25	90	3.1	89	0	.47	.40	5.0	0
474	Piecrust mix with enriched flour and vegetable shortening, 10-oz pkg. prepared and baked.	Piecrust for 2-crust pie, 9-in diam.	320	19	1,485	20	93	22.7	39.7	23.4	161	131	272	6.1	179	0	1.0	.79	9.9	0

[56]Made with vegetable shortening.
[57]Products are commercial unless otherwise specified.
[58]Made with enriched flour and vegetable shortening except for macaroons which do not contain flour or shortening.
[59]Applies to yellow varieties; white varieties contain only a trace.
[60]Contains vegetable shortening and butter.
[61]Made with corn oil.
[62]Made with regular margarine.
[63]Applies to product made with yellow cornmeal.
[64]Made with enriched degermed cornmeal and enriched flour.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS - Continued

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amount)

Item No.	Foods, approximate measure, units, and weight (edible part unless footnotes indicate otherwise)		NUTRIENTS IN INDICATED QUANTITY																
							Fatty Acids												
			Water	Food energy	Protein	Fat	Saturated (total)	Unsaturated: Oleic	Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
		Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	GRAIN PRODUCTS—Con.																		
475	Pizza (cheese) baked, 4 3/4-in sector; 1/8 of 12-in diam. pie.[19]	1 sector	60	45	145	6	4	1.7	1.5	0.6	22	86	89	1.1	67	230	0.16	0.18	1.6	4
	Popcorn, popped:																		
476	Plain, large kernel	1 cup	6	4	25	1	Trace	Trace	.1	.2	5	1	17	.2	—	—	—	.01	.1	0
477	With oil (coconut) and salt added, large kernel.	1 cup	9	3	40	1	2	1.5	.2	.2	5	1	19	.2	—	—	—	.01	.2	0
478	Sugar coated	1 cup	35	4	135	2	1	.5	.2	.4	30	2	47	.5	—	—	—	.02	.4	0
	Pretzels, made with enriched flour:																		
479	Dutch, twisted, 2 3/4 by 2 5/8 in.	1 pretzel	16	5	60	2	1	—	—	—	12	4	21	.2	21	0	.05	.04	.7	0
480	Thin, twisted, 3 1/4 by 2 1/4 by 1/4 in.	10 pretzels	60	5	235	6	3	—	—	—	46	13	79	.9	78	0	.20	.15	2.5	0
481	Stick, 2 1/4 in long	10 pretzels	3	5	10	Trace	Trace	—	—	—	2	1	4	Trace	4	0	.01	.01	.1	0
	Rice, white, enriched:																		
482	Instant, ready-to-serve, hot	1 cup	165	73	180	4	Trace	Trace	Trace	Trace	40	5	31	1.3	—	0	.21	(**)	1.7	0
	Long grain:																		
483	Raw	1 cup	185	12	670	12	1	.2	.2	.2	149	44	174	5.4	170	0	.81	.06	6.5	0
484	Cooked, served hot	1 cup	205	73	225	4	Trace	.1	.1	.1	50	21	57	1.8	57	0	.23	.02	2.1	0
	Parboiled:																		
485	Raw	1 cup	185	10	685	14	1	.2	.1	.2	150	111	370	5.4	278	0	.81	.07	6.5	0
486	Cooked, served hot	1 cup	175	73	186	4	Trace	.1	.1	.1	41	33	100	1.4	75	0	.19	.02	2.1	0
	Rolls, enriched:[20]																		
	Commercial:																		
487	Brown-and-serve (12 per 12-oz pkg.), browned.	1 roll	26	27	85	2	2	.4	.7	.5	14	20	23	.5	25	Trace	.10	.06	.9	Trace
488	Cloverleaf or pan, 2 1/2-in diam., 2 in high.	1 roll	28	31	85	2	2	.4	.6	.4	15	21	24	.5	27	Trace	.11	.07	.9	Trace
489	Frankfurter and hamburger (8 per 11 1/2-oz pkg.).	1 roll	40	31	120	3	2	.5	.8	.6	21	30	34	.8	38	Trace	.16	.10	1.3	Trace
490	Hard, 3 3/4-in diam., 2 in high.	1 roll	50	25	155	5	2	.4	.6	.5	30	24	46	1.2	49	Trace	.20	.12	1.7	Trace
491	Hoagie or submarine, 11 1/2 by 3 by 2 1/2 in.	1 roll	135	31	390	12	4	.9	1.4	1.4	75	58	115	3.0	122	Trace	.54	.32	4.5	Trace
	From home recipe:																		
492	Cloverleaf, 2 1/2-in diam., 2 in high.	1 roll	35	26	120	3	3	.8	1.1	.7	20	16	36	.7	41	30	.12	.12	1.2	Trace
	Spaghetti, enriched, cooked:																		
493	Firm stage, "al dente," served hot.	1 cup	130	64	190	7	1	—	—	—	39	14	55	1.4	103	0	.23	.13	1.8	0
494	Tender stage, served hot	1 cup	140	73	155	5	1	—	—	—	32	11	70	1.3	85	0	.20	.11	1.5	0
	Spaghetti (enriched) in tomato sauce with cheese:																		
495	From home recipe	1 cup	250	77	260	9	9	2.0	5.4	.7	37	80	135	2.3	408	1,080	.25	.18	2.3	13
496	Canned	1 cup	250	80	190	6	2	.5	.3	.4	39	40	88	2.8	303	930	.35	.28	4.5	10
	Spaghetti (enriched) with meat balls and tomato sauce:																		
497	From home recipe	1 cup	248	70	330	19	12	3.3	6.3	.9	39	124	236	3.7	665	1,590	.25	.30	4.0	22
498	Canned	1 cup	250	78	260	12	10	2.2	3.3	3.9	29	53	113	3.3	245	1,000	.15	.18	2.3	5
499	Toaster pastries	1 pastry	50	12	200	3	6	—	—	—	36	**54	**67	1.9	**74	500	.16	.17	2.1	(**)
	Waffles, made with enriched flour, 7-in diam.:[20]																		
500	From home recipe	1 waffle	75	41	210	7	7	2.3	2.8	1.4	28	85	130	1.3	109	250	.17	.23	1.4	Trace
501	From mix, egg and milk added	1 waffle	75	42	205	7	8	2.8	2.9	1.2	27	179	257	1.0	146	170	.14	.22	.9	Trace

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	Wheat flours:																		
	All-purpose or family flour, enriched:																		
502	Sifted, spooned	1 cup	115	12	420	12	1	0.2	0.1	0.5	88	18	100	3.3	109	0	0.74	0.46	6.1	0
503	Unsifted, spooned	1 cup	125	12	455	13	1	.2	.1	.5	95	20	109	3.6	119	0	.80	.50	6.6	0
504	Cake or pastry flour, enriched, sifted, spooned.	1 cup	96	12	350	7	1	.1	.1	.3	76	16	70	2.8	91	0	.61	.38	5.1	0
505	Self-rising, enriched, unsifted, spooned.	1 cup	125	12	440	12	1	.2	.1	.5	93	331	583	3.6	—	0	.80	.50	6.6	0
506	Whole-wheat, from hard wheats, stirred.	1 cup	120	12	400	16	2	.4	.2	1.0	85	49	446	4.0	444	0	.66	.14	5.2	0
	LEGUMES (DRY), NUTS, SEEDS; RELATED PRODUCTS																		
	Almonds, shelled:																		
507	Chopped (about 130 almonds)	1 cup	130	5	775	24	70	5.6	47.7	12.8	25	304	655	6.1	1,005	0	.31	1.20	4.6	Trace
508	Slivered, not pressed down (about 115 almonds).	1 cup	115	5	690	21	62	5.0	42.2	11.3	22	269	580	5.4	889	0	.28	1.06	4.0	Trace
	Beans, dry:																		
	Common varieties as Great Northern, navy, and others:																		
	Cooked, drained:																		
509	Great Northern	1 cup	180	69	210	14	1	—	—	—	38	90	266	4.9	749	0	.25	.13	1.3	0
510	Pea (navy)	1 cup	190	69	225	15	1	—	—	—	40	95	281	5.1	790	0	.27	.13	1.3	0
	Canned, solids and liquid:																		
	White with—																		
511	Frankfurters (sliced)	1 cup	255	71	365	19	19	—	—	—	32	94	303	4.8	668	330	.18	.15	3.3	Trace
512	Pork and tomato sauce	1 cup	255	71	310	16	7	2.4	2.8	.6	48	138	235	4.6	536	330	.20	.08	1.5	5
513	Pork and sweet sauce	1 cup	255	66	385	16	12	4.3	5.0	1.1	54	161	291	5.9	—	—	.15	.10	1.3	—
514	Red kidney	1 cup	255	76	230	15	1	—	—	—	42	74	278	4.6	673	10	.13	.10	1.5	—
515	Lima, cooked, drained	1 cup	190	64	260	16	1	—	—	—	49	55	293	5.9	1,163	—	.25	.11	1.3	—
516	Blackeye peas, dry, cooked (with residual cooking liquid).	1 cup	250	80	190	13	1	—	—	—	35	43	238	3.3	573	30	.40	.10	1.0	—
517	Brazil nuts, shelled (6-8 large kernels).	1 oz	28	5	185	4	19	4.9	6.2	7.1	3	53	196	1.0	203	Trace	.27	.03	.5	—
518	Cashew nuts, roasted in oil	1 cup	140	5	785	24	64	12.9	35.8	10.2	41	53	522	5.3	650	140	.60	.35	2.5	—
	Coconut meat, fresh:																		
519	Piece, about 2 by 2 by 1/2 in.	1 piece	45	51	155	2	16	14.0	.9	.3	4	6	43	.8	115	0	.02	.01	.2	1
520	Shredded or grated, not pressed down.	1 cup	80	51	275	3	28	24.8	1.6	.5	8	10	76	1.4	205	0	.04	.02	.4	2
521	Filberts (hazelnuts), chopped (about 80 kernels).	1 cup	115	6	730	14	72	5.1	55.2	7.3	19	240	388	3.9	810	—	.53	—	1.0	Trace
522	Lentils, whole, cooked	1 cup	200	72	210	16	Trace	—	—	—	39	50	238	4.2	498	40	.14	.12	1.2	0
523	Peanuts, roasted in oil, salted (whole, halves, chopped).	1 cup	144	2	840	37	72	13.7	33.0	20.7	27	107	577	3.0	971	—	.46	.19	24.8	0
524	Peanut butter	1 tbsp	16	2	95	4	8	1.5	3.7	2.3	3	9	61	.3	100	—	.02	.02	2.4	0
525	Peas, split, dry, cooked	1 cup	200	70	230	16	1	—	—	—	42	22	178	3.4	592	80	.30	.18	1.8	—
526	Pecans, chopped or pieces (about 120 large halves).	1 cup	118	3	810	11	84	7.2	50.5	20.0	17	86	341	2.8	712	150	1.01	.15	1.1	2
527	Pumpkin and squash kernels, dry, hulled.	1 cup	140	4	775	41	65	11.8	23.5	27.5	21	71	1,602	15.7	1,386	100	.34	.27	3.4	—
528	Sunflower seeds, dry, hulled	1 cup	145	5	810	35	69	8.2	13.7	43.2	29	174	1,214	10.3	1,338	70	2.84	.33	7.8	—
	Walnuts:																		
	Black:																		
529	Chopped or broken kernels	1 cup	125	3	785	26	74	6.3	13.3	45.7	19	Trace	713	7.5	575	380	.28	.14	.9	—
530	Ground (finely)	1 cup	80	3	500	16	47	4.0	8.5	29.2	12	Trace	456	4.8	368	240	.18	.09	.6	—
531	Persian or English, chopped (about 60 halves).	1 cup	120	4	780	18	77	8.4	11.8	42.2	19	119	456	3.7	540	40	.40	.16	1.1	2

[1]Crust made with vegetable shortening and enriched flour.
[2]Made with vegetable shortening.
[3]Product may or may not be enriched with riboflavin. Consult the label.
[4]Value varies with the brand. Consult the label.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS - Continued

Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amount.

Item No.	Foods, approximate measures, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
								Fatty Acids												
				Water	Food energy	Protein	Fat	Saturated (total)	Unsaturated: Oleic	Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
			Grams	Per cent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	SUGARS AND SWEETS																			
	Cake icings:																			
	Boiled, white:																			
532	Plain	1 cup	94	18	295	1	0	0	0	0	75	2	2	Trace	17	0	Trace	0.03	Trace	0
533	With coconut	1 cup	166	15	605	3	13	11.0	.9	Trace	124	10	50	0.8	277	0	0.02	.07	0.3	0
	Uncooked:																			
534	Chocolate made with milk and butter.	1 cup	275	14	1,036	9	38	23.4	11.7	1.0	185	165	306	3.3	536	580	.06	.28	.6	1
535	Creamy fudge from mix and water.	1 cup	245	15	830	7	16	5.1	6.7	3.1	183	96	218	2.7	238	Trace	.05	.20	.7	Trace
536	White	1 cup	319	11	1,200	2	21	12.7	5.1	.5	260	48	38	Trace	57	860	Trace	.06	Trace	Trace
	Candy:																			
537	Caramels, plain or chocolate	1 oz	28	8	115	1	3	1.6	1.1	.1	22	42	35	.4	54	Trace	.01	.05	.1	Trace
	Chocolate:																			
538	Milk, plain	1 oz	28	1	145	2	9	5.5	3.0	.3	16	65	65	.3	109	80	.02	.10	.1	Trace
539	Semisweet, small pieces (60 per oz).	1 cup or 6-oz pkg	170	1	860	7	61	36.2	19.8	1.7	97	51	255	4.4	553	30	.02	.14	.9	0
540	Chocolate-coated peanuts	1 oz	28	1	160	5	12	4.0	4.7	2.1	11	33	84	.4	143	Trace	.10	.05	2.1	Trace
541	Fondant, uncoated (mints, candy corn, other).	1 oz	28	8	105	Trace	1	.1	.3	.1	25	4	2	.3	1	0	Trace	Trace	Trace	0
542	Fudge, chocolate, plain	1 oz	28	8	115	1	3	1.1	1.4	.6	21	22	24	.3	42	Trace	.01	.03	.1	Trace
543	Gum drops	1 oz	28	12	100	Trace	Trace	—	—	—	25	2	Trace	.1	1	0	0	Trace	Trace	0
544	Hard	1 oz	28	1	110	0	Trace	—	—	—	28	6	2	.5	1	0	0	0	0	0
545	Marshmallows	1 oz	28	17	90	1	Trace	—	—	—	23	5	2	.5	2	0	0	Trace	Trace	0
	Chocolate-flavored beverage powders (about 4 heaping tsp per oz):																			
546	With nonfat dry milk	1 oz	28	2	100	5	1	.5	.3	Trace	20	167	155	.5	227	10	.04	.21	.2	1
547	Without milk	1 oz	28	1	100	1	1	.4	.2	Trace	25	9	48	.6	142	—	.01	.03	.1	0
548	Honey, strained or extracted	1 tbsp	21	17	65	Trace	0	0	0	0	17	1	1	.1	11	0	Trace	.01	.1	Trace
549	Jams and preserves	1 tbsp	20	29	55	Trace	Trace	—	—	—	14	4	2	.2	18	Trace	Trace	.01	Trace	Trace
550		1 packet	14	29	40	Trace	Trace	—	—	—	10	3	1	.1	12	Trace	Trace	Trace	Trace	Trace
551	Jellies	1 tbsp	18	29	50	Trace	Trace	—	—	—	13	4	1	.3	14	Trace	Trace	.01	Trace	1
552		1 packet	14	29	40	Trace	Trace	—	—	—	10	3	1	.2	11	Trace	Trace	Trace	Trace	1
	Syrups:																			
	Chocolate-flavored sirup or topping:																			
553	Thin type	1 fl oz or 2 tbsp	38	32	90	1	1	.5	.3	Trace	24	6	35	.6	106	Trace	.01	.03	.2	0
554	Fudge type	1 fl oz or 2 tbsp	38	25	125	2	5	3.1	1.6	.1	20	48	60	.5	107	50	.02	.08	.2	Trace
	Molasses, cane:																			
555	Light (first extraction)	1 tbsp	20	24	50	—	—	—	—	—	13	33	9	.9	183	—	.01	.01	Trace	—
556	Blackstrap (third extraction)	1 tbsp	20	24	45	—	—	—	—	—	11	137	17	3.2	585	—	.02	.04	.4	—
557	Sorghum	1 tbsp	21	23	55	—	—	—	—	—	14	35	5	2.6	—	—	—	.02	Trace	—
558	Table blends, chiefly corn, light and dark.	1 tbsp	21	24	60	0	0	0	0	0	15	9	3	.8	1	0	0	0	0	0
	Sugars:																			
559	Brown, pressed down	1 cup	220	2	820	0	0	0	0	0	212	187	42	7.5	757	0	.02	.07	.4	0
	White:																			
560	Granulated	1 cup	200	1	770	0	0	0	0	0	199	0	0	.2	6	0	0	0	0	0
561		1 tbsp	12	1	45	0	0	0	0	0	12	0	0	Trace	Trace	0	0	0	0	0
562		1 packet	6	1	23	0	0	0	0	0	6	0	0	Trace	Trace	0	0	0	0	0
563	Powdered, sifted, spooned into cup.	1 cup	100	1	386	0	0	0	0	0	100	0	0	.1	3	0	0	0	0	0

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	VEGETABLE AND VEGETABLE PRODUCTS																		
	Asparagus, green:																		
	Cooked, drained:																		
	Cuts and tips, 1 1/2- to 2-in lengths:																		
564	From raw	1 cup	145	94	30	3	Trace	—	—	—	5	30	73	0.9	265	1,310	0.23	0.26	2.0	38
565	From frozen	1 cup	180	93	40	6	Trace	—	—	—	6	40	115	2.2	396	1,530	.25	.23	1.8	41
	Spears, 1/2-in diam. at base:																		
566	From raw	4 spears	60	94	10	1	Trace	—	—	—	2	13	30	.4	110	540	.10	.11	.8	16
567	From frozen	4 spears	60	92	15	2	Trace	—	—	—	2	13	40	.7	143	470	.10	.08	.7	16
568	Canned, spears, 1/2-in diam. at base.	4 spears	80	93	15	2	Trace	—	—	—	3	15	42	1.5	133	640	.05	.08	.6	12
	Beans:																		
	Lima, immature seeds, frozen, cooked, drained:																		
569	Thick-seeded types (Fordhooks)	1 cup	170	74	170	10	Trace	—	—	—	32	34	153	2.9	724	390	.12	.09	1.7	29
570	Thin-seeded types (baby limas)	1 cup	180	68	210	13	Trace	—	—	—	40	63	227	4.7	709	400	.16	.09	2.2	22
	Snap:																		
	Green:																		
	Cooked, drained:																		
571	From raw (cuts and French style).	1 cup	125	92	30	2	Trace	—	—	—	7	63	46	.8	189	680	.09	.11	.6	15
	From frozen:																		
572	Cuts	1 cup	135	92	35	2	Trace	—	—	—	8	54	43	.9	205	780	.09	.12	.5	7
573	French style	1 cup	130	92	35	2	Trace	—	—	—	8	49	39	1.2	177	690	.08	.10	.4	9
574	Canned, drained solids (cuts).	1 cup	135	92	30	2	Trace	—	—	—	7	61	34	2.0	128	630	.04	.07	.4	5
	Yellow or wax:																		
	Cooked, drained:																		
575	From raw (cuts and French style).	1 cup	125	93	30	2	Trace	—	—	—	6	63	46	.8	189	290	.09	.11	.6	16
576	From frozen (cuts)	1 cup	135	92	35	2	Trace	—	—	—	8	47	42	.9	221	140	.09	.11	.5	8
577	Canned, drained solids (cuts).	1 cup	135	92	30	2	Trace	—	—	—	7	61	34	2.0	128	140	.04	.07	.4	7
	Beans, mature. See Beans, dry (items 509-515) and Blackeye peas, dry (item 516).																		
	Bean sprouts (mung):																		
578	Raw	1 cup	105	89	35	4	Trace	—	—	—	7	20	67	1.4	234	20	.14	.14	.8	20
579	Cooked, drained	1 cup	125	91	35	4	Trace	—	—	—	7	21	60	1.1	195	30	.11	.13	.9	8
	Beets:																		
	Cooked, drained, peeled:																		
580	Whole beets, 2-in diam.	2 beets	100	91	30	1	Trace	—	—	—	7	14	23	.5	208	20	.03	.04	.3	6
581	Diced or sliced	1 cup	170	91	55	2	Trace	—	—	—	12	24	39	.9	354	30	.05	.07	.5	10
	Canned, drained solids:																		
582	Whole beets, small	1 cup	160	89	60	2	Trace	—	—	—	14	30	29	1.1	267	30	.02	.06	.2	5
583	Diced or sliced	1 cup	170	89	65	2	Trace	—	—	—	15	32	31	1.2	284	30	.02	.05	.2	5
584	Beet greens, leaves and stems, cooked, drained.	1 cup	145	94	25	2	Trace	—	—	—	5	144	36	2.8	481	7,400	.10	.22	.4	22
	Blackeye peas, immature seeds, cooked and drained:																		
585	From raw	1 cup	165	72	180	13	1	—	—	—	30	40	241	3.5	625	580	.50	.18	2.3	28
586	From frozen	1 cup	170	66	220	15	1	—	—	—	40	43	286	4.8	573	290	.68	.19	2.4	15
	Broccoli, cooked, drained:																		
	From raw:																		
587	Stalk, medium size	1 stalk	180	91	45	6	1	—	—	—	8	158	112	1.4	481	4,500	.16	.36	1.4	162
588	Stalks cut into 1/2-in pieces	1 cup	155	91	40	5	Trace	—	—	—	7	136	96	1.2	414	3,880	.14	.31	1.2	140
	From frozen:																		
589	Stalk, 4 1/2 to 5 in long	1 stalk	30	91	10	1	Trace	—	—	—	1	12	17	.2	66	570	.02	.03	.2	22
590	Chopped	1 cup	185	92	50	5	1	—	—	—	9	100	104	1.3	392	4,810	.11	.22	.9	106
	Brussels sprouts, cooked, drained:																		
591	From raw, 7-8 sprouts (1 1/4- to 1 1/2-in diam.).	1 cup	155	88	55	7	1	—	—	—	10	50	112	1.7	423	810	.12	.22	1.2	135
592	From frozen	1 cup	155	89	50	5	Trace	—	—	—	10	33	95	1.2	457	880	.12	.16	.9	126

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS – Continued

Blanks (—) denote lack of reliable data for a constituent believed to be present in measurable amount.

Item No.	Foods, approximate measure, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
								Fatty Acids												
								Saturated (total)	Unsaturated: Oleic	Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	
		Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams	
	VEGETABLE AND VEGETABLE PRODUCTS—Con.																			
	Cabbage:																			
	Common varieties:																			
	Raw:																			
593	Coarsely shredded or sliced	1 cup	70	92	15	1	Trace	—	—	—	4	34	20	0.3	163	90	0.04	0.04	0.2	33
594	Finely shredded or chopped	1 cup	90	92	20	1	Trace	—	—	—	5	44	26	.4	210	120	.05	.05	.3	42
595	Cooked, drained	1 cup	145	94	30	2	Trace	—	—	—	6	64	29	.4	236	190	.06	.06	.4	48
596	Red, raw, coarsely shredded or sliced.	1 cup	70	90	20	1	Trace	—	—	—	5	29	25	.6	188	30	.06	.04	.3	43
597	Savoy, raw, coarsely shredded or sliced.	1 cup	70	92	15	2	Trace	—	—	—	3	47	38	.6	188	140	.04	.06	.2	39
598	Cabbage, celery (also called pe-tsai or wongbok), raw, 1-in pieces.	1 cup	75	95	10	1	Trace	—	—	—	2	32	30	.5	190	110	.04	.03	.5	19
599	Cabbage, white mustard (also called bokchoy or pakchoy), cooked, drained.	1 cup	170	95	25	2	Trace	—	—	—	4	252	56	1.0	364	5,270	.07	.14	1.2	26
	Carrots:																			
	Raw, without crowns and tips, scraped:																			
600	Whole, 7 1/2 by 1 1/8 in, or strips, 2 1/2 to 3 in long.	1 carrot or 18 strips	72	88	30	1	Trace	—	—	—	7	27	26	.5	246	7,930	.04	.04	.4	6
601	Grated	1 cup	110	88	45	1	Trace	—	—	—	11	41	40	.8	375	12,100	.07	.06	.7	9
602	Cooked (crosswise cuts), drained	1 cup	155	91	50	1	Trace	—	—	—	11	51	48	.9	344	16,280	.08	.08	.8	9
	Canned:										10									
603	Sliced, drained solids	1 cup	155	91	45	1	Trace	—	—	—	2	47	34	1.1	186	23,250	.03	.05	.6	3
604	Strained or junior (baby food)	1 oz (1 3/4 to 2 tbsp)	28	92	10	Trace	Trace	—	—	—		7	6	.1	51	3,690	.01	.01	.1	1
	Cauliflower:																			
605	Raw, chopped	1 cup	115	91	31	3	Trace	—	—	—	6	29	64	1.3	339	70	.13	.12	.8	90
	Cooked, drained:																			
606	From raw (flower buds)	1 cup	125	93	30	3	Trace	—	—	—	5	26	53	.9	258	80	.11	.10	.8	69
607	From frozen (flowerets)	1 cup	180	94	30	3	Trace	—	—	—	6	31	68	.9	373	50	.07	.09	.7	74
	Celery, Pascal type, raw:																			
608	Stalk, large outer, 8 by 1 1/2 in, at root end.	1 stalk	40	94	5	Trace	Trace	—	—	—	2	16	11	.1	136	110	.01	.01	.1	4
609	Pieces, diced	1 cup	120	94	20	1	Trace	—	—	—	5	47	34	.4	409	320	.04	.04	.4	11
	Collards, cooked, drained:																			
610	From raw (leaves without stems)	1 cup	190	90	66	7	1	—	—	—	10	357	99	1.5	498	14,820	.21	.38	2.3	144
611	From frozen (chopped)	1 cup	170	90	50	5	1	—	—	—	10	299	87	1.7	401	11,560	.10	.24	1.0	56
	Corn, sweet:																			
	Cooked, drained:																			
612	From raw, ear 5 by 1 3/4 in	1 ear[1]	140	74	70	2	1	—	—	—	16	2	69	.5	151	[2]310	.09	.08	1.1	7
	From frozen:																			
613	Ear, 5 in long	1 ear[1]	229	73	120	4	1	—	—	—	27	4	121	1.0	291	[2]440	.18	.10	2.1	9
614	Kernels	1 cup	165	77	130	5	1	—	—	—	31	5	120	1.3	304	[2]580	.15	.10	2.5	8
	Canned:																			
615	Cream style	1 cup	256	76	210	5	2	—	—	—	51	8	143	1.5	248	[2]840	.08	.13	2.6	13
	Whole kernel:																			
616	Vacuum pack	1 cup	210	76	175	5	1	—	—	—	43	6	153	1.1	204	[2]740	.06	.13	2.3	11
617	Wet pack, drained solids	1 cup	165	76	140	4	1	—	—	—	33	8	81	.8	160	[2]580	.05	.08	1.5	7
	Cowpeas. See Blackeye peas. (Items 585-586).																			
	Cucumber slices, 1/8 in thick (large, 2 1/8-in diam.; small, 1 3/4-in diam.):																			
618	With peel	6 large or 8 small slices	28	95	5	Trace	Trace	—	—	—	1	7	8	.3	45	70	.01	.01	.1	3

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
619	Without seed	6 1/2 large or 9 small pieces.	28	96	5	Trace	Trace	—	—	—	1	5	5	0.1	45	Trace	0.01	0.01	0.1	3
620	Dandelion greens, cooked, drained	1 cup	105	90	35	2	1	—	—	—	7	147	44	1.9	244	12,290	.14	.17	—	19
621	Endive, curly (including escarole), raw, small pieces.	1 cup	50	93	10	1	Trace	—	—	—	2	41	27	.9	147	1,650	.04	.07	.3	5
	Kale, cooked, drained:																			
622	From raw (leaves without stems and midribs).	1 cup	110	88	45	5	1	—	—	—	7	206	64	1.8	243	9,130	.11	.20	1.8	102
623	From frozen (leaf style)	1 cup	130	91	40	4	1	—	—	—	7	157	62	1.3	251	15,660	.08	.20	.9	49
	Lettuce, raw:																			
	Butterhead, as Boston types:																			
624	Head, 5-in diam	1 head[11]	220	95	25	2	Trace	—	—	—	4	57	42	3.3	430	1,580	.10	.10	.5	13
625	Leaves	1 outer or 2 inner or 3 heart leaves.	15	95	Trace	Trace	Trace	—	—	—	Trace	5	4	.3	40	150	.01	.01	Trace	1
	Crisphead, as Iceberg:																			
626	Head, 6-in diam	1 head[11]	567	96	70	5	1	—	—	—	16	108	110	2.7	943	1,780	.32	.32	1.6	32
627	Wedge, 1/4 of head	1 wedge	135	96	20	1	Trace	—	—	—	4	27	30	.7	236	450	.08	.08	.4	8
628	Pieces, chopped or shredded	1 cup	55	96	5	Trace	Trace	—	—	—	2	11	12	.3	96	180	.03	.03	.2	3
629	Looseleaf (bunching varieties including romaine or cos), chopped or shredded pieces.	1 cup	55	94	10	1	Trace	—	—	—	2	37	14	.8	145	1,050	.03	.04	.2	10
630	Mushrooms, raw, sliced or chopped	1 cup	70	90	20	2	Trace	—	—	—	3	4	81	.6	290	Trace	.07	.32	2.9	2
631	Mustard greens, without stems and midribs, cooked, drained.	1 cup	140	93	30	3	1	—	—	—	6	193	45	2.5	308	8,120	.11	.20	.8	67
632	Okra pods, 3 by 5/8 in, cooked	10 pods	106	91	30	2	Trace	—	—	—	6	98	43	.5	184	520	.14	.19	1.0	21
	Onions:																			
	Mature:																			
	Raw:																			
633	Chopped	1 cup	170	89	65	3	Trace	—	—	—	15	46	61	.9	267	[12]Trace	.05	.07	.3	17
634	Sliced	1 cup	115	89	45	2	Trace	—	—	—	10	31	41	.6	181	[12]Trace	.03	.05	.2	12
635	Cooked (whole or sliced), drained.	1 cup	210	92	60	3	Trace	—	—	—	14	50	61	.8	231	[12]Trace	.06	.06	.4	15
636	Young green, bulb (3/8 in diam.) and white portion of top.	6 onions	30	88	15	Trace	Trace	—	—	—	3	12	12	.2	69	Trace	.02	.01	.1	8
637	Parsley, raw, chopped	1 tbsp	4	85	Trace	Trace	Trace	—	—	—	Trace	7	2	.2	25	300	Trace	.01	Trace	6
638	Parsnips, cooked (diced or 2-in lengths).	1 cup	155	82	100	2	1	—	—	—	23	70	96	.9	587	50	.11	.12	.2	16
	Peas, green:																			
	Canned:																			
639	Whole, drained solids	1 cup	170	77	150	8	1	—	—	—	29	44	129	3.2	163	1,170	.15	.10	1.4	14
640	Strained (baby food)	1 oz (1 3/4 to 2 tbsp)	28	86	15	1	Trace	—	—	—	3	3	18	.3	28	140	.02	.03	.3	3
641	Frozen, cooked, drained	1 cup	160	82	110	8	Trace	—	—	—	19	30	138	3.0	216	960	.43	.14	2.7	21
642	Peppers, hot, red, without seeds, dried (ground chili powder, added seasonings).	1 tsp	2	9	5	Trace	Trace	—	—	—	1	5	4	.3	20	1,300	Trace	.02	.2	Trace
	Peppers, sweet (about 5 per lb, whole), stem and seeds removed:																			
643	Raw	1 pod	74	93	15	1	Trace	—	—	—	4	7	16	.5	157	310	.06	.06	.4	94
644	Cooked, boiled, drained	1 pod	73	95	15	1	Trace	—	—	—	3	7	12	.4	109	310	.05	.05	.4	70
	Potatoes, cooked:																			
645	Baked, peeled after baking (about 2 per lb, raw).	1 potato	156	75	145	4	Trace	—	—	—	33	14	101	1.1	782	Trace	.15	.07	2.7	31
	Boiled (about 3 per lb, raw):																			
646	Peeled after boiling	1 potato	137	80	105	3	Trace	—	—	—	23	10	72	.8	556	Trace	.12	.05	2.0	22
647	Peeled before boiling	1 potato	135	83	90	3	Trace	—	—	—	20	8	57	.7	385	Trace	.12	.05	1.6	22
	French-fried, strip, 2 to 3 1/2 in long:																			
648	Prepared from raw	10 strips	50	45	135	2	7	1.7	1.2	3.3	18	8	56	.7	427	Trace	.07	.04	1.6	11
649	Frozen, oven heated	10 strips	50	53	110	2	4	1.1	.8	2.1	17	5	43	.9	326	Trace	.07	.01	1.3	11
650	Hashed brown, prepared from frozen.	1 cup	155	56	345	3	18	4.6	3.2	9.0	45	28	78	1.9	439	Trace	.11	.03	1.6	12
	Mashed, prepared from—																			
	Raw:																			
651	Milk added	1 cup	210	83	135	4	2	.7	.4	Trace	27	50	103	8	548	40	.17	.11	2.1	21

[11]Weight includes cob. Without cob, weight is 77 g for item 612, 126 g for item 613.
[12]Based on yellow varieties. For white varieties, value is trace.
[13]Weight includes refuse of outer leaves and core. Without these parts, weight is 163 g.
[14]Weight includes core. Without core, weight is 539 g.
[15]Value based on white-fleshed varieties. For yellow-fleshed varieties, value in International Units (I.U.) is 70 for item 633, 50 for item 634, and 80 for item 635.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS – Continued

(Blanks (—) denote lack of reliable data for a constituent believed to be present in measurable amount)

Item No.	Foods, approximate measures, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
				Water	Food energy	Protein	Fat	Fatty Acids: Saturated (total)	Fatty Acids: Unsaturated: Oleic	Fatty Acids: Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	VEGETABLE AND VEGETABLE PRODUCTS—Con.		Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	Potatoes, cooked—Continued																			
	Mashed, prepared from—Continued																			
	Raw—Continued																			
652	Milk and butter added	1 cup	210	80	195	4	9	5.6	2.3	0.2	26	50	101	0.8	525	360	0.17	0.11	2.1	19
653	Dehydrated flakes (without milk), water, milk, butter, and salt added.	1 cup	210	79	195	4	7	3.6	2.1	.2	30	65	99	.6	601	270	.08	.08	1.9	11
654	Potato chips, 1 3/4 by 2 1/2 in oval cross section.	10 chips	20	2	115	1	8	2.1	1.4	4.0	10	8	28	.4	226	Trace	.04	.01	1.0	3
655	Potato salad, made with cooked salad dressing.	1 cup	250	76	250	7	7	2.0	2.7	1.3	41	80	160	1.5	798	350	.20	.18	2.8	28
656	Pumpkin, canned	1 cup	245	90	80	2	1	—	—	—	19	61	64	1.0	588	15,680	.07	.12	1.5	12
657	Radishes, raw (prepackaged) stem ends, rootlets cut off.	4 radishes	18	95	5	Trace	Trace	—	—	—	1	5	6	.2	58	Trace	.01	.01	.1	5
658	Sauerkraut, canned, solids and liquid.	1 cup	235	93	40	2	Trace	—	—	—	9	85	42	1.2	329	120	.07	.09	.5	33
	Southern peas. See Blackeye peas (items 586-586).																			
	Spinach:																			
659	Raw, chopped	1 cup	55	91	15	2	Trace	—	—	—	2	51	28	1.7	259	4,860	.06	.11	.3	28
	Cooked, drained:																			
660	From raw	1 cup	180	92	40	5	1	—	—	—	6	167	68	4.0	583	14,580	.13	.25	.9	50
	From frozen:																			
661	Chopped	1 cup	205	92	45	6	1	—	—	—	8	232	90	4.3	683	16,200	.14	.31	.8	39
662	Leaf	1 cup	190	92	45	6	1	—	—	—	7	200	84	4.8	688	15,390	.15	.27	1.0	53
663	Canned, drained solids	1 cup	205	91	50	6	1	—	—	—	7	242	53	5.3	513	16,400	.04	.25	.6	29
	Squash, cooked:																			
664	Summer (all varieties), diced, drained.	1 cup	210	96	30	2	Trace	—	—	—	7	53	53	.8	256	820	.11	.17	1.7	21
665	Winter (all varieties), baked, mashed.	1 cup	205	81	130	4	1	—	—	—	32	57	98	1.6	945	8,610	.10	.27	1.4	27
	Sweetpotatoes:																			
	Cooked (raw, 5 by 2 in; about 2 1/2 per lb):																			
666	Baked in skin, peeled	1 potato	174	64	160	2	1	—	—	—	37	46	66	1.0	342	9,230	.10	.08	.8	25
667	Boiled in skin, peeled	1 potato	151	71	170	3	1	—	—	—	40	48	71	1.1	367	11,940	.14	.09	.9	26
668	Candied, 2 1/2 by 2-in piece	1 piece	105	60	175	1	3	2.0	.8	.1	36	39	45	.9	200	6,620	.06	.04	.4	11
	Canned:																			
669	Solid pack (mashed)	1 cup	255	72	275	5	1	—	—	—	63	64	105	2.0	510	19,890	.13	.10	1.5	36
670	Vacuum pack, piece 2 3/4 by 1 in.	1 piece	40	72	45	1	Trace	—	—	—	10	10	16	.3	80	3,120	.02	.02	.2	6
	Tomatoes:																			
671	Raw, 2 3/5-in diam. (3 per 12 oz pkg.).	1 tomato[66]	135	94	25	1	Trace	—	—	—	6	16	33	.6	300	1,110	.07	.05	.9	[67]28
672	Canned, solids and liquid	1 cup	241	94	50	2	Trace	—	—	—	10	[68]14	46	1.2	523	2,170	.12	.07	1.7	41
673	Tomato catsup	1 cup	273	69	290	5	1	—	—	—	69	60	137	2.2	991	3,820	.25	.19	4.4	41
674		1 tbsp	15	69	15	Trace	Trace	—	—	—	4	3	8	.1	54	210	.01	.01	.2	2
	Tomato juice, canned:																			
675	Cup	1 cup	243	94	45	2	Trace	—	—	—	10	17	44	2.2	552	1,940	.12	.07	1.5	39
676	Glass (6 fl oz)	1 glass	182	94	35	2	Trace	—	—	—	8	13	33	1.6	413	1,460	.09	.05	1.5	29
677	Turnips, cooked, diced	1 cup	155	94	35	1	Trace	—	—	—	8	54	37	.6	291	Trace	.06	.08	.5	34
	Turnip greens, cooked, drained:																			
678	From raw (leaves and stems)	1 cup	145	94	30	3	Trace	—	—	—	5	252	49	1.5	—	8,270	.15	.33	.7	68
679	From frozen (chopped)	1 cup	166	93	40	4	Trace	—	—	—	6	195	64	2.6	246	11,390	.08	.15	.7	31
680	Vegetables, mixed, frozen, cooked	1 cup	182	83	115	6	1	—	—	—	24	46	115	2.4	348	9,010	.22	.13	2.0	15

(A)	(B)		(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
	MISCELLANEOUS ITEMS																		
	Baking powders for home use:																		
	Sodium aluminum sulfate:																		
681	With monocalcium phosphate monohydrate.	1 tsp	3.0	2	5	Trace	Trace	0	0	0	1	58	87	—	5	0	0	0	0	0
682	With monocalcium phosphate monohydrate, calcium sulfate.	1 tsp	2.9	1	5	Trace	Trace	0	0	0	1	183	45	—	—	0	0	0	0	0
683	Straight phosphate	1 tsp	3.8	2	5	Trace	Trace	0	0	0	1	239	359	—	6	0	0	0	0	0
684	Low sodium	1 tsp	4.3	2	5	Trace	Trace	0	0	0	2	207	314	—	471	0	0	0	0	0
685	Barbecue sauce	1 cup	250	81	230	4	17	2.2	4.3	10.0	20	53	50	2.0	435	900	.03	.03	.8	13
	Beverages, alcoholic:																			
686	Beer	12 fl oz	360	92	150	1	0	0	0	0	14	18	108	Trace	90	—	.01	.11	2.2	—
	Gin, rum, vodka, whisky:																			
687	80-proof	1 1/2-fl oz jigger	42	67	95	—	—	0	0	0	Trace	—	—	—	1	—	—	—	—	—
688	86-proof	1 1/2-fl oz jigger	42	64	105	—	—	0	0	0	Trace	—	—	—	1	—	—	—	—	—
689	90-proof	1 1/2-fl oz jigger	42	62	110	—	—	0	0	0	Trace	—	—	—	1	—	—	—	—	—
	Wines:																			
690	Dessert	3 1/2-fl oz glass	103	77	140	Trace	0	0	0	0	8	8	—	—	77	—	.01	.02	.2	—
691	Table	3 1/2-fl oz glass	102	86	85	Trace	0	0	0	0	4	9	10	.4	94	—	Trace	.01	.1	—
	Beverages, carbonated, sweetened, nonalcoholic:																			
692	Carbonated water	12 fl oz	366	92	115	0	0	0	0	0	0	29	—	—	—	—	0	0	0	0
693	Cola type	12 fl oz	369	90	145	0	0	0	0	0	0	37	—	—	—	—	0	0	0	0
694	Fruit-flavored sodas and Tom Collins mixer.	12 fl oz	372	88	170	0	0	0	0	0	0	45	—	—	—	—	0	0	0	0
695	Ginger ale	12 fl oz	366	92	115	0	0	0	0	0	0	29	—	—	—	0	0	0	0	0
696	Root beer	12 fl oz	370	90	150	0	0	0	0	0	0	39	—	—	—	0	0	0	0	0
	Chili powder. See Peppers, hot, red (item 642).																			
	Chocolate:																			
697	Bitter or baking	1 oz	28	2	145	3	15	8.9	4.9	.4	8	22	109	1.9	235	20	.01	.07	.4	0
	Semisweet, see Candy, chocolate (item 539).																			
698	Gelatin, dry	1 7-g envelope	7	13	25	6	Trace	0	0	0	0	—	—	—	—	—	—	—	—	—
699	Gelatin dessert prepared with gelatin dessert powder and water.	1 cup	240	84	140	4	0	0	0	0	34	—	—	—	—	—	—	—	—	—
700	Mustard, prepared, yellow	1 tsp or individual serving pouch or cup.	5	80	5	Trace	Trace	—	—	—	Trace	4	4	.1	7	—	—	—	—	—
	Olives, pickled, canned:																			
701	Green	4 medium or 3 extra large or 2 giant.[64]	16	78	15	Trace	2	.2	1.2	.1	Trace	8	2	.2	7	40	—	—	—	—
702	Ripe, Mission	3 small or 2 large[65]	10	73	15	Trace	2	.2	1.2	.1	Trace	9	1	.1	2	10	Trace	Trace	—	—
	Pickles, cucumber:																			
703	Dill, medium, whole, 3 3/4 in long, 1 1/4-in diam.	1 pickle	65	93	5	Trace	Trace	—	—	—	1	17	14	.7	130	70	Trace	.01	Trace	4
704	Fresh-pack, slices 1 1/2-in diam., 1/4 in thick.	2 slices	15	79	10	Trace	Trace	—	—	—	3	5	4	.3	—	20	Trace	Trace	Trace	1
705	Sweet, gherkin, small, whole, about 2 1/2 in long, 3/4-in diam.	1 pickle	15	61	20	Trace	Trace	—	—	—	5	2	2	.2	—	10	Trace	Trace	Trace	1
706	Relish, finely chopped, sweet	1 tbsp	15	63	20	Trace	Trace	—	—	—	5	3	2	.1	—	—	—	—	—	—
	Popcorn. See items 476-478.																			
707	Popsicle, 3-fl oz size	1 popsicle	95	80	70	0	0	0	0	0	18	0	—	Trace	—	0	0	0	0	0

[64] Weight includes cores and stem ends. Without these parts, weight is 123 g.
[65] Based on year-round average. For tomatoes marketed from November through May, value is about 12 mg; from June through October, 32 mg.
[66] Applies to product without calcium salts added. Value for products with calcium salts added may be as much as 63 mg for whole tomatoes, 241 mg for cut forms.
[67] Weight includes pits. Without pits, weight is 13 g for item 701, 9 g for item 702.

TABLE 2.– NUTRITIVE VALUES OF THE EDIBLE PART OF FOODS · Continued

(Dashes (—) denote lack of reliable data for a constituent believed to be present in measurable amount)

Item No.	Foods, approximate measure, units, and weight (edible part unless footnotes indicate otherwise)			NUTRIENTS IN INDICATED QUANTITY																
							Fatty Acids													
				Water	Food energy	Protein	Fat	Saturated (total)	Unsaturated: Oleic	Unsaturated: Linoleic	Carbohydrate	Calcium	Phosphorus	Iron	Potassium	Vitamin A value	Thiamin	Riboflavin	Niacin	Ascorbic acid
(A)	(B)			(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)
			Grams	Percent	Calories	Grams	Grams	Grams	Grams	Grams	Grams	Milligrams	Milligrams	Milligrams	Milligrams	International units	Milligrams	Milligrams	Milligrams	Milligrams
	MISCELLANEOUS ITEMS—Con.																			
	Soups:																			
	Canned, condensed:																			
	Prepared with equal volume of milk:																			
708	Cream of chicken	1 cup	245	85	180	7	10	4.2	3.6	1.3	15	172	152	0.5	260	610	0.05	0.27	0.7	2
709	Cream of mushroom	1 cup	245	83	215	7	14	5.4	2.9	4.6	16	191	169	.5	279	250	.05	.34	.7	1
710	Tomato	1 cup	250	84	175	7	7	3.4	1.7	1.0	23	168	155	.8	418	1,200	.10	.25	1.3	15
	Prepared with equal volume of water:																			
711	Bean with pork	1 cup	250	84	170	8	6	1.2	1.8	2.4	22	63	128	2.3	395	650	.13	.08	1.0	3
712	Beef broth, bouillon, consomme	1 cup	240	96	30	5	0	0	0	0	3	Trace	31	.5	130	Trace	Trace	.02	1.2	—
713	Beef noodle	1 cup	240	93	65	4	3	.6	.7	.8	7	7	48	1.0	77	50	.05	.07	1.0	Trace
714	Clam chowder, Manhattan type (with tomatoes, without milk)	1 cup	245	92	80	2	3	.5	.4	1.3	12	34	47	1.0	184	880	.02	.02	1.0	—
715	Cream of chicken	1 cup	240	92	95	3	6	1.6	2.3	1.1	8	24	34	.5	79	410	.02	.05	.5	Trace
716	Cream of mushroom	1 cup	240	90	135	2	10	2.6	1.7	4.5	10	41	50	.5	98	70	.02	.12	.7	Trace
717	Minestrone	1 cup	245	90	105	5	3	.7	.9	1.3	14	37	59	1.0	314	2,350	.07	.05	1.0	—
718	Split pea	1 cup	245	85	145	9	3	1.1	1.2	.4	21	29	149	1.5	270	440	.25	.15	1.5	1
719	Tomato	1 cup	245	91	90	2	3	.5	.5	1.0	16	15	34	.7	230	1,000	.05	.05	1.2	12
720	Vegetable beef	1 cup	245	92	80	5	2	—	—	—	10	12	49	.7	162	2,700	.05	.05	1.0	—
721	Vegetarian	1 cup	245	92	80	2	2	—	—	—	13	20	39	1.0	172	2,940	.06	.05	1.0	—
	Dehydrated:																			
722	Bouillon cube, 1/2 in	1 cube	4	4	5	1	Trace	—	—	—	Trace	—	—	—	4	—	—	—	—	—
	Mixes:																			
	Unprepared:																			
723	Onion	1 1/2-oz pkg	43	3	150	6	5	1.1	2.3	1.0	23	42	49	.6	238	30	.05	.03	.3	6
	Prepared with water:																			
724	Chicken noodle	1 cup	240	95	55	2	1	—	—	—	8	7	19	.2	19	50	.07	.05	.5	Trace
725	Onion	1 cup	240	96	35	1	1	—	—	—	6	10	12	.2	58	Trace	Trace	Trace	Trace	2
726	Tomato vegetable with noodles	1 cup	240	93	65	1	1	—	—	—	12	7	19	.2	29	480	.05	.02	.5	5
727	Vinegar, cider	1 tbsp	15	94	Trace	Trace	0	0	0	0	1	1	1	.1	15	—	—	—	—	—
728	White sauce, medium, with enriched flour	1 cup	250	73	405	10	31	19.3	7.8	.8	22	288	233	.5	348	1,150	.12	.43	.7	2
	Yeast:																			
729	Baker's, dry, active	1 pkg	7	5	20	3	Trace	—	—	—	3	3	90	1.1	140	Trace	.16	.38	2.6	Trace
730	Brewer's, dry	1 tbsp	8	5	25	3	Trace	—	—	—	3	[79]17	140	1.4	152	Trace	1.25	.34	3.0	Trace

[79]Value may vary from 6 to 60 mg.

SPORTS-NUTRITION POSTTEST

DIRECTIONS: For questions 1-6, there may be more than one appropriate response. If no response is appropriate, leave the item blank. For questions 7-105, there is only *one* best response. Blacken the appropriate bracket(s) on the answer sheet. DO NOT WRITE ON THIS TEST BOOKLET AND RETURN IT WITH YOUR ANSWER SHEET.

1. What is your age group?

   a. 25 or under
   b. 26-33
   c. 34-41
   d. 42-49
   e. 50 or over

2. What is your sex?

   a. Female
   b. Male

3. Which of the following areas do you coach?

   a. Baseball (softball)
   b. Basketball
   c. Football
   d. Soccer
   e. Tennis

4. Which of the following areas do you coach?

   a. Track
   b. Volleyball
   c. Wrestling
   d. Other Sport
   e. I do not coach

5. What age group do you coach?

   a. Grades 1-3
   b. Grades 4-6
   c. Grades 7-9
   d. Grades 10-12
   e. Other groups

6. How many years have you been coaching?

   a. 1-3
   b. 4-5
   c. 6-9
   d. 10 or more

7. The percentage body fat for a competitive tennis player and a competitive long distance runner is generally:

   a. greater in the tennis player.
   b. same for both types of athletes.
   c. less in the tennis player.
   d. independent of the sport.

8. In aerobic exercise, the release of energy requires:

   a. B-vitamins.
   b. oxygen.
   c. carbon dioxide.
   d. both a and b.

9. Nutrients are transported to the cells via the:

   a. nervous system.
   b. digestive system.
   c. reproductive system.
   d. circulatory system.

10. One gram of fat contains:

   a. 100 calories.
   b. 25 calories.
   c. 9 calories.
   d. 4 calories.

11. The body's storage form of carbohydrate is:

   a. lactate.
   b. carbonate.
   c. glucose.
   d. glycogen.

12. Exercise which is fueled primarily by the oxidation of both fatty acids and glucose is called:

   a. anaerobic.
   b. fermentative.
   c. glycolytic.
   d. aerobic.

13. Guidelines used for estimating nutrient and energy needs of groups of healthy people based on age and gender are the:

   a. Required Dietary Guidelines (RDG).
   b. Recommended Dietary Allowances (RDA).
   c. Recommended Nutrient Requirements (RNR).
   d. Required Nutrient Guidelines (RNG).

14. Which of the following sporting events is primarily fueled aerobically?

   a. High jump
   b. Bench press
   c. Football
   d. 1500 meter swim

15. The food group that is a major source of fiber is:

a. milk-dairy group.
b. meat group.
c. fruit-vegetable group.
d. carbohydrate group.

16. The American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) developed the health related fitness test to evaluate:

a. lower back strength and flexibility.
b. cardiovascular fitness.
c. flexibility and sports skills.
d. both a and b.

17. The minimum amount of time required for a moderate intensity aerobic exercise session to provide cardiovascular conditioning is:

a. 60-90 minutes.
b. 45-60 minutes.
c. 20-40 minutes.
d. 10-15 minutes.

18. The formula (1 calorie per kilogram body weight x 24 hours per day) is a way to estimate the amount of energy required to meet the needs of a male's daily:

a. basal metabolic rate.
b. specific dynamic energy.
c. activity energy requirements.
d. retinol equivalents.

19. The intake of energy compared to the output of energy is called:

a. dynamic balance.
b. energy balance.
c. energy threshold.
d. caloric threshold.

20. Caffeine has been demonstrated to be an ergogenic aid which increases:

a. speed.
b. strength.
c. flexibility.
d. endurance.

21. You plan to make a liquid meal to be consumed two hours before a swimming competition. The recipe includes 1 cup 2% milk and ¼ cup of peanut butter. Based on your knowledge of the role of fat in digestion, you should:

a. add more peanut butter to the milk.
b. use whole milk.
c. omit the peanut butter.
d. use the recipe as it is given.

22. The percentage of body weight composed of each nutrient is called:

a. body nutrient density.
b. lean body mass.
c. body composition
d. body surface area.

23. The recommended range for weight loss for one week is:

a. one to two pounds.
b. five to seven pounds.
c. eight to ten pounds.
d. b or c.

24. Recommended diet management for events requiring 10-15 minutes of constant high intensity activity includes:

a. using a glycogen loading diet two days before the event.
b. drinking 1-2 cups water 20 minutes before the event.
c. drinking a beverage containing 150 milligrams of caffeine one hour before the event.
d. taking at least 20 grams of a protein supplement for one week before the event.

25. Your team has a three hour road trip to a championship event. You know there will be a two hour wait from the time of arrival to the start of the game. To optimize performance, you suggest that the team members:

a. take packed lunches to eat along the way.
b. eat a large steak dinner before leaving.
c. avoid eating during the five hours before game time.
d. eat a large meal upon arrival.

26. The recommended training heart rate range for aerobic cardiovascular conditioning exercise is:

a. 95-100% of the maximum heart rate.
b. 70-85% of the maximum heart rate.
c. 50-75% of the maximum heart rate.
d. 35-55% of the maximum heart rate.

27. Nutritional status assessment includes:

a. diet analysis.
b. anthropometric measurements.
c. biochemical analysis.
d. all of the above.

28. Which of the following recommendations would increase the probability that a person would have a nutritionally adequate diet?

a. Taking megadoses of vitamin and mineral supplements regularly
b. Regularly eating a variety of minimally processed foods
c. Increasing portions of high protein foods when training
d. Decreasing high carbohydrate foods when training

29. Vitamin B-complex and Vitamin C are soluble in:

a. protein.
b. fat.
c. carbohydrate.
d. water.

30. Cellular oxidation of carbohydrate, fat, and protein releases energy and forms carbon dioxide, water, and:

a. ATP.
b. glycogen.
c. glucose.
d. fat.

31. Regular intakes of 10 times the Recommended Dietary Allowances of Vitamins A, D, E, or K can result in:

a. improved athletic performance.
b. improved nutritional status.
c. increased malnutrition risk.
d. increased resistance to infection.

32. The major area of nutrient absorption in the digestive system is the:

a. mouth.
b. stomach.
c. small intestine.
d. large intestine.

33. Which combination makes a complete protein?

a. Grains and fruits
b. Grains and legumes
c. Fruits and seeds
d. Grains and nuts

34. When compared to sucrose and fructose, the nutritional value of honey is:

a. much greater.
b. much less.
c. about the same.
d. slightly less.

35. The Basal Metabolic Rate (BMR) is the rate of energy consumption:

a. by all the body's physical activities for 24 hours.
b. for metabolizing nutrients in low-intensity activities.
c. by the body at rest after a 12 hour fast.
d. for digesting foods three hours after a large meal.

36. The anaerobic release of energy occurs:

a. inside of the cell's cytoplasm.
b. inside the cell's mitochondria.
c. inside and outside the cell's mitochondria.
d. outside of the cell's membrane.

37. Too much or too little of any nutrient can result in:

a. malnutrition.
b. rapid growth.
c. increased performance.
d. increased fitness.

38. The Basal Metabolic Rate (BMR) tends to be higher in:

a. males.
b. females.
c. elderly.
d. fasting.

39. Which of the following factors can affect an athlete's calorie or energy requirements?

a. Activity level
b. Age
c. Body composition
d. All of the above

40. Oxygen consumption rises quickly during the first few minutes of jogging. Then, the oxygen consumption levels off and remains relatively stable for the rest of the exercise period if the intensity of the exercise is not increased. This period of stable oxygen consumption is known as the:

a. oxygen debt.
b. steady state.
c. dynamic ventilation.
d. dynamic state.

41. The energy release system used in high intensity activity such as an athlete "kicking" the last leg of a 1 or 2 mile race is called:

a. oxidative.
b. anaerobic.
c. static.
d. aerobic.

42. When compared to unsaturated fats, saturated fats are usually:

a. solid at room temperature.
b. liquid at room temperature.
c. obtained from fresh vegetables.
d. obtained from unprocessed grains.

43. One method of assessing the nutritional adequacy of an athlete's diet is to:

a. take a 24 hour diet recall.
b. check a 7 day lunch profile.
c. analyze vitamin supplement dosage.
d. take a hair analysis test.

44. The food combination highest in saturated fats is:

a. beef and pork.
b. poultry and fish.
c. grains and vegetables.
d. skim and low-fat milk.

45. Each food group from the five basic food groups contains:

a. a high concentration of some essential nutrients.
b. a low concentration of all essential nutrients.
c. a high concentration of dietary fiber.
d. all the essential vitamins.

46. Glycogen is stored in the:

a. liver and pancreas.
b. brain and skeletal muscle.
c. liver and skeletal muscle.
d. blood and pancreas.

47. When minimum requirements for calories and protein are met, additional protein intake from food or protein supplements will be converted to:

a. muscle.
b. fat.
c. bone mineral.
d. collagen.

48. The major function of the body's electrolytes is to regulate:

a. enzyme breakdown.
b. protein synthesis.
c. vitamin intake.
d. fluid balance.

49. The percentages of the six major nutrients in the body:

a. do not change with age.
b. change with age.
c. are the same for males and females.
d. both a and c are correct.

50. The American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) sit-up test measures the student's level of fitness in:

a. muscle strength and endurance.
b. cardiovascular strength.
c. body flexibility.
d. body composition.

51. Which of the following is not a major physical training principle?

a. Contact
b. Specificity
c. Overload
d. Reversibility

52. The use of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) fitness tests in an athletic training program is a means to:

a. evaluate athletes' potential to perform.
b. motivate athletes to improve their fitness level.
c. evaluate training programs.
d. all of the above.

53. The recommended minimum frequency of exercising aerobically to maintain cardiovascular fitness is:

a. once a week.
b. three times a week.
c. five times a week.
d. every day.

54. The major nutritional priority in post event diet management is restoring:

a. fat losses.
b. glycogen losses.
c. protein losses.
d. water losses.

55. Using the same scale and taking the measurement at the same time of day are recommended guidelines for monitoring an athlete's:

a. body weight.
b. body density.
c. skinfold measurement.
d. body surface area.

56. Total body weight minus estimated body fat weight equals:

a. body weight composition.
b. lean body weight.
c. density of the body weight.
d. body surface area.

57. Saturated body carbohydrate stores will result in:

a. increased performance of moderate-intensity activity lasting 25 minutes.
b. no improvement in performance of short-term, high intensity activity lasting 10 minutes.
c. extended performance duration for continuous activity lasting more than one hour.
d. both b and c.

58. In planning a pre-game meal, psychological considerations for diet management are:

a. of major importance.
b. not significant.
c. of little importance.
d. the only consideration.

59. In order to maintain adequate hydration status during training and sports events, an athlete should:

a. drink copious amounts of water frequently.
b. take salt tablets with water.
c. avoid water and hydrate after the game or practice.
d. drink small amounts of water frequently.

60. Which of the following principles would *not* be used by an athlete to select food for their training diet?

a. Variety in food choices
b. Timing of pre-event meals
c. Psychological needs of individuals
d. Specificity of body density.

61. The norms available for evaluating skinfold measurements of adolescents provide:

a. precise measures of lean body mass.
b. estimates of body fatness.
c. estimates of lean body mass.
d. precise measures of body fatness.

62. With increasing age in adulthood, the precent body fat typically:

a. increases.
b. stabilizes.
c. decreases.
d. either b or c.

63. The best plan for maximizing body fat loss and preventing lean body mass loss during weight reduction is:

a. fasting for several days; then decreasing food intake moderately.
b. eating a low-carbohydrate diet and increasing activity level.
c. eating a low-calorie diet and taking protein supplements.
d. decreasing calorie intake moderately and increasing activity level.

64. The process of glycogen loading used by some athletes may be an ergogenic aid for a bicycle race of:

a. 90 minutes.
b. 30 minutes.
c. 15 minutes.
d. all of the above.

65. An athlete asks for your advice on what is the best vitamin and mineral supplement dosage to buy and how often he or she should take the supplement. Which of the following is the best recommendation to make?

a. 1000% of the RDA, once a day.
b. 250% of the RDA with each meal.
c. 100% of the RDA, once a day.
d. 100% of the RDA with each meal.

66. The amount of energy the body consumes at rest after a 12 hour fast is called the:

a. Basal Metabolic Rate (BMR).
b. Specific Dynamic Energy (SDE).
c. Metabolic Cost at Rest (MET).
d. Retinol Equivalents (RE).

67. An easy recommended method of evaluating and monitoring an athlete's hydration status is to measure the athlete's:

a. weight before and after the practice or event.
b. plasma electrolyte levels before and after the practice or event.
c. blood pressure before and after the practice or event.
d. hydrostatic weight before and after the practice or event.

68. Ken Walsh, your 167 pound high school tail-back, wants to gain weight. He has asked you for advice on the best technique for gaining weight. You suggest that he increase his:

a. body fat by adding an extra 2000-3000 calories to his diet and using endurance training.
b. lean mass by eating high-protein supplements and using strength training.
c. lean mass by adding an extra 700-1000 calories to his diet and using strength training.
d. body fat by taking high-energy vitamin supplements and using strength training.

69. Eating the recommended number of servings in the Five Food Groups Guide to Good Eating will usually provide the athlete with all the nutritional requirements with the exception of sufficient:

a. calories.
b. protein.
c. vitamins.
d. minerals.

70. A rapid loss of more than 4.5 pounds of body water in a 150 pound wrestler will:

a. increase performance measurably.
b. not affect performance significantly.
c. lead to impaired performance.
d. result in heat exhaustion.

71. The most common mineral deficiency found in American women athletes is a deficiency of:

a. iodine.
b. sodium.
c. calcium.
d. iron.

72. Skinfold measurements are:

a. taken at randomly selected body areas.
b. used to estimate percent body fat.
c. precise measures of percent body fat.
d. more accurate with fewer site measurements.

73. The regulation of body temperature and transportation of waste products are physiological functions of body:

a. water.
b. lipids.
c. carbohydrates.
d. all of the above.

74. The correct location for measuring a tricep skinfold is:

a. two inches above the upper arm midpoint.
b. two inches below the upper arm midpoint.
c. at the top of the triceps muscle.
d. midpoint of the back of the upper arm.

75. For children the recommended site for measuring pulse rate is:

a. radial artery in right wrist.
b. carotid artery in neck.
c. radial artery in the left wrist.
d. either a or c.

76. Which of the following can be used to evaluate the nutritional adequacy of athletes' diets?

a. Five Food Groups Guide to Good Eating
b. Vegetarian Food Group Guidelines
c. Recommended Dietary Allowances
d. All of the above

77. I feel an athlete's diet plays an important role in maintaining physical fitness.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

78. I feel an athlete's diet plays an important role in achieving maximum sport performance.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

79. I feel I should routinely recommend vitamin or mineral supplements for athletes.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

80. I feel an athlete's diet will usually be nutritionally adequate if he or she regularly eats a variety of minimally processed foods from the food group guidelines.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

81. I feel vitamin and mineral supplements are necessary every day for good health.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

82. I feel vitamin and mineral supplements are necessary as an insurance measure just in case a diet does not contain sufficient amounts of nutrients.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

83. I feel megadoses of vitamin and mineral supplements are needed for top athletic performance.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

84. Regular monitoring of athlete's hydration status is an essential part of an athlete's training program.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

85. I feel that cutting out high carbohydrate foods, such as breads, potatoes, and cereals, is an effective way to reduce body weight.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

86. I think a well planned vegetarian diet can promote optimal physical performance.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

87. I feel athletes need protein supplements in addition to a nutritionally balanced diet.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

88. I feel that the nutrient composition of a pre-game meal will affect an athlete's performance.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

89. I feel that taking salt tablets should be a part of an athletes diet.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

90. I feel that excessive sugar, fat, and sodium consumption may be related to the development of chronic diseases like diabetes, heart disease, and obesity.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

91. I feel that athletes require vitamin and mineral supplements due to the high stress placed on their bodies.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

92. I feel that abruptly changing an athlete's typical pre-game food choices may be detrimental to performance.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

93. I feel that water is the best drink for maintaining adequate hydration in athletes.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

94. I feel an athlete's fitness level will effect his or her sports performance.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

95. I feel that evaluating athletes' fitness level is an important part of a training program.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

96. I feel that monitoring athletes' body fatness level is an important part of a training program.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

97. I feel that evaluating what athletes eat is an important part of a training program.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

98. I feel an athlete should *not* eat a large meal 3-4 hours before an event or game.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

99. I would recommend this sports-nutrition program to other coaches, teachers, or athletes.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

100. I feel this sports-nutrition program gave me practical information for use in my athletic training program.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

101. As a result of this sports-nutrition program, I feel I have learned how to help athletes select foods that are of benefit to their health and performance.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

102. As a result of this sports-nutrition program, I feel I have changed some of my eating habits.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

103. As a result of this sports-nutrition program, I plan to change some of my eating habits.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

104. As a result of this sports-nutrition program, I plan to change some of my athlete training program recommendations.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

105. I plan to use the sports-nutrition program kit contents in my coaching or work.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

SPORTS-NUTRITION POSTTEST ANSWER KEY

7. a
8. d
9. d
10. c
11. d
12. d
13. b
14. d
15. c
16. d
17. c
18. a
19. b
20. d
21. c
22. a
23. a
24. b
25. a
26. b
27. d
28. b
29. d
30. a
31. c
32. c
33. b
34. c
35. c
36. a
37. a
38. a
39. d
40. b
41. b
42. a
43. a
44. a
45. a
46. c
47. b
48. d
49. b
50. a
51. a
52. d
53. b
54. d
55. a
56. b
57. c
58. a
59. d
60. d
61. b
62. a
63. d
64. a
65. c
66. a
67. a
68. c
69. a
70. c
71. d
72. b
73. a
74. d
75. b
76. d