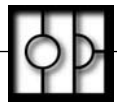


Research Article

Perception and Accuracy of Hispanics in South Florida in Estimating Energy Expenditure for Physical Activity

Valerie George, Su-Nui Escobar, and Cristen Harris

ABSTRACT

Background: *In 2004, in an attempt to address the current obesity epidemic, the United States Department of Health and Human Services announced a strategy to focus on educating the public on the concept of energy balance. The premise of "Calories Count" was that energy balance is primarily a function of calories in (energy in food) versus calories out (energy for physical activity).* ***Purpose:*** *The purpose of this study was to gain further insight into the accuracy of perceived energy expenditure for various intensities of physical activity.* ***Methods:*** *Over 600 individuals (21- 64 years of age), identifying themselves as Hispanic, were recruited from sites of the Department of Motor Vehicles in Miami, Florida. Participants were surveyed in English by a Hispanic interviewer and asked to provide information on their age, education, leisure time physical activity, height and weight. Participants were also asked to report how many calories they used/expended for ten standard physical activities.* ***Results:*** *Overall, only 30% of the participants accurately assessed their energy expenditure. The range in estimated calories for sedentary and vigorous physical activity for one hour was 0 to 4,000, and 0 to 20,000 calories, respectively. A majority of the participants underestimated energy expenditure for most activities. There was a significant ($p<0.001$) relationship between education and accuracy.* ***Discussion:*** *These findings suggest that further efforts are needed to educate at-risk populations about the "Calories Count" approach and energy balance.* ***Translation to Health Education Practice:*** *Future efforts should be made in collaboration with community gatekeepers to determine culturally sensitive methods to teach the public about: (1) the caloric value of various daily physical activities based on the duration and intensity of the activity in reference to body weight; and (2) the concept of energy balance and the component of physical activity.*

BACKGROUND

Recent analysis of the NHANES data (2003-2004) reported that 66% of adults age 20 years and older are either overweight or obese (32% obese).[1] Among Hispanics, the fastest growing population in the United States,[2] the rate is even higher. Approximately 73% of Hispanics are classified as overweight or obese.[3] Overweight and obesity are linked with higher risk for diabetes, cardiovascular disease, high blood pressure, and stroke. In addition, obesity and overweight may be related to increased risk of asthma, arthritis, certain cancers, gallbladder disease, and poor health status.[4] It has also been reported that the annual national health care expenditures related to obesity are estimated to range from $98 to $129 billion.[5] With the increased prevalance of overweight and obesity in the United States and the associated annual national health care expenditures, it is essential that efforts be made to gain further understanding of factors that might influence behaviors that effect weight management.

In 2004, the United States Department of Health and Human Services unveiled a new Food and Drug Administration strategy to aid in the campaign to reduce the ever-

Valerie George is a research associate professor at Stempel School of Public Health, University Park, HLS 455, Florida International University, Miami Florida 33199; E-mail: georgev@fiu.edu. Su-Nui Escobar is a nutrition educator for WIC, Miami, Florida 33166. Cristen Harris is an assistant professor at Bastyr University, Kenmore, WA 98028-4966.

rising problem of overweight and obesity.[6] This new strategy suggested focusing on educating the consumer on the concept of energy balance for weight control. This strategy stressed the "Calories Count" approach and reflects our understanding that, in general, overweight and obesity is the result of positive energy balance over an extended period of time[7] in relation to diet or energy intake, and energy expenditure, which includes physical activity. The rationale behind this strategy could be linked to such models as the Knowledge-Attitudes-Behavior Model[8] and the Transtheoretical Model of Change (i.e., the construct of consciousness-raising).[9]

It has been reported that eating fewer calories is a commonly used strategy for weight loss and weight maintenance[10-13] and information about calories in food has been reported as a successful aid to weight management.[11-12] However, a "Calories Count" approach may not be successful when people are inaccurate in their perception of either the calories in foods they eat or in the calories they think they expend for exercise or physical activity. There are some reports about knowledge and perception of calories in foods which indicate that people are not always accurate in their estimation of the number of calories in the foods they eat.[14-16] However, very little is known about the accuracy of perception for the number of calories used for various types of physical activity for the general population and for high-risk populations for obesity. In addition, it is unknown if such factors as age, sex, education, Body Mass Index (BMI), or culture might play a role in this issue.

Although there is a paucity of literature in this area, some insight on the potential impact of these factors on accuracy of perception of energy expenditure for physical activity can be obtained from a few reported studies. A recent meta-analysis on perceived fitness versus actual fitness reported that there was a significant correlation between age and accuracy of perception, with less accuracy associated with increasing age.[17] It has also been reported that males use exercise more frequently than females as a weight management strategy[18] and thus, perhaps they have a greater awareness of calories associated with physical activity. On the other hand, previous reports have indicated that females use calorie counting more frequently than males for weight management, and have a greater knowledge of calories overall.[19] In reference to education, it was reported that nutrition education improved accuracy in estimated calories in foods.[20-21] However, no studies have reported on education and knowledge of calories expended for various types of physical activity in adults.

Finally, a few studies have reported that factors influencing weight management vary among cultures and in reference to level of acculturation.[22-24] A recent review of the literature revealed that only three controlled weight-loss intervention studies have been published with Hispanic populations.[25] However, one study, the "Energy balance for Latinas in Texas: a qualitative assessment," revealed that Latino women reported that barriers to performing physical activities included lack of knowledge about physical activity in relation to both energy balance and to health.[26]

PURPOSE

The primary purpose of this study was to learn more about accuracy in perception of calories expended for various physical activities in Hispanic adults in an effort to have further understanding of how a "Calories Count" approach might work for weight management in this at-risk population. In addition, we investigated whether age, sex, education, BMI, and leisure-time physical activity related to accuracy in perception of calories expended for various types of physical activity. Based on very limited literature on this topic, we predicted that younger individuals and females would be more accurate in their estimations and that individuals with more education would have greater accuracy. In addition, we thought that BMI and level of leisure time physical activity might influence accuracy in perceived energy expenditure (calories) for various physical activities.

METHODS

Sample

Over 600 participants were randomly recruited from sites of the Department of Motor Vehicles in Miami-Dade County, Florida. At the time of the study there were 39 sites. The sites where participants were recruited were randomly selected; with one site out of every four being in predominantly Hispanic (Cuban) areas. These sites represented both genders and people of various ages, BMIs, levels of education, and levels of leisure time physical activity. As people waited in line to meet with an employee of the Motor Vehicle Department, they were asked if they would be willing to be surveyed by an interviewer. The response rate was good and approximately one out of three persons approached agreed to be surveyed. All participants provided a signed informed consent and prior to the study, approval was granted by the Institutional Review Board. Individuals were eligible to participate in the study if they reported that they were Hispanic, between 21-64 years of age, ambulatory, without disabilities, and able to understand and communicate in English. Obtaining information from the participants took about 10-15 minutes and data collection took place during a four-month period.

Data Collection and Assessment

All data were collected by a trained researcher who was Hispanic. The participant's age, ethnicity and education were obtained based on questions from the Behavioral Risk Factor Surveillance Survey.[27] Participants were also asked their current weight and height. Self- reported weight and height have been reported to be an acceptable method to determine BMI.[28] Each participant was asked to respond to the following question: *How many calories do you think you use/ burn/expend when you _____ for an hour?* The question was asked ten times with the insertion each time with one of ten physical activities: (1) sleep or rest; (2) sit; (3) stand; (4) get dressed; (5) walk at a leisurely pace; (6) do light manual work; (7) do light sport or leisure activity; (8) do moderate sport or leisure activities; (9) walk

at a brisk pace; and (10) do vigorous physical activity. The ten physical activities that were assessed were based on the Bouchard 3-Day Activity Record. The participants were given examples for each activity reflecting those in the Bouchard 3-Day Physical Activity Record.[29] For example, the activities for sitting included: eating, writing, reading, listening to the radio or TV, taking a bath.

The standard question on energy expenditure for the physical activities was developed by experts in the field and found to be acceptable for content and construct validity as described by Parmenter and Wardle, 2000.[30] This standard question was used in previously published studies for the evaluation of perception of moderate intensity physical activity.[31] In addition, single item questions have been used and reported in the literature to be valid and reliable for the assessment of perceived fitness and level of physical activity.[32]

The reliability of the questions on energy expenditure was tested through a pilot study among a convenience sample of 50 individuals who were representative of those from the same sites where study participants were recruited. Participants were surveyed at two time periods with a one-week interval between surveys. The paired sample correlation for the ten physical activities assessed ranged from 0.59 to 0.76.

Finally, participants were requested to respond to the four questions of the Godin Leisure Time Physical Activity Questionnaire.[33] This questionnaire is based on seven-day recall of strenuous, moderate, and mild exercise. This questionnaire has been reported to be valid and reliable.[34] A total leisure time physical activity score was calculated for each participant by multiplying frequency (times/week) by each of the physical activity levels (i.e., strenuous=9, moderate=5, and light=3). The sum of the individual scores provided a final leisure time physical activity score for each participant. The Godin leisure time physical activity questions were also tested in the pilot study as previously described. The paired sample correlations for the individual questions were high (range from 0.98 to 0.99).

Determination of actual energy expenditure for each type of physical activity

A standard formula was used to determine the actual energy expenditure (calories) for each participant for each of the ten physical activities assessed. This formula was the energy cost of each type of physical activity in kcal/kg/15-min intervals, which was multiplied by the individual participant's self-reported weight in kilograms, and then multiplied times 4. The result of this calculation was equal to the energy expenditure for 60 minutes for each specific intensity physical activity. The values for each activity were derived from the Compendium of Physical Activities.[35]

Statistical Analyses

Statistical analyses were performed using SPSS version 14.0 (SPSS Inc. Chicago, Ill, 2003). Estimation of calories, actual calories, and the percent difference between estimated and actual calories were described with ranges and medians. Frequencies were produced to describe gender, age, BMI, education, and leisure time physical activity levels for participants. Categories for BMI were created based on guidelines from the World Health Organization, using the following classifications: normal weight (BMI 19-24.9), overweight (BMI 25-29.9), and obese (BMI >30).[36]

Because the data were not normally distributed and since some previous research suggests that accuracy in perception of physical activity varies widely, we conducted Kruskal-Wallis ANOVAs on the percent difference for the physical activity levels by age, gender, BMI, education, and level of leisure time physical activity. Post hoc tests were done with Wilcoxon's Rank Sum Test with Holm's sequential Bonferroni procedure at $p<0.05$. Power analysis for the Kruskal-Wallis test with four groups yielded 99% power to detect a medium effect size of 0.25 ($p<0.05$) with a sample size of 600.

Cross tabulations were used to describe the percentage of participants estimating the caloric value for the different physical activities within different accuracy ranges (i.e., underestimating >50%, under- or overestimating within 50%, or overestimating >50%) of the actual value.

RESULTS

In this study, six hundred twenty-one people were surveyed. Three individuals were excluded from the study because of missing data. In total, 618 individuals, 298 females and 320 males, participated in the study. Descriptive characteristics of the participants in reference to education, sex, age, leisure time physical activity, and BMI are shown in Table 1. Approximately half (52%) of the participants were male and half were female (48%). The largest percentage of participants was between 21-30 years of age (34%), and only 16% were between the ages of 51-64 years of age. The majority of the participants had attended college (58%). Thirty-six percent of the participants reported that they were college graduates or had done graduate studies. Sixty percent of the participants were categorized according to reported leisure time physical activity as inactive, 29% as moderately active, and 11% as active. In addition, based on reported height and weight, 40% of the participants had a BMI placing them in the overweight category and 23% had a BMI categorizing them as obese.

Table 2 shows the range of estimated and actual calories for the different physical activities. There was an extremely wide range of estimated calories for all activities. The range for activities in estimated calories was as follows: sedentary (0 to 4,000), light (0 to 6,000), moderate (0 to 60,000), and vigorous (0 to 20,000). Table 2 also illustrates the median for both estimated and actual calories for the four categories of physical activity. The median for estimated calories vs. the median for actual calories was 47 vs.139 (sedentary), 133 vs. 265 (light), 190 vs. 291 (moderate), and 250 vs. 567 (vigorous) respectively. The median percent difference for sedentary, light, moderate and vigorous physical activity was -66%, -49%, -35%, and -56% respectively. The median percent difference represents the median energy expenditure and actual energy expenditure divided by the actual. About one-third of

Table 1. Descriptive Characteristics of Participants by Education Level*

	Total	High School or less (n=260)	Some College (n=135)	College Graduate (n=223)
Gender				
Male	320 (52)	135 (52)	61 (45)	124 (56)
Female	298 (48)	125 (48)	74 (55)	99 (44)
Age (years)				
21-30	212 (34)	80 (31)	59 (44)	73 (33)
31-40	168 (27)	79 (30)	35 (26)	54 (24)
41-50	143 (23)	54 (21)	26 (19)	63 (28)
51-64	95 (16)	47 (18)	15 (11)	33 (15)
Leisure Time Physical Activity				
Inactive	367 (60)	165 (64)	74 (56)	128 (58)
Moderately active	177 (29)	63 (24)	44 (33)	70 (32)
Active	66 (11)	30 (12)	15 (11)	21 (10)
BMI (kg/m2)				
Normal weight (<24.9)	231 (37)	87 (34)	52 (38)	92 (41)
Overweight (25-29.9)	247 (40)	108 (41)	51 (38)	88 (40)
Obesity (>30)	140 (23)	65 (25)	32 (24)	43 (19)

* n (%)

the participants were within 50% of the estimation for the actual number of calories. However, the majority of the participants underestimated the number of calories for all types of activity, particularly for sedentary activities. The greatest percentage of overestimation (25%) was for moderate sport or leisure activity.

Based on the results of the Kruskal-Wallis analyses, there were no significant differences between perceived and actual energy expenditure by age, BMI, gender, or leisure time physical activity. However, education proved to be a significant determinant for accuracy of estimation for all categories: sedentary physical activity, $\chi^2(2, N = 618) = 25.68$, $p<0.001$; light physical activity, $\chi^2(2, N = 616) = 36.42$, $p<0.001$; moderate physical activity, $\chi^2(2, N = 617) = 44.09$, $p <0.0001$; and vigorous physical activity, $\chi^2(2, N = 616) = 48.90$, $p<0.0001$. The post hoc tests indicated that participants with no more than a high school education were significantly less accurate in estimating energy expenditure for all four physical activity categories than participants who had some college or a college degree. This is illustrated in Figure 1 which shows level of education (high school or less, some college, or college graduate) in reference to the percentage of participants whose estimations for energy expenditure were within 50% of the actual calculated energy expenditure for each category of physical activity (sedentary, light, moderate, vigorous). So, for example, among participants with a high school education or less, only 22% were within ≤50% of the calculated energy expenditure for vigorous physical activity where as 42% of the college graduate were within ≤50% of the calculated energy expenditure for vigorous physical activity. This indicates that a larger percentage of those with a higher education were more accurate in their estimation of energy expenditure.

DISCUSSION

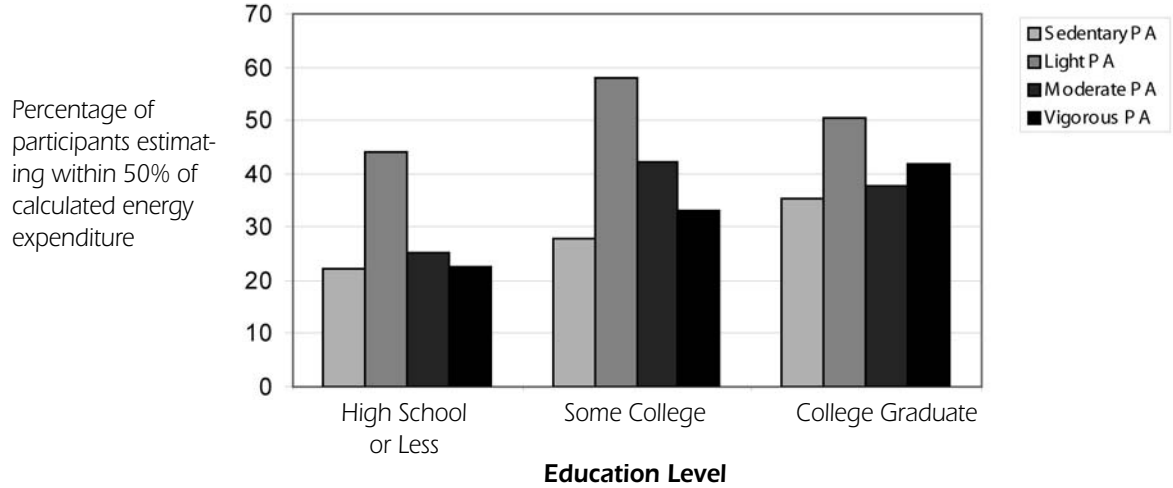
To our knowledge, this is the first study ever reported in Hispanic men and women on accuracy in perception of energy expenditure (calories) for various types of physical activity Furthermore, very little information has been reported on this topic for the population in general. Our results indicated that overall, only 30% of the participants were able to accurately estimate energy expenditure (within 50% of the calculated energy expenditure) for ten different activities representing sedentary, light, moderate, and vigorous physical activity. The majority of participants underestimated energy expenditure for the different types of physical activity. In addition, there was an extremely

Table 2. Range and Median for Estimated and Actual Calories and the Percentage of the Participants' who Estimated under, within and over 50% the Number of Calories for Sedentary, Light, Moderate and Vigorous Physical Activities*

	Range Estimated	Range Actual[a]	Median Estimated	Median Actual	% Under	% Within	% Over
Sedentary Activities			47	139			
Sleeping or resting in bed	0-3,000	43-170			54	24	22
Sitting quietly	0-1,500	62-249			69	19	11
Standing	0-4,000	93-373			65	25	10
Getting dressed, taking a shower or driving	0-3,000	115-458			68	23	9
Light Activities			133	265			
Walking-leisurely pace	0-5,500	115-458			56	30	14
Light manual work	0-6,000	136-543			53	29	18
Light sport or leisure	1-5,500	196-785			52	32	16
Moderate Activities			190	291			
Sport/ leisure activities	0-60,000	164-655			44	31	25
Walking-brisk pace	0-10,000	164-655			44	35	21
Vigorous Activities			250	567			
(i.e.,running, dancing)	0-20,000	319-1276			52	32	16

* Calculations based on duration (60 minutes) intensity of activity (sedentary, light, moderate, and vigorous) and body weight

Figure 1. Level of Education and Percentage of Participants Estimating within 50% or Less of Calculated Energy Expenditure for Various Intensity Physical Activities



large range in estimated energy expenditure for each activity. We also investigated accuracy of perception in reference to other factors including age, sex, BMI, education, and leisure time physical activity.

Education was the only significant variable we found to influence accuracy in perception of energy expenditure for physical activity. With the exception of light and moderate physical activity, college graduates were more accurate in their estimation of the number of calories for the physical activities

surveyed than less educated participants. Perhaps individuals with more education have greater exposure to information about the concept of energy balance and the number of calories used for various types of physical activity.

We predicted that younger individuals would be more accurate in their estimation of perceived energy expenditure for different physical activities based on a previous report on the association between perceived fitness and age.[17] However, we did not find this to be the case, perhaps this relates to the fact that perception of fitness is a variable that can be defined in many ways, while calories can be calculated. In addition, we thought that women would be more accurate in their perception although we did not find this to be true. This assumption was made based on the results of a previous study that reported that, in general, females use calorie counting more frequently than males for weight management, and have a greater knowledge of calories overall.[12] It has also been reported that females are more frequently concerned about their weight and diet than men.[10]

On the other hand, it should be considered that a number of reports have indicated that factors influencing weight management may vary not just among males and females, but also among cultures in reference to level of acculturation, particularly with regard to physical activity.[22-24] The "Energy balance for Latinas in Texas: a qualitative assessment" journal article found that Latino women reported that barriers to performing physical activities included lack of knowledge about physical activity in reference to energy balance and physical activity in relation to health.[26]

Another variable that was thought to influence perception of energy expenditure for physical activity was BMI. We thought it would be feasible that normal weight individuals might be more accurate in their estimation of energy expenditure for physical activity and hence their normal weight status. On the other hand, we also thought it might be feasible that individuals who are overweight are more concerned about energy balance and calories and thus perhaps are more accurate. However, our results indicated that BMI did not influence accuracy in perception of energy expenditure. Therefore, neither of the proposed rationales were conclusive.

Finally, we did not find a significant relationship between leisure time physical activity and accuracy of perception. In reference to leisure time physical activity, overall, the majority of the participants (60%) were categorized as inactive. Such results reflect the literature.[37] In order to evaluate the activity level of the participants in this study, we used the Godin Leisure-Time Physical Activity Questionnaire which, as indicated in the title, addresses only leisure time physical activity. Perhaps if accuracy in perception of energy expenditure (calories) for physical activity had been assessed either in reference to fitness level or total physical activity, including work activities, we might have found a different relationship.

Our study had some additional limitations. Participants were recruited from sites randomly selected from offices of the Miami-Dade County, Florida Department of Motor Vehicle in predominantly Cuban areas. Therefore, the sample was limited to individuals who were obtaining services in person rather than online. One of the eligibility criteria for our study was the ability to understand and communicate in English; therefore, our results cannot be applied to Spanish-speaking only adults. Also, since all the respondents spoke English, it might be that this group was more acculturated than other Hispanics not speaking English. Finally, the population evaluated was predominantly Cuban, and therefore, our results may not represent other Hispanic groups or the non-Hispanic population. However, since the prevalence of overweight and obesity in the Hispanic population is high (>73% of Hispanics classified as overweight or obese)[2] and the Hispanic population is the fastest growing ethnic group in the United States (projected to be the largest minority group by the year 2050—representing 25% of the United States), it seems very relevant to investigate factors influencing the risk of obesity in this population.[38]

In conclusion, this study provides some insight into what is understood about energy expenditure (calories) for physical activity. The results of this study indicated that the majority of the participants were inaccurate in their perception of energy expenditure for physical activity and there was an extremely large range in estimates. Even though the a majority of the participants underestimated energy expenditure for the physical activities, which might be interpreted as a benefit in reference to energy balance, these results also suggest that there is a lack of knowledge and understanding of energy expenditure (calories) for physical activity and this could have an impact on the "Calories Count" approach.

TRANSLATION TO HEALTH EDUCATION PRACTICE

The strategy stressing the "Calories Count" approach introduced by the United States Department of Health and Human Services in 2004 was created in an effort to emphasize the importance of the concept of energy balance. This effort was made to assist people in understanding that calories in the foods eaten as well as those used in the physical activity have an impact on energy balance and weight management. The fact that the majority of the participants surveyed were inaccurate in their estimation of energy expenditure for physical activity indicates there is a lack of knowledge about energy expenditure and physical activity.

These results suggest that additional efforts need to be made to educate the Hispanic population about energy expenditure associated with physical activity. A recent article suggests that if successful energy balance programs are to be designed and implemented, researchers must include two approaches.[39] One approach is to look at particular segments of the population and determine what will be culturally accepted and what appeals to that particular population. The second approach involves collaboration with community gatekeepers in order to understand more about the beliefs and attitudes of the community. Therefore, if the "Calories Count" approach is to have

maximum impact, future efforts should be made in collaboration with community gatekeepers to determine culturally sensitive methods to teach the public about: (1) the caloric value of various daily physical activities based on the duration and intensity of the activity and in reference to body weight, and (2) the concept of energy balance and the component of physical activity. Finally, the effectiveness of such education needs to be evaluated in diverse populations in well designed weight management interventions.

REFERENCES

1. National Health and Nutrition Examination Survey (7/03): Healthy weight, overweight, and obesity among U.S. adults. Available at: http://64.233.169.104/search?q=cache:rHjgQTne7ZcJ:www.cdc.gov/nchs/data/nhanes/databriefs/adultweight.pdf+cdc.gov/nchs/data/nhanes/databriefs/adultweight.pdf&hl=en&ct=clnk&cd=1&gl=us. Accessed 12/10/2007.

2. US Census Press Releases. Available at: http://www.census.gov/Press-Release/www/releases/archives/population/005164.html. Accessed 10/31/2008.

3. Flegal KM, Carroll MD, Ogden CL, et al. Prevalence and trends in obesity among US adults, 1999-2000. *JAMA.* 2002;288:1723-1727.

4. Mokdad AH, Marks JS, Stroup DF, et al. Actual causes of death in the United States, 2000. *JAMA*. 2004;291(10):1238-1245.

5. Finkelstein EA, Fiebelkorn IC, Wang G. State-level estimates of annual medical expenditures attributable to obesity. *Obes Res.* 2004;12(1):18-24.

6. FDA Consumer. HHS Tackles Obesity. Available at: http://www.fda.gov/fdac/features/2004/304_fat.html. Accessed 12/10/2007.

7. Lyznicki J, Young D, Riggs J, et al. Obesity: Assessment and management in primary care. *Am Fam Phys.* 2001;63:2185-2196.

8. Contento I, Balch GI, Bronner YL. Theoretical frameworks of models for nutrition education. *J Nutr Edu*. 1995;27:287-290.

9. Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *Am J Health Promotion.* 1997;12:38-48.

10. Kruger J, Galuska DA, Serdula MK, et al. Attempting to lose weight: specific practices among U.S. adults. *Am J Prev Med.* 2004;26:402-406.

11. Kruger J, Blanck HM, Gillespie C. Dietary and physical activity behaviors among adults successful at weight loss maintenance. *Int J Behav Nutr Phys Act.* 2006;3:1-16.

12. Wing RR, Phelan S. Long-term weight loss maintenance. *Am J Clin Nutr.* 2005;83(1):222S-225S.

13. Klem ML, Wing RR, McGuire MT, et al. A descriptive study of individuals successful at long-term maintenance of substantial weight loss. *Am J Clin Nutr.* 1997; 66:239-246.

14. Wansink B, Chandon P. Meal size, not body size, explains errors in estimating the calorie content of meals. *Ann Intern Med.* 2006;145:326-332.

15, Carels RA, Harper J, Konrad K. Qualitative perceptions and caloric estimations of healthy and unhealthy foods by behavioral weight loss participants. *Appetite.* 2006:49:199-206.

16. Carels RA, Konrad K, Harper J. Individual differences in food perceptions and calorie estimation: An examination of dieting status, weight, and gender. *Appetite*. 2007;49:450-458.

17. Germian J, Hausenblas H. The Relationship between perceived and actual physical fitness: a meta-analysis. *J Appl Sport Psych.* 2006;18:283-296.

18. Weiss EC, Galuska DA, Khan K, et al. Weight-control practices among U.S. adults, 2001-2002. *Am J Prev Med.* 2006;31:18-24.

19. French SA, Jeffery RW, Wing RR. Sex differences among participants in a weight-control program. *Addict Behav*. 1994;19(2):47-158.

20. Champagne CM, Bray GA, Kurtz AA, et al. Energy intake and energy expenditure: a controlled study comparing dietitians and non-dietitians. *JADA.* 2002;102:1428-1432.

21. Slattery ML, Sweeney C, Edwards S, et al. Physical activity patterns and obesity in Hispanic and non-Hispanic white women. *Med Sci Sports Exerc*. 2006;38(1):33-41.

22. Dias VA, Mainous III AG, Pope C. Cultural conflicts in the weight loss experience of overweight Latinos. *Int J Obes*. 2007;31:328-333.

23. Breitkopf CR, Berenson AB. Correlates of Weight Loss Behaviors Among Low-Income African-American, Caucasian, and Latina Women. *Am J Obstet Gynecol*. 2004;103(2).

24. Hubert HB, Snider J, Winkleby MA. Health status, health behaviors, and acculturation factors associated with overweight and obesity in Latinos form a community and agricultural labor camp survey. *Prev Med.* 2005;40:642-651.

25. Lindberg NM, Stevens VJ. Review: Weight loss interventions with Hispanic populations. *Ethn Dis.* 2007;17(2):397-402.

26. Ramirez AG, Chalela P, Gallion K, et al. Energy balance for Latinas in Texas: a qualitative assessment. *Prev Chronic Dis.* 2007;4(4):1-12.

27. National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control. Behavioral Risk Factor Surveillance System: Questionnaires. Available at: http://www.cdc.gov/brfss/questionnaires/questionnaires.htm. Accessed July 18, 2004.

28. Stunkard AF, Albaum JM. The accuracy of self-reported weights. *Am J Clin Nutr.* 1982;34:1593-1599.

29. Bouchard C, Tremblay A, Leblanc C, et al. A method to assess energy expenditure in children and adults. *Am J Clin Nutr.* 1983;37:461-467.

30. Parmenter K, Wardle J. Evaluation and design of nutrition knowledge measures. *J Nutr Educ.* 2000;32:269-277.

31. Visona C, George VA. The impact of dieting status and restraint on post-exercise energy intake in overweight females. *Obes Res.* 2002;10:1251-1258.

32. Godin G, Shephard RJ, Colantonio A. The cognitive profile of those who intend to exercise but do not. *Public Health Rep*. 1986;101:521-526,

33. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. *Can J Appl Sport Sci.* 1985;10(3):141-146.

34. Jacobs DR, Anisworth BE, Hartman TJ, Leon AS. A Simultaneous evaluation of 10 commonly used physical activities questionnaires. *Med Sci Sports Exerc*. 1983;25:81-91.

35. Ainsworth BE, Haskell WW, Whitt MC, et al. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc.* 2000;32:S498-504.

36. WHO Consultation on Obesity. Obesity: Preventing and managing the global epidemic. *World Health Organization Tech Report Service.* 2000;894:1-253.

37. Centers for Disease Control and Preven-

tion. Trends in Leisure-Time Physical Inactivity by Age, Sex, and Race/Ethnicity --- United States, 1994--2004. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5439a5.htm. Accessed 12/10/2007.

38. U.S. Census Bureau National Population Projections of the United States by age, sex, race, Hispanic origin, and nativity:1999-2100. Available at: http://www.census.gov/population/www/projections/natsum.html. Accessed 12/10/2007.

39. Van Duyn MS, McCrae T, Wingrove BK, et al. Adapting evidence-based strategies to increase physical activity among African Americans, Hispanics, Homong, and Native Hawaiians: A Social Marketing Approach. *Prev Chronic Dis.* 2007;4(4):1-16.