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ABSTRACT

This study sought to determine the changes elicited following 9 weeks of fast fitness circuit training 4 days a week. Data were gathered for a 3-year time period on 5,993 female and 4,708 male volunteer subjects with a mean age of 27.6. A one-group pretest-posttest design was used. The independent variable consisted of 24 exercise stations equally distributed between strength and aerobic modalities in an alternating fashion. FFCT workout time was 27 minutes, 45 seconds. The mean change across participants in each of the dependent variables measured was: increase in muscular endurance (10 percent), strength (8.6 percent), flexibility (7 percent), and body weight (0.5 percent); decrease in body fat composition (4.3 percent), diastolic blood pressure (4 percent), systolic blood pressure (1.3 percent), resting heart rate (4 percent), and resting pulse rate (3.6 percent). It is recognized that these data may not have a causal effect; however, it was concluded that 9 weeks of FFCT may have accounted for the changes elicited in the subjects. The recommendation for future studies is to use a stronger research design and statistical procedures that allow for more definitive statements regarding the efficacy of FFCT. (Author/JD)

THE PHYSIOLOGICAL AND HEALTH RESPONSE ELICITED IN 10,701 FEMALES AND MALES FOLLOWING A NINE WEEK FAST FITNESS CIRCUIT TRAINING PROGRAM

A research report presented to

The Department of Physical Education, Health and Recreation
Eastern Washington University
Cheney, Washington

by

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RUNNING HEAD: Response to Fast Fitness Circuit Training

ABSTRACT

The purpose of this study was to determine the changes elicited following nine weeks of fast fitness circuit training (FFCT) four days/week. Data was gathered for a three year time period on female (5,993) and male (4,708) volunteer subjects at "The Body Shop Wellness - Fitness Center" at Eastern Washington University. Subjects aged from 12-83 years (mean = 27.6). A one group pretest-posttest design was used. The independent variable (FFCT) consisted of 24 exercise stations equally distributed between strength and aerobic modalities (in an alternating fashion). After warming up for minutes, subjects performed exercise bouts consisting of 12 repetitions on the strength exercises and 30 seconds on the aerobic exercises followed by 5 minutes of stretching exercises. Subjects were allowed 15 seconds of rest between exercises. FFCT workout time was 27 minutes and 45 seconds. The mean change across participants in each of the dependent variables measured was: muscular endurance increased by 10.0%; strength increased by 8.6%; flexibility improved 7.0%; body weight increased by .5%; body fat composition decreased by 4.3%; diastolic blood pressure decreased by 4.0%; resting heart rate decreased by 4.0%; resting pulse decreased by 3.6%; and systolic blood pressure decreased by 1.3%. Potential threats to the internal validity of this study

included history, maturation, and the testing effect. Although one is cautioned to not view these data as having a causal effect, it was concluded that nine weeks of FFCT may have accounted for the changes which were elicited in the subjects. Future studies should use a stronger research design and statistical procedures which allow for more definitive statements to be made regarding the efficacy of FFCT.

INTRODUCTION

Circuit weight training (CWT) has been around for quite sometime (Sorani, 1966). Most CWT programs have subjects lift modest amounts of weight with minimal rest periods between sets. This maintains the subjects activity level and creates a state of breathlessness which in turn is thought to increase the subjects cardiorespiratory capacity. Although CWT programs have been shown to increase strength and decrease body composition (Wilmore et al., 1976) only modest, if any, improvements in cardiorespiratory capacity have been observed (Gettman, Ayres, Pollock, & Jackson, 1978; Allen, Byrd, & Smith, 1976). Studies in the early 80s added an "aerobic" component to CWT in an effort to elicit even greater cardiorespiratory capacity effects. Programs such as the "Aerobic Super Circuit" (ASC) (Universal, 1983) were then tested. The ASC program had subjects exercise for 12 weeks, three days per week, rapidly lifting 40% of the

subjects' one repetition maximum (1RM) on 10 single station strength machines and running for 30 seconds between each single station strength machine (duration 30 minutes). These programs produced greater improvements in each of the dependent variables examined compared to regular CWT.

In the late 80s another exercise modality was introduced, "Fast Fitness Circuit Training" (FFCT). This program is most like the ASC described earlier with the following noted exceptions: a five minute aerobic warm-up preceded the actual FFCT workout, 12 single station strength machines were used, subjects jogged and used cycle ergometry for the aerobic component of the program, the FFCT took 19 minutes and 45 seconds to complete, subjects performed flexibility exercises for five minutes after completing the FFCT, and the program duration was 9 weeks. These changes were necessary to (1) accommodate the 10 quarter schedule of the university, (2) minimize the duration of the activity to accommodate the needs of participants, and (3) maximize the use of the equipment available. To date, no data has been published regarding the relative effectiveness of FFCT.

It was the purpose of this study to assess the changes elicited following nine weeks of FFCT on the strength, muscular endurance, body fat composition, body weight, flexibility, systolic blood pressure, diastolic blood pressure, recovery heart rate, and resting pulse rate of the 10,701 subjects involved in this study.

METHODS AND PROCEDURES

Volunteer participation was solicited through the Physical Education, Health and Recreation Department (PEHR) at Eastern Washington University (EWU) for a 3 year time period. This solicitation resulted in the recruitment of 10,701 volunteers ages 12 to 83 years (mean age of 27.6). The group was composed of 5,993 females (56%) and 4,708 males (44%). All of the participants were free of major coronary risk factors, as determined by a modified PAR-Q (Shepard, 1988) instrument which accommodated the more stringent guidelines of the American College of Sports Medicine (1986). A complete orientation was then conducted with this group. The orientation consisted of an explanation about the program, what was expected of participants in the program, methods for achieving maximal gains from the program, and the participants were acquainted with how to use the machines.

Following the orientation, participants were asked to sign a release and informed consent. Once this was completed they were then able to schedule a pre-assessment. The pre-assessment consisted of:

A. blood pressure and resting heart rate (Cardinal & Krause, 1989)

B. recovery heart rate as determined with a step test (Cardinal et al., 1989; Golding, Myers, & Sinning, 1989)

C. total body weight and height (Cardinal et al., 1989)

D. skinfold assessment to determine body fat composition (Nieman, 1990; Cardinal et al., 1989; Pollock, Schmidt, & Jackson, 1980)

E. the sit and reach test to determine flexibility (Nieman, 1990; Cardinal et al., 1989; Golding et. al, 1989)

F. three-inch curl up test to determine muscular endurance (Cardinal et al., 1989; Golding et al., 1989)

G. one repetition maximum (1RM) on twelve specific strength machines (Cardinal et al., 1989)

After completing the pre-assessment, the participants were given individualized exercise prescriptions to help them better utilize the FFCT program. The exercise prescription utilized Karvonen's formula in establishing cardiorespiratory exercise intensity. Strength intensity was set at 40% of 1RM for all participants. Participants were monitored by Instructors as they exercised in the FFCT, to help ensure that these guidelines were being adhered to.

Each workout was recorded and resulted in an exercise frequency rate of 3.5 days per week for nine weeks (31.5 total exercise sessions for the average participant). Repetitions for the strength machines were established at twelve. Heart rate was monitored using the manual palpation technique (Pollock, Broida, Kendrick, 1972).

The FFCT was composed of twelve strength machines and twelve aerobic machines (Table 1). Participants alternated

between these modalities in intervals of 30 seconds followed by a 15 second time frame in which participants changed stations.

Prior to beginning station one, participants warmed-up on either a bicycle ergometer or running board for approximately five minutes or until the heart rate was elevated into the proper training zone. Upon completing station 24, participants cooled down by performing flexibility exercises for approximately five minutes (Table 2). This three phased program (Figure 1) was termed "The Essential Elements of Exercise" (Cardinal et al., 1989). Participants completed one FFCT per exercise session.

Following nine weeks of training in the FFCT program, a post-fitness assessment was conducted to ascertain changes. The post-fitness assessment was conducted in the same fashion as the pre-fitness assessment and the same tests were used.

RESULTS

Posttest data came from each of the 10,701 subjects who underwent pretesting. The mean improvement for each of the dependent variables are presented in Figures 3 and 4. As can been seen, positive changes were elicited in each of the dependent variables following a nine week, one set, FFCT exercise program with the exception of body weight. Muscular endurance had the greatest percent change, (range =

+3% to +25%), followed by total strength (range = +4% to +18%), flexibility (range = 0 to +18%), body fat composition (range = +1% to -8%), recovery heart rate (range = -.5% to -8%), diastolic blood pressure (range = +6% to -14%), resting pulse (range = +1% to -9%), systolic blood pressure (range = +7% to -6%), and total body weight (range = -.5 to +3%).

DISCUSSION

This study is limited in that a one group pretest-posttest design was used. This design threatens the internal validity of the study because history, maturation, and testing were not controlled for; however, the results of the current study are strengthened by those of DePaoli (1989) who found significant improvements in muscular endurance (15.8%), cardiorespiratory capacity/$VO_{2\ MAX}$ (5.4%), absolute strength (8.5%) and body fat composition (-6.4%) in twenty four males following only six weeks of FFCT in a smaller experimental study. DePaoli also noticed a slight increase in body weight (+.62%).

One is cautioned to not view these data as a having a causal effect. The preexperimental design chosen only allows for less definitive remarks. It was therefore

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1 Figures have been rounded.

concluded that FFCT does potentially enhance the variables of muscular strength, muscular endurance, cardiorespiratory endurance, flexibility, lean body composition, and diastolic blood pressure following nine weeks of training. Future studies should utilize a stronger experimental design and statistical procedures which allow for more definitive statements to be made regarding the efficacy of FFCT. As an early installment in this base of literature, the current study does provide some degree of hopefulness.

AUTHOR NOTES

The author would like to thank the faculty and students of the PEHR Department and "The Body Shop Wellness - Fitness Center" at Eastern Washington University for their assistance with the data collection. The author would also like to thank reviewers for their comments on an early draft of this document.

Table 1: Composition and arrangement of exercise stations in the FFCT

Station	Exercise	Repetitions
1	Shoulder Press	12 rep.
2	Running board	30 sec.
3	Bicep Curl	12 rep.
4	Bicycle ergometer	30 sec.
5	Leg Extension	12 rep.
6	Running board	30 sec.
7	Rear Deltoid/Trapezius	12 rep.
8	Bicycle ergometer	30 sec.
9	Seated Chest Press	12 rep.
10	Running board	30 sec.
11	Abdominal Board	12 rep.
12	Bicycle ergometer	30 sec.
13	Vertical Seated Rowing	12 rep.
14	Running board	30 sec.
15	Total Tricep	12 rep.
16	Bicycle ergometer	30 sec.
17	Lying Leg Curl	12 rep.
18	Running board	30 sec.
19	Lateral Deltoid	12 rep.
20	Bicycle ergometer	30 sec.
21	Pectoral Fly	12 rep.
22	Running board	30 sec.
23	Lower Back	12 rep.
24	Bicycle ergometer	30 sec.

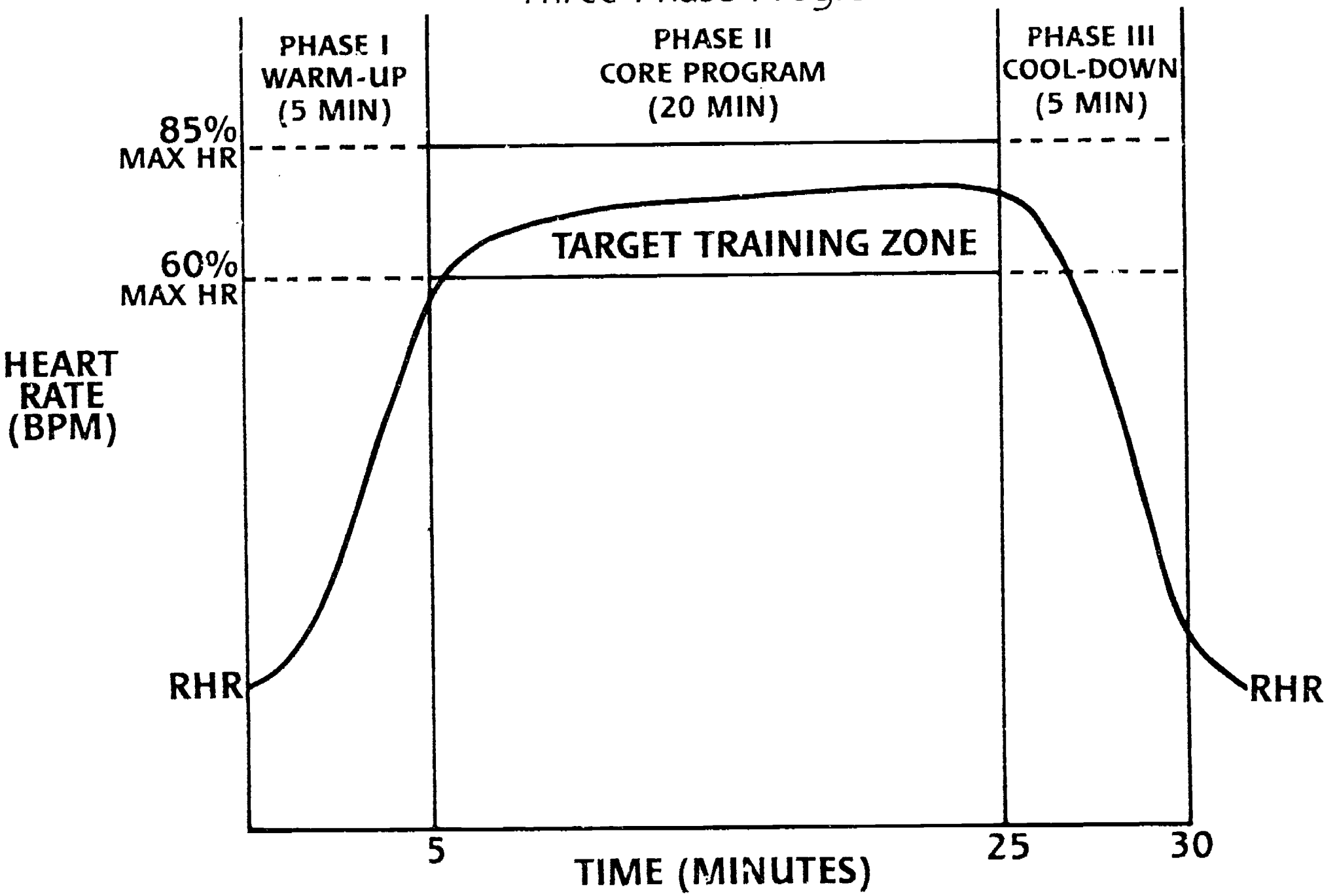
Table 2: Flexibility exercises performed by participants upon completing station #24 in FFCT

Exercise	Position held for	Repetitions
Chest stretch	5 full breaths	one
Tricep, shoulder back stretch	5 full breaths	one
Groin stretch	5 full breaths	one
Lower back stretch	5 full breaths	one
Quadricep stretch (repeated on both sides)	5 full breaths	one
Hamstring stretch (repeated on both sides)	5 full breaths	one
Calf stretch (repeated on both sides)	5 full breaths	one
Single leg tuck (repeated on both sides)	5 full breaths	one
Elongation stretch	5 full breaths	one

Figure 1:

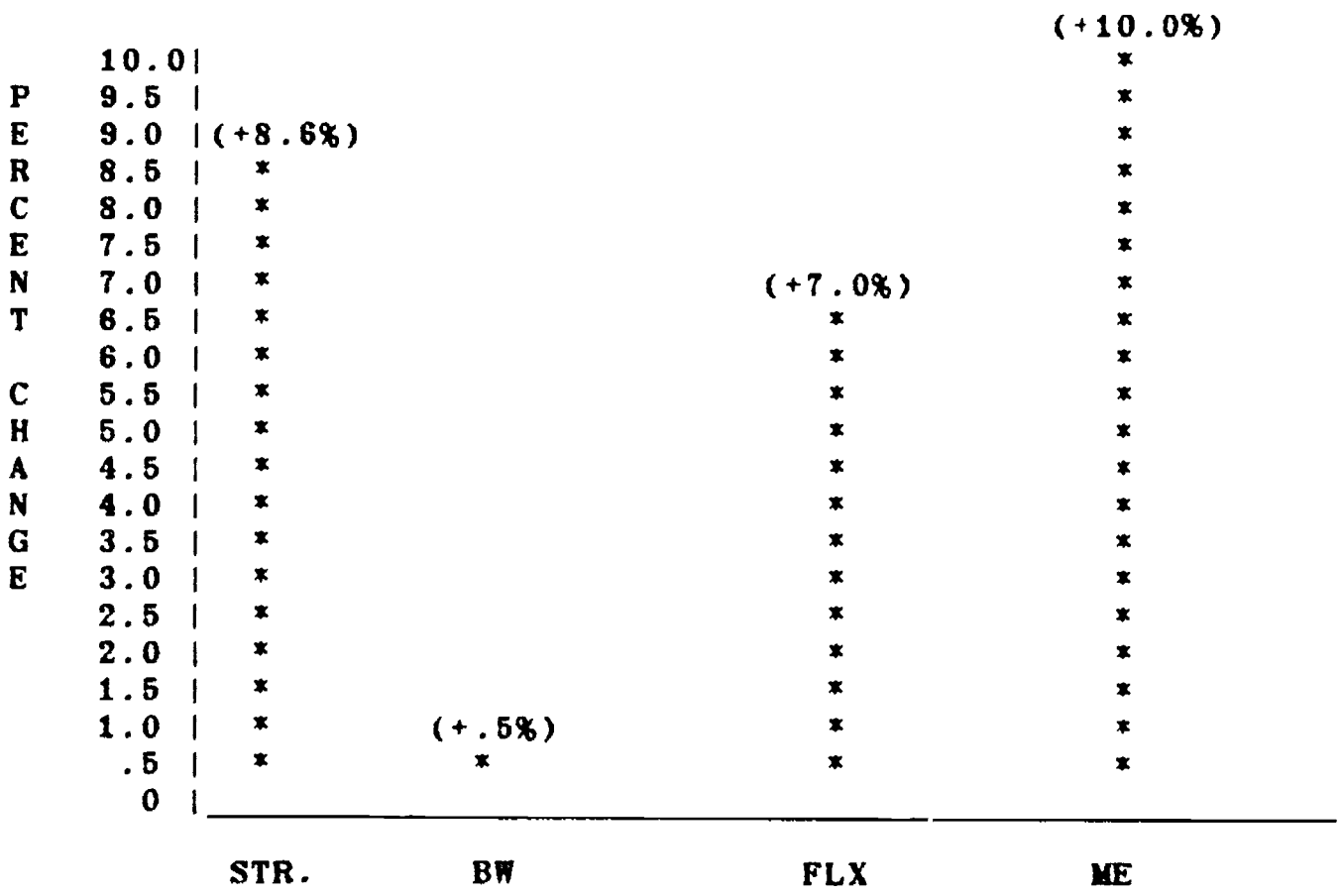
THE ESSENTIAL ELEMENTS OF EXERCISE

Three Phase Program



Source: Cardinal, B.J. & Krause, J.V. (1989). Physical Fitness: The Hub of the Wellness Wheel. Dubuque, Iowa: Kendall/Hunt. Used with permission of the authors.

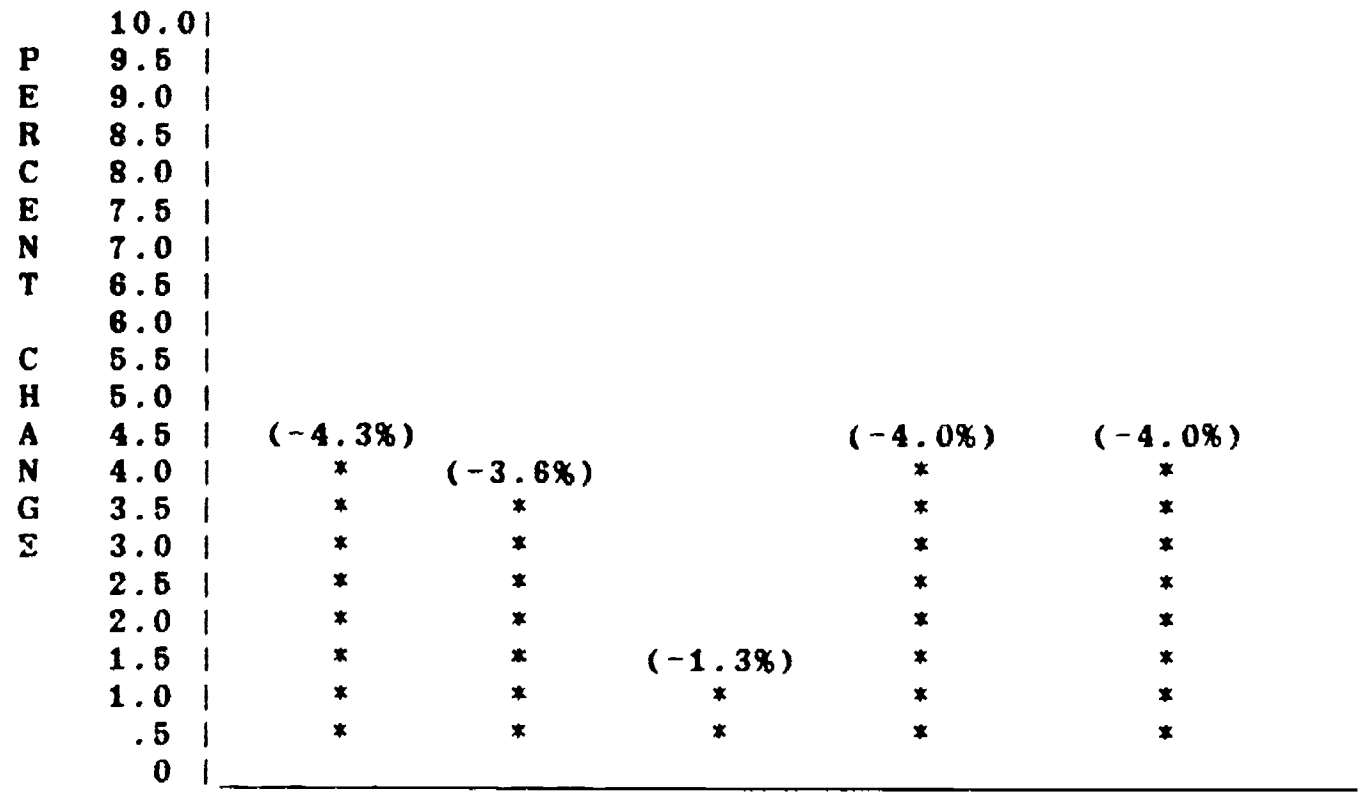
Figure 2: Dependent variables which increased following nine weeks of FFCT



STR. = total strength
BW = body weight
FLX = flexibility
ME = muscular endurance

Note: Figures have been rounded.

Figure 3: Dependent variables which decreased following nine weeks of FFCT



BFC = body fat composition
RP = resting pulse rate
SBP = systolic blood pressure
DBP = diastolic blood pressure
RHR = recovery heart rate

Note: Figures have been rounded.

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