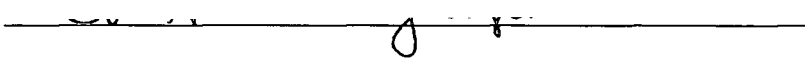


AN ABSTRACT OF THE THESIS OF

Janet G. Mann for the degree of Master of Science in Nutrition and Food Management presented on October 2, 2001. Title: Short and Long-Term Effectiveness of a Weight Loss Program.

Abstract approved: _____


Constance Georgiou

The purpose of this study was to determine that a behavioral lifestyle modification approach to weight loss changes participants' dietary intake and physical activity levels and that these changes were associated with weight loss and weight loss maintenance. Behavioral factors important in other weight control studies were also investigated to see if they are important indicators of successful weight control in this program as well. A group of previously validated questionnaires, along with a weight history written for this study, was administered to current participants in Providence Health System's Smart CHOICES program both before and after program participation. The same questionnaires were administered to past participants in a one-time follow-up for the CHOICES program approximately 2 years after program completion. The study found that current participant successful weight losers did decrease their percentage of energy intake from fat more than did non-successful weight losers over the course of the program. Also, successful

weight losers decreased their caloric intake and increased physical activity levels during the program and these changes did not occur in non-successful weight losers. The Eating Inventory scales for cognitive restraint and Westenhoefer's flexible control showed expected increases and disinhibition and hunger scores showed expected decreases among successful weight losers. However, non-successful weight losers showed these same changes except for the hunger scores, which did not decrease during the program. There were no differences found between past participant weight loss maintainers and non-maintainers in caloric intake, percentage fat intake, physical activity levels, Eating Inventory scales, or flexible and rigid control. When compared to successful weight losers among the current participants, there were suggestions that past participant weight loss maintainers and non-maintainers regressed toward their pre-treatment levels in percentage of fat intake, physical activity levels, and flexible control scores over time. While the Smart CHOICES program is effective in bringing about short-term behavior change to produce weight loss, maintenance of weight loss is a problem in this program as it is in other lifestyle modification programs. The factors differentiating successful weight maintenance from weight regain after loss in this program were not identified.

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Short and Long-Term Effectiveness of a Weight Loss Program

by

Janet G. Mann

A THESIS

Submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Presented October 2, 2001
Commencement June 2002

Master of Science thesis of Janet G. Mann presented on October 2, 2001

APPROVED:

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Janet G. Mann, Author

ACKNOWLEDGMENTS

Constance Georgiou, PhD, RD, LD was instrumental in guiding and offering suggestions during the planning and carrying out of the current research.

Dr. Georgiou also helped plan and review writing up the results of the research.

Sandy S. Miller, MS, RD, LD Coordinator of Health Education Services at Providence Health System helped substantially by providing information on previously conducted outcome follow-up studies and information about the Smart CHOICES and CHOICES weight control program as well as assisting in the recruitment of subjects for the current research.

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DEDICATION

Dedicated to my supportive husband, John R. Mann and in loving memory of my parents, Eleanor G. and George A. Gwin, Jr.

SHORT AND LONG-TERM EFFECTIVENESS OF A WEIGHT LOSS PROGRAM

INTRODUCTION

Objective

The purpose of this study is to determine that a behavioral approach to weight loss, as represented by Providence Health System's Smart CHOICES and CHOICES programs, will change the dietary intake and physical activity levels of a portion of its participants and that these changes will be associated with weight loss and weight loss maintenance. Additionally, this study will explore whether certain behavioral attitudes and psychological indicators, which have been identified as important in other weight control studies, will also be important indicators of successful weight loss and weight loss maintenance in the Smart CHOICES and CHOICES programs.

Background

Obesity is becoming more prevalent in the United States (1) and throughout the world (2). When this is coupled with our lack of success in treating obesity (3), real concern exists for the potential increase in health risks associated with obesity (4), increased incidence of disease (5, 6), and death (7). Most participants in behavioral treatment for obesity, regain all weight lost and return to baseline levels

in 3-5 years (8). This does not mean that all participants regain all weight lost. Average weight loss in 20-22 weeks of treatment is 8.5 kg, which decreases to 5-6 kg average net loss at 4-5 years post-treatment (9). The typical pattern for weight regain is that participants regain 30-35% of the weight loss in the year following treatment and after 5 years, 50% or more of the participants have regained to their baseline weight (9).

How do these typical results of clinical trials compare with an actual dietetic practice situation? That is what the current research attempts to answer, as well as identify those factors that are associated with successful weight loss and weight loss maintenance in a particular program. As such, the current research answers the call for clinical dietetic outcome research made by Polly Fitz, MA RD as president of the American Dietetic Association in 1997 (10). It also conforms to the suggestion made by Eck et al. for collaboration between the academic/research community and clinical dietitians in conducting needed clinical dietetic outcome research (11). The effectiveness of our treatments as dietitians can only be demonstrated in such a formal and controlled fashion. Such research can also suggest future improvements that can continue to increase program effectiveness.

A recent observational study has found evidence of even more effective long-term maintenance of weight loss and the factors associated with it than can be claimed by standard behavioral weight loss programs. Klem, Wing, McGuire, Seagle, and Hill sought out these individuals through general advertisements and enrolled them in the National Weight Control Registry (NWCR) as volunteer study

participants (12). As a group, these successful weight loss maintainers lost an average of 30 kg (66 lb) and maintained a minimum of 13.6 kg (30 lb) weight loss for 5.5 years. The researchers then studied the dietary, physical activity, attitudinal, and psychological characteristics of these successful weight loss maintainers using quantitative and semi-quantitative measures (12, 13, 14, & 15). After following their subjects for 1 year, they re-administered the measurement tools in an effort to see if some of the subjects started re-gaining weight and how they differed from those continuing to maintain their weight loss (16). The same research group repeated the study utilizing a random telephone survey (17) to determine the incidence of weight loss maintenance in the general population. They found that among subjects who were overweight at their maximum body mass index (BMI; defined as $[\text{weight in kg}] / [\text{height in m}]^2$) and who reported intentional weight loss of 10% or more of their body weight, 49.5% had maintained an average loss of $45.5 \text{ lb} \pm 31.7 \text{ lb}$ (mean \pm SD) for an average of 7.2 ± 8.5 years.

Though the possibility of successfully sustained weight loss is suggested by this research, the factors that determine successful maintenance of weight loss are still being elucidated. It is possible that different factors have differing relative importance in the various stages of the weight loss/maintenance process. For instance, a decrease in caloric intake may be more important during the weight loss phase than during weight maintenance. The 3-year Pound of Prevention study (18), which evaluated the effectiveness of an intervention in preventing weight gain with age in a community sample, suggested this by showing that those who lost weight

over the 3-year period were more likely to show a decrease in caloric intake than those who gained weight. While caloric restriction plus exercise does not significantly increase weight loss over caloric restriction alone in the weight loss phase (19), it does seem to be implicated in long-term maintenance of weight loss. The NWCR study suggests that while a low fat, low calorie diet is necessary for long-term maintenance of weight loss among those using behavioral methods to control their weight (14), use of a low fat, low calorie diet does not differentiate between those who continue to maintain weight loss and those who subsequently regain weight (16). This is confirmed by Jeffery et al.'s study (20) that showed weight regain at 18 months after treatment induced weight loss despite continued maintenance of a low calorie, low fat diet as measured by both a 60-item Block Food Frequency Questionnaire and a series of three 24-hour dietary recalls. The factors that differentiate between maintainers and re-gainers in the NWCR Follow-up (16) are total caloric expenditure in physical activity, higher levels of cognitive restraint (a measure of the conscious attempt to decrease food intake), and lower levels of perceived hunger, disinhibition (a measure of the loss of control of eating), and depressive symptoms. The importance of regular physical activity in weight maintenance has been implicated in other studies (18, 21, 22) and in one review (23). The Pound of Prevention study (18) implicated strenuous activity as particularly important while a Finnish study of determinants of weight loss maintenance after a very low calorie diet (21) suggested increased general lifestyle physical activity was most important.

Though each of the factors suggested by the NWCR has been studied individually, the current study will attempt to investigate all of these factors in an actual dietetic practice situation. The Providence Health System Smart CHOICES weight control program was chosen to study since it is an organized, consistent program that offers the potential of a sufficient sample size. The basic philosophy of the program is to provide a behavioral approach that focuses on permanent lifestyle changes to bring about weight loss and weight loss maintenance (24). This is a different emphasis and a less rigid approach than the early behavioral weight loss programs (9). For instance, rather than prescribing a particular diet, it emphasizes permanently changing food habits in the direction of lower fat and lower calorie intake. Food diaries are used to increase awareness of actual eating behavior rather than to check compliance with a particular diet. It does not emphasize a continuing care approach that has been advocated by Foreyt and Poston as the only way to improve the long-term outcome of behavioral weight loss programs (8). This study will attempt to confirm whether this approach can be effective in changing dietary intake and physical activity over both the short and long term; and also, whether there are certain additional behavioral attitudes and psychological indicators that are important for successful weight loss and weight loss maintenance in such a program. Currently the program is called the Smart CHOICES program (24), and in 1998 it was called the CHOICES program.

A previous outcome follow-up (personal communication of unpublished results from Sandy S. Miller, MS RD May, 2000) was done in 1998 on 1996

CHOICES program participants. The sample size was small and represented 21% of the original 272 participants. The primary outcome measure was maintenance of weight loss with secondary measures of client perceptions about continued changes in food and eating habits, exercise level, interpersonal behavior, self-esteem, and health as a result of the CHOICES program. The current research attempts to extend those findings by studying a group of current participants, before and after program participation, and a group of past participants using previously validated objective measures of food intake, physical activity, eating attitudes, and depressive symptomatology.

Hypotheses

Diet Related

1. Current Smart CHOICES participants

Successful weight losers (≥ 5 lb weight loss) in the current Smart CHOICES program will have decreased relative caloric intake and the percentage of energy intake from fat more than non-successful weight losers (< 5 lb weight loss) from the beginning to the end of the program.

2. Past participants of the CHOICES program

At 22-26 months after completing the program, weight loss maintainers (< 5 lb regained since completion of the program) will have a lower relative caloric

intake and a smaller percentage of energy from fat than non-maintainers (≥ 5 lb regained since completion of the program).

Exercise Related

3. Current Smart CHOICES participants

Successful weight losers currently in the Smart CHOICES program will increase more in total leisure time physical activity from baseline to completion of the program than non-successful weight losers.

4. Past participants of the CHOICES program

Among past program participants, there will be a higher level of total leisure time physical activity and strenuous exercise among weight loss maintainers than among non-maintainers.

Behavior Related

5. Current Smart CHOICES participants

a. Successful weight losers will have higher scores in flexible control, as measured by Westenhofer's flexible control scale, at the beginning of the program compared to non-successful weight losers.

b. Non-successful weight losers will have higher scores on disinhibition, as measured by the Eating Inventory at the beginning of the program, compared to successful weight losers.

c. Successful weight losers will have fewer symptoms of depression as measured by the CES-D at baseline than those who are non-successful weight losers.

d. Successful weight losers will increase more in flexible control as measured by the difference between beginning and ending scores on Westenhoefer's scale than non-successful weight losers.

e. Successful weight losers will decrease more in disinhibition, as measured by the difference between beginning and ending scores on the Eating Inventory, than non-successful weight losers.

6. Past participants of the CHOICES program

a. At 22-26 months after completing the program, weight loss maintainers will have higher scores in flexible control than non-maintainers on Westenhoefer's scale.

b. Non-maintainers will have higher dietary disinhibition scores than weight loss maintainers on the Eating Inventory.

c. Non-maintainers will have higher rigid control scores than weight loss maintainers on Westenhoefer's scale.

Overall Importance

7. Current Smart CHOICES participants

Among current participants, relative caloric intake at the end of the Smart CHOICES program will be more strongly related to successful weight loss than the percentage of energy from fat and leisure time physical activity.

8. Past participants of the CHOICES program

Among past participants, total leisure time physical activity, and strenuous exercise in particular, will be more strongly related to successful maintenance of weight loss than will be relative caloric intake and the percentage of energy from fat.

LITERATURE REVIEW

Current Treatment Approaches

A recent review (3) has effectively outlined the primary problem with current weight loss treatments; the majority of people who lose weight regain most of the weight lost in 3-5 years after treatment. So, the problem is not how to help people lose weight but how to do it in a manner that keeps the weight off. The authors point out that the natural history of weight loss is remarkably consistent among patients participating in behavioral treatments for obesity. The initial rate of weight loss is rapid and slowly declines so that the point of maximum weight loss is usually reached 6 months after initiation of treatment. After that, weight regain begins and continues until weight stabilizes somewhat below baseline levels at 3-5 years. This same pattern occurs regardless of whether the initial weight loss was large or small. Those patients with a more rapid initial rate of weight loss also have a more rapid rate of regain so that net results are indistinguishable at 4 years post-treatment (3, 25).

Cognitive Behavioral Treatment of Obesity

Behavioral treatments for obesity have been called the foundation (25) and the gold-standard (26) of dietary and lifestyle treatments for obesity. The Smart CHOICES and CHOICES programs studied in the present research represent this

type of treatment. In the 1970's, behavioral treatments were based on the self-control model from psychological learning theory and used behavior modification to change eating behavior to produce a negative energy balance and create weight loss (26). Later inactivity was added to overeating as an appropriate target behavior for change (25). With the development of cognitive approaches to behavior change, cognitive restructuring was added to help modify "self-defeating" thoughts and feelings (25). As mentioned earlier in the Introduction, the results of behavioral treatment summarized from 1991-1995 show that patients lose an average of 8.5 kg over 22.2 weeks of treatment and have a net weight loss of 5.9 kg at 47.7 weeks after initiation of treatment (9). When these results are compared with earlier behavioral treatments, the length of treatment has increased by about the same proportion as the amount of weight lost. In 1974, the average treatment was 8.4 weeks while in 1991-1995 it was 22.2 weeks. Weight loss per week has remained fairly stable at 0.5 kg per week in 1974 to 0.4 kg per week in 1991-1995 (9). About 80% of patients who begin treatment complete it (9).

Treatment starts with setting behavioral goals based on a functional analysis of eating and physical activity behaviors. Monitoring progress continues through the use of food and activity records. Stimulus control is utilized to stop urges to overeat or to be inactive. Examples would be to keep high calorie tempting foods out of the house, to not grocery shop when hungry, or to leave the television turned off during certain periods of the day. Since some stimuli cannot be avoided, efforts to extinguish the connection between particular stimuli and the avoided behavior

are made using a behavior modification technique called exposure with response prevention. This is also called learned self-control. The new aspect of cognitive restructuring is used to modify self-defeating cognitions, to set realistic goals for weight loss and to be satisfied with them, to improve body image, and to acknowledge the likelihood of lapses and prevent them from becoming relapses (26).

More recent research on habits and the influence of plans for behavior change on implementing behavior changes have supported the cognitive behavioral approach by confirming some of the underlying techniques with basic research. Ouellette and Wood (27) showed in their meta-analysis that past behavior has an important effect in influencing current behavior when contexts are stable, there is frequent opportunity to perform the behavior, and the behavior is relatively easy to perform. In other words, past behavior determines future behavior when habits are involved with continuing behavior. This has implications both for the likelihood that old habits will continue unless the stable contexts are upset and the need to develop a new stable routine that is practiced frequently in order to establish a new habit. In contrast, Ouellette and Wood (27) point out that conscious intention is an important determinant of future behavior in situations where the supporting context is unstable and opportunity for performing the behavior is infrequent. So making plans with behavioral goals is an important step in implementing new behaviors. Gollwitzer and Brandstätter (28) go one step further in showing that forming implementation intentions, detailed plans of exactly what will be done when a

certain situation arises, greatly increase the likelihood that hard tasks will be completed. This confirms that besides forming behavioral goals, plans for implementation as practiced in cognitive behavioral therapy are important in bringing about a behavior change. Of note in Gollwitzer and Brandstätter's research is that implementation intentions suggested by another person, not necessarily self-generated by the subject, are also effective in producing a planned behavior. This indirectly supports the therapist's role in cognitive behavioral therapy in helping bring about behavior change.

Cognitive behavioral approaches are often combined with other approaches including low calorie diets, very low calorie diets, low fat *ad libitum* diets, exercise, and general lifestyle change. The following sections describe research reported in each of these areas since the 1991-1995 summary data indicated earlier (3).

Low Calorie Diets and Very Low Calorie Diets

Two of the possible dietary treatments for weight loss are low calorie diets (LCD's) and very low calorie diets (VLCD's). A low calorie diet (LCD) typically consists of mixed foods totaling 1200-1800 kcal/day depending on initial body size and gender (29). A very low calorie diet (VLCD) program usually consists of one phase lasting 4 weeks to 6 months (depending on the program) that is made up entirely of a commercial low calorie drink that provides between 450 and 1100 kcal/day. This is followed by either a LCD or a low fat, high fiber diet consisting of ordinary foods (30, 21, 31, 29).

One recent report of improved weight maintenance after a LCD intervention is the Trevoze Behavior Modification program in Philadelphia, PA. (32). They show a 17.3% net mean weight loss (15.7 kg net mean weight loss) at 5 years after initiation of treatment. This represents the 22% of the participants who successfully completed the first 5 weeks of treatment and remained in the treatment program at 5 years after initiation of treatment. Among the 78% who completed the first 5 weeks of treatment but dropped out of the program sometime later, 58% were contacted at the 5-year follow-up. They had maintained a 4.7% net mean weight loss (4.5 kg weight loss). From these results the researchers concluded that staying in the program greatly increases the successful long-term maintenance of large weight losses. Of note are the unique aspects of this particular behavior modification program. Participants are dismissed from the program if they do not meet pre-determined attendance and weight loss goals. Thus, continued participation in the program for 5 years represents those individuals both able to meet initial weight loss goals and later weight maintenance goals. In the study population, they represented 37 out of 171 program members. It is unusual that contingencies are based on weight loss goals rather than more readily observable behaviors such as food intake and physical activity over which participants have direct control. Weight loss is a result, not a modifiable behavior (33).

Among the 4 studies found that were published after 1995 and describe use of a VLCD, mean weight loss varied widely depending on the length of time the VLCD was used. A Dutch study showed a mean weight loss of 10.7 kg in 4 weeks

(31), A Finnish study showed a mean weight loss of 13.5 kg in 7 weeks (21, 34), a Swedish study showed a mean weight loss of approximately 16 kg in 12 weeks (29), and an American study showed a mean weight loss of 29.7 kg in 4-6 months (30). All these levels of weight loss greatly exceed the average 8.5 kg loss reported for behavioral treatment programs from 1991-1995 (9). When it comes to follow-up, net weight loss ranged from 4.7 kg (44% of initial weight loss) at 1 year in the Dutch study (31), to 13.1 kg (97% of initial weight loss) at 1 year in the Finnish study (21), to 9.2 kg (58% of initial weight loss) at 2 years in the Swedish study (35), and 8 kg (27% of initial weight loss) at 3-5 years in the American study (30). A probable reason for the large difference in percentage weight maintenance between the 1 year follow-ups in the Dutch and Finnish studies was that the Dutch study provided no recommendations to subjects regarding diet or physical activity after the initial weight loss phase (31), while the Finnish study provided 40 weeks of weekly meetings during the weight maintenance period immediately following the 12-week active treatment phase (21). Both the Swedish (29) and the American studies (30) also offered weight maintenance programs for 9 and 18 months respectively.

Of note, is that the Swedish study offered a LCD control group as comparison for the VLCD and they found no significant difference in net weight loss at 2 years between the VLCD (9.2 kg) and the LCD (6.3 kg) groups. At an approximate maximum weight loss of 8 kg at 6 months, the LCD group lost only 50% of the weight initially lost by the VLCD group (29). The American study with

their much longer follow-up was able to describe the trend for regain as occurring rapidly for the first 3 years at a rate of 2.5% regain per month and then maintenance of a stable weight for 3-7 years (30). The primary differences since the recent review (3) are that long term results are similar between LCD's and VLCD's except when the VLCD weight loss period is long and creates substantial weight loss as with the American study. In any event, weight regain with a VLCD is usually substantial.

Low Fat Diets

Another behavioral approach to changing energy balance is the institution of a low fat diet. This intervention is aimed at the proposed causal association between high fat intake and the development of obesity (36, 37, 38). Epidemiological studies have pointed in this direction and are represented by Bray and Popkin's compilation of data from various countries on the prevalence of overweight ($BMI \geq 25$) and the percentage fat intake in the typical diet. They showed a large, significant, positive association between dietary fat consumption and the proportion of the adult population who were overweight (36). Dissenters to the viewpoint for this causal association (39) point to countries like South Africa, the Russian Federation, and Saudi Arabia who have a high prevalence of overweight, 48%-56% of the population, yet have typical diets with 25% or less of energy from fat (36). While most point out that a high fat intake is not the only reason for a high incidence of obesity (36, 37, 38), countries that increase their

percentage of fat intake over time do have an increased prevalence of obesity over time (36).

Longer-term results for a low fat diet used in weight control are represented by 3 recent studies giving follow-up periods of from 9 months to 2 years. The first study, by Schlundt et al. (40), used a 16-20 week behavioral weight loss program in which 60 subjects were randomized to either a low fat *ad libitum* diet or a low calorie diet. In both interventions the subjects kept detailed records of their food intake. For the low fat *ad libitum* diet they were restricted to a goal of 25 g fat intake per day and kept records to document achievement of this goal on a daily basis. The low calorie diet consisted of a 1200 kilocalorie diet for women and a 1500 kilocalorie diet for men. They documented caloric intake for each of the foods on their daily food record. Over time, food diary compliance fell off in both groups so that 43% of the diaries were returned in the low fat group and 51% of the diaries were returned in the low calorie group. The low calorie group lost more weight, 8.8 kg in 16-20 weeks of treatment versus 4.6 kg in the low fat group, and had a lower average caloric intake, 1265 kcal/day versus 1425 kcal/day in the low fat group. Though this latter difference in average caloric intake is not significant, the researchers were able to show a significant difference in total energy and carbohydrate intake in 4 of the first 6 weeks of treatment (when compliance with diary completion was better) between the low calorie and low fat groups. At 9-12 month follow-up, the average net weight loss was 5.5 kg in the low calorie group

and 2.6 kg in low fat group, which does not reflect a significant difference between the two groups.

The second study, by Jeffery et al. (20), also used a behavioral weight loss program in which 122 women subjects were randomized into 2 treatment conditions, a low fat counseling group and a low calorie counseling group. Group meetings were held weekly for the first 6 weeks, every other week for the next 20 weeks, and monthly through the end of the study at 18 months. They were also instructed to keep food record diaries and either document grams of fat intake per day for the low fat group or daily caloric intake for the low calorie group. The goal for the low fat group was 20g fat intake per day and the goal for the low calorie group was either 1000 or 1200 kilocalories per day depending on initial body weight (20). Evaluation of compliance with dietary goals was made by three 24-hour recalls done at each of three time points, baseline, 6, and 12 months and a reduced Block 60-item food frequency questionnaire at baseline, 6, 12, and 18 months. Mean weight loss in both groups was 8-10 lb at 6 months with no significant difference between the 2 groups. After 6 months, both groups started regaining weight so that at 18 months the average weight was above baseline and not significantly different between the 2 groups. No significant differences in caloric intake were noticeable at any time point between the low calorie and low fat groups. The low calorie group showed a slight increase in caloric intake between the 6-month and 12-month evaluations, which corresponded to a slight increase in mean body weight. The biggest difference between the 2 groups was that the

participants in the fat counseling group were more compliant with treatment instructions (attendance at treatment visits and completion of assigned food diaries), reported greater success in reaching their dietary goals, rated their diet as higher in palatability, and had greater decreases in binge eating scores than those in the low calorie group (20).

The third study (41) was measuring the effect of a low fat versus a low calorie diet on weight maintenance. Initial weight loss was produced by either a VLCD for 8 weeks or a LCD for 17 weeks. Initial weight loss showed no significant differences between groups at the end of the weight loss phase (mean weight loss 12.6 kg in both groups) or at any of the weight maintenance or follow-up time points. After weight loss, 37 subjects were re-randomized to two 1-year weight maintenance treatment groups; an *ad-lib*, low fat, high carbohydrate diet or a fixed energy intake diet. The instructions for the *ad-lib*, low fat, high carbohydrate diet included general food preparation and eating instructions such as “use a thin layer of butter or margarine on bread or none at all” or “select lean meat and meat products (<10 g fat/100 g of food item)” (41; page 4 of 12 on the online copy of the article) that was designed to achieve a macronutrient composition of 20-25% of energy from fat and at least 55% of energy from carbohydrate. The fixed energy intake diet was based on isoenergetic interchangeable units represented by 144 counters, each with a small picture of the food it symbolized. At the start of the weight maintenance program, subjects were given a ration of 30 counters per day (approximately 62.5 kcal/counter or 1875 kcal/day for 30

counters), which was reduced stepwise by two to a minimum of 20 counters (1250 kcal/day) if weight started to increase. During the weight maintenance and follow-up phases, analyses were carried out based on intention-to-treat so that for the 3 subjects who dropped out after 6 months of the weight maintenance program and the 6 additional ones unavailable at follow-up, their last weight was carried forward for the additional time periods. Since subjects were gaining weight during this period (41), this probably inflated the mean weight maintenance values for both groups. However, with 13 subjects remaining in the *ad-lib* group and 15 in the fixed energy intake group at follow-up, drastically different levels in attrition are not noticeable. The researchers report a net loss of 8.1 kg (from a maximum loss of 13.5 kg) for the *ad-lib*, low fat, high carbohydrate group and a net loss of 2.5 kg (from a maximum loss of 13.8 kg) in the fixed energy intake groups. Due to the inflation of the intent-to-treat data manipulation, the report of the percentages of subjects who completed the study and who maintained >5 kg net weight losses at 2 years are probably more reflective of actual outcome. This represented 58% of subjects in the *ad-lib*, low fat, high carbohydrate group and 25% of the subjects in the fixed energy intake groups (41).

Exercise

Exercise represents the fourth component frequently utilized in behavioral approaches to weight loss and weight loss maintenance. As with low fat diet interventions, this represents another attempt to address a root cause of the

increasing prevalence of obesity. Hill et al. (42) have suggested that a toxic environment exists where the energy needed for activities of daily living and work related physical activity is decreasing, sedentary behavior is increasing, and low cost, palatable foods are more readily available. These environmental, toxic effects exert constant pressure on energy balance leading to an increase in body fat mass.

Jeffery et al. (3) point out in their review that both correlational and experimental studies indicate that exercise is not only “beneficial for weight control but the benefit is particularly evident in the long term.” (3, page 10) Votruba, Horvitz, and Schoeller’s review (43) categorize the basic issues involved in the role of exercise in the treatment of obesity into 3 main areas; the role of exercise on weight loss, the effect of exercise on the composition of weight loss, and the effect of exercise on the maintenance of weight loss. This categorization will be used to describe the recent studies on the use of exercise in weight loss and weight loss maintenance.

Starting with the role of exercise on weight loss, Votruba, Horvitz, and Schoeller report (43) that exercise alone can cause a small weight loss and that adding exercise to a diet component has no reliable effect on total weight loss. They report some studies with an increase in weight loss when exercise is added to a food intake restriction while others have shown no beneficial effect. They further report that exercise intensity, between moderate and strenuous, has no consistent effect on the amount of weight loss and resistance exercise (strength building) appears to have no beneficial effect on weight loss. Wing agrees with these

findings in her meta-analytic review of randomized controlled trials (19). She quantifies the weight loss occurring with exercise alone as modest, amounting to 1.5-3 kg. She also concurs that exercise plus diet does not significantly increase weight loss over diet alone. However, despite the lack of a significant difference, she does report that the trend indicates more weight loss with exercise plus diet interventions.

Among the more recent studies, one reported in 1999 and one reported in 2000, both agree that exercise alone causes only modest weight loss. The first study involved the HERITAGE family study (44) and was conducted at 4 North American study sites. It attempted to determine the effects of a highly controlled exercise training intervention on body weight and composition in more than 500 free-living subjects. During 20 weeks, subjects exercised 3 days/week on computer controlled cycle ergometers that maintained the subjects' heart rates at fixed percentages of their aerobic capacity. They started with 30 minutes/session and gradually increased to 50 minutes/session, where they were maintained for the last 6 weeks of the training period. The net weight loss across the entire sample was small (-0.2 ± 0.1 kg) but was significant. By sub-groups, significant weight losses were noted for men, Caucasians, and middle-aged parents but not for women, African Americans, and young adult children. The second study (45) compared continuous exercise of 30 minutes duration 3 times per week to intermittent exercise 2 times per day, 5 days per week at 15 minutes per session. Energy expenditure was purposely greater in the intermittent exercise intervention.

Subjects were 22 previously sedentary, moderately overweight females. This exercise only intervention lasted 18 months. The findings were that there was no significant difference in body weight between the continuous and intermittent exercise groups for any of the 3 time periods (baseline, 9 months, and 18 months). However, the continuous exercise group had a small significant decrease of 1.7 kg over the 18 months. In contrast, the intermittent exercise group decreased in body weight at 9 months then returned to baseline by 18 months. The researchers could not explain the difference in weight change patterns between the 2 groups since both groups were set up with ways to verify adherence to the exercise program through independent observers. However, they did point out that the difference between groups in body weight was not significant at any time.

A Canadian study by Ross et al. (46) shows that exercise and food intake restriction are equivalent in effectiveness in men when the amount of exercise and dietary caloric intake are carefully controlled. The researchers used overweight men with an average BMI of 30-32 as subjects and matched a 700 kcal/day energy deficit between a diet-induced weight loss group and an exercise-induced weight loss group. They also included 2 more groups; a control group and an exercise without weight loss group. All 4 groups followed a low fat baseline diet that varied in caloric content between the 4 groups. The control group and exercise induced weight loss groups were prescribed caloric intakes designed to maintain baseline weight. The diet induced weight loss group had their caloric intake decreased 700 kcal/day below their baseline weight maintenance level and the exercise without

weight loss group increased their caloric intake by 700 kcal/day to balance the increased expenditure of 700 kcal/day in exercise. Of note was the effectiveness of the dietary intervention since all 4 groups met the caloric intake guidelines for their particular group and either lost weight or not as planned despite the fact that the subjects were free-living and consumed self-selected foods. To accomplish this, all participants were instructed in a low fat diet (20-25% energy as fat, 55-60% energy from carbohydrate, and 15-20% energy from protein) that was based on their estimated energy needs calculated from the Harris-Benedict equation and multiplied by a factor of 1.5. They consumed this diet during a 4-5 week baseline period during which they kept detailed food intake records analyzed daily and attended a series of seminars taught by a dietitian on proper food selection and preparation. Weight stability was evaluated at the end of this period and estimated caloric intake needs readjusted for an additional 2-week weight stabilization period. Subsequent to this 2-week period, the energy intake prescriptions for the diet-induced weight loss group and the exercise without weight loss groups were adjusted. The exercise intervention consisted of daily brisk walking or light jogging on a motorized treadmill for a length of time pre-determined from heart rate and oxygen consumption data obtained in a graded exercise test. The time period was calculated to consume 700 kcal while exercising at approximately 80% of maximal heart rate. A little more than 60 minutes/day on the treadmill was calculated for most of the subjects. All exercise sessions were by appointment and were supervised. The average weekly weight losses of 0.6 kg were the same in both the

diet-induced and exercise-induced weight loss groups. Average total weight loss was 7.4 kg in the diet-induced weight loss group and 7.6 kg in the exercise-induced weight loss group.

The primary objective for the above noted study (46) was to compare the difference in body composition and anthropometrics between the 2 weight loss groups, the control group, and the exercise without weight loss group. This leads into the second main area of review suggested by Votruba et al. (43) of the effect of exercise on the composition of weight loss. Ross et al.'s study (46) as well as another Canadian study (47), the HERITAGE family study (44), and an intermittent versus continuous exercise group intervention for sedentary moderately obese women (45) all provide information on the change in body composition with exercise interventions. The main conclusion cited by Votruba et al. in their review is that exercise during weight loss tends to preserve fat free mass. The 4 studies cited here offer more detailed information on the composition of the weight loss.

Starting with Ross et al.'s study (46) in men, they found that exercise-induced weight loss reduced total body fat and improved cardiovascular fitness significantly more than the equivalent diet-induced weight loss. Skeletal muscle mass decreased in the diet-induced weight loss group but was unchanged in the exercise-induced weight loss and the exercise without weight loss groups. Similar amounts of weight loss resulted in similar reductions in abdominal obesity, visceral fat, and insulin resistance in both the diet-induced weight loss and exercise-induced weight loss groups. The exercise without weight loss group also decreased in

abdominal obesity and visceral fat but not as much as the 2 weight loss groups and did not change in insulin resistance when compared to the control group.

Another interesting Canadian study investigated the difference in type of exercise on body composition (47). Weight loss was not significant during either intervention in these non-obese young adults. The researchers divided 27 non-obese men and women into 2 exercise interventions. The researchers called the first intervention a moderate intensity endurance exercise condition; however, the 20 weeks of training at 30 minutes for 60% of maximal heart rate, which gradually increased to 45 minutes at 85% of maximal heart rate (47), is called a high intensity intervention in Votruba et al.'s review (43). The second intervention was 15 weeks of high intensity exercise interspersed initially with 15-30 second, and gradually increased to 60-90 second, bursts of exercise at 60-70% maximal work output and could be termed interval training. Despite the lower total energy cost of the interval training program, loss of subcutaneous fat as measured by the sum of 6 skin-folds was significantly greater in the interval training group than in the continuous high intensity exercise group. In fact, when they compared fat loss as measured by change in the sum of 6 skin-folds per unit of energy expended during exercise, they found a 9-fold greater fat loss in the interval training versus the continuous high intensity group. This was paralleled by a significantly greater increase in skeletal muscle fat oxidation as measured by the change in 3-hydroxyacyl-CoA dehydrogenase (HADH) activity, an enzyme used in the β -oxidation of fatty acids.

The earlier cited HERITAGE family study (44), where exercise induced only small weight losses, also found small but significant decreases in fat mass, subcutaneous fat mass, and abdominal visceral adipose mass. Small but significant increases in fat free mass were also noted. The intermittent versus continuous exercise intervention in women (45) showed fat mass significantly decreased over 18 months in the continuous exercise but not the intermittent exercise groups. The continuous exercise group showed a net weight loss over time while the intermittent exercise group did not. Both exercise groups showed improvement in HDL cholesterol and insulin as measured by area under the curve analysis without meeting the usual 5-10% weight loss recommendations for improvements in these cardiovascular disease and diabetes risks.

The third main area of review suggested by Votruba et al. (43) concerns the effect of exercise on long-term maintenance of weight loss. In their review, Votruba et al. (43) report that both retrospective and prospective studies tend to agree with longitudinal studies that associate exercise and lack of weight gain in the general population. That is, individuals in retrospective studies who maintain weight losses report high levels of physical activity and those in prospective studies who maintained an exercise program of some sort regained less weight than did sedentary individuals. Wing reports similar results in her meta-analytic study of randomized controlled trials (19). She compared 6 studies with at least 1 year follow-up and found that all had weight losses at follow-up that were greater in the diet plus exercise intervention than in the diet only intervention. Unfortunately, the

difference in net weight loss at follow-up was statistically significant between the diet plus exercise intervention compared to the diet only intervention in only 2 of the 6 studies. Wing suggests that this may be due to regression to the mean in exercise behavior; those who were randomized to exercise conditions exercised less over time and/or those who were randomized to diet only interventions exercised more over time. Another review of physical activity (48), not necessarily associated with weight loss, also reports that physical activity is often not maintained over time.

This explanation is plausible when the results of a recent Finnish study (34) are considered. Eighty-two premenopausal women were placed on a VLCD for a 12-week weight reduction phase. Afterwards subjects were randomized to 3 groups so that similar numbers of subjects at different levels of weight loss were represented in all 3 groups. The 3 groups consisted of a control group with no increase in habitual exercise, a walk-1 group with a walking program targeted to expend 4.2 MJ/week (1000 kcal/week) and a walk-2 group with a walking program targeted to expend 8.4 MJ/week (2000 kcal/week). Though parameters were individualized to each subject, basically members of the walk-1 group needed to perform 2-3 hours of walking weekly and those in the walk-2 group needed to walk 4-6 hours per week. All three groups met weekly with an exercise instructor for the 40-week maintenance program, were instructed to follow a low fat diet, and received educational material monthly. After the 1-year of weight loss and maintenance phases, subjects were only contacted at 1 and 2 year follow-up. Mean

weight loss after the 12-week weight reduction phase was 13.1 kg. During the maintenance program, the control group regained 2.0 kg while those in the 2 exercise groups maintained their original loss. By the end of follow-up, there were marginally significant differences in weight maintenance between the walk-1 group (lower energy expenditure) compared to the control group but there was no significant difference between the walk-2 group (higher energy expenditure) and the control group. The walk-1 group regained 5.9 kg of the initial loss while the walk-2 group regained 9.2 kg and the control group regained 9.7 kg.

Subjects wore pedometers for 1 week at several time points throughout the study. Analysis of these results show that the mean number of steps taken per day in the control group didn't change from the end of maintenance through the 1 and 2 year follow-ups while the walk-2 group (higher energy expenditure) took more steps at the end of the weight maintenance period and gradually decreased to the 1 year and 2 year follow-up time points so that they were not significantly different from the control group at the 2-year follow-up. The walk-1 group (lower energy expenditure) took a mean number of steps between the walk-2 group and the control group at the end of the maintenance period and increased their mean number of steps at the 1-year follow-up so that it was more than the walk-2 group and significantly higher than the control group. By the year-2 follow-up, the walk-1 group had also decreased in the mean number of steps taken per day so that all 3 groups took a similar mean number of steps/day (34). Adherence to an exercise program appears to be a problem but apparently is more of a problem in exercise

interventions that require a greater time commitment (4-6 hours per week in the walk-2 group) than those with a more moderate time commitment (2-3 hours per week in the walk-1 group).

Votruba et al. (43) report on one study that deserves more thorough review since they were able to quantify the amount of exercise needed for maintenance of weight loss (49). This study by Schoeller et al. had 34 subjects who were recruited after they had lost ≥ 12 kg, had maintained weight stability for greater than 1 month but not more than 3 months. Thus, these individuals used different methods of weight loss and maintenance of weight loss was the primary thing studied. The study was observational in that they were neither encouraged nor discouraged in using regular exercise and subjects were told to follow whatever maintenance strategy they preferred. The difference in weight gain at various activity levels was observed over the next 12 months using measurement of weight along with periodic 7-day physical activity recalls and heart rate monitors at baseline and 12 months. A physical activity index (PAI) was calculated utilizing results from estimated total energy expenditure (TEE) derived from the doubly labeled water method, measured resting metabolic rate, measured thermic effect of a meal, and baseline body weight to yield a value expressed in kJ of energy expenditure per kg body weight each day. What they found is that active post-obese women maintained their weight loss much better than those who were inactive. Two of 8 subjects categorized as active at baseline gained greater than 4.5 kg over the course of the year while 13 of 24 categorized as moderately active or sedentary gained

more than 4.5 kg during the year. When regression analysis was used, they found that the physical activity index (PAI) was a predictor of both weight gain and fat gain but the result was not linear. Instead there was a threshold of physical activity for minimizing weight gain at 47 kJ/kg body weight each day. This corresponds to approximately 80 minutes per day of moderate intensity activity like brisk walking or 35 minutes/day of vigorous physical activity. The authors point out that this is much higher than the 1995 Centers for Disease Control and Prevention (CDC) and American College of Sports Medicine (ACSM) joint recommendation for 30 minutes/day of moderate intensity physical activity on most days of the week. Three of 16 subjects with a PAI > 47 kJ/kg body weight gained more than 4.5 kg, while 12 of 17 subjects with a PAI of < 47 kJ/kg body weight per day gained > 4.5 kg (49).

A study by Jakicic et al. (50), which compared various exercise interventions on weight loss in sedentary overweight women, offers another estimate of exercise needed to prevent weight regain. This study compared long bout, short bout, and short bout with a provided motorized treadmill as the different exercise interventions. After noting that weight loss was similar in all 3 groups at 6 months, researchers re-analyzed subject results by categorizing them into low, medium, and high exercise groups. The low exercise group exercised less than 150 minutes/week, the medium exercise group exercised 150 to less than 200 minutes/week, and the high exercise group exercised 200 or more minutes per week as determined throughout the 18-month study. The higher the reported exercise

from the subjects' exercise logs, the more weight they lost and the less weight they regained regardless of which intervention group to which they were originally assigned. In fact, those who exercised 200 or more minutes/week maintained their 6-month weight loss through month 18. Their net mean weight loss at 18 months was 13.1 kg compared to 8.5 kg in the medium exercise group and 3.5 kg in the low exercise group (50). This is more similar to the previously mentioned 1995 CDC and ACSM joint recommendation of 30 minutes of moderate intensity exercise on most days of the week.

General Lifestyle Change

The general lifestyle change method of weight management is more of a philosophy than a precise weight loss program. It is based on the premise that life-long changes in dietary and physical activity habits are necessary for weight loss to be maintained. Fairburn and Cooper (51), Westenhoefer (52), and Miller (53) have all advocated this approach and the Smart CHOICES and CHOICES programs studied in the current research are also based on this approach. It emphasizes moderation and development of sustainable habits rather than adherence to rigid dietary and exercise regimens. Going along with it is the realization that even modest weight losses of 5-10% along with improvement in dietary and exercise habits are sufficient for improvement in health status (53). In fact, Tremblay et al (54) have suggested that after losing 10-15% of their body weight, individuals reach a level of resistance to further weight loss which only more severe dietary

and exercise habits can overcome. These more severe changes he feels cannot be sustained over the long term.

Indeed, some of the previously mentioned LCD and low fat interventions suggest maintenance procedures that would be very difficult to maintain over the long term. For instance, Schlundt et al's (40) maintenance dietary restrictions were both very rigid. The low fat *ad libitum* diet was to have no more than 25g fat/day, which would correspond to 10-15% of energy as fat on a 1500 to 2000 kcal diet. The low calorie maintenance diet only allowed 1200 kcal/day for women. Jeffery et al's study (20) was very similar. They used just one intervention for both weight loss and weight maintenance but it consisted of 20 g fat per day in the low fat condition and either 1000 or 1200 kcal/day in the low calorie condition. Sherwood and Jeffery further report in their review of the behavioral determinants of exercise (48) that rigid physical activity regimens are also very difficult to continue over the long term.

While this premise for treatment is promising, it is at odds with patients' expectations. Foster et al (55) measured patients' expectations while participating in a weight loss program about their goal weight and what physical and psychosocial benefits they anticipated achieving by losing weight to their goal weight level. The patients' goal weights required an average weight loss of 32% of their initial body weight and were equivalent to the lowest adult weight that they had maintained for at least 1 year. At the end of the 48 week treatment intervention, patients had averaged a loss of about half of the weight necessary for achieving

their goal weight. It was encouraging that they had achieved all the positive physical and psychosocial benefits that they had anticipated with weight loss even though they lost much less weight than they would have liked. Still, participants were dissatisfied with their ending weight. Fairburn and Cooper have stated that it is important in weight loss programs to include cognitive restructuring to help individuals accept more modest weight loss goals (51).

Few studies exist that specifically address a lifestyle change program and their effect on maintenance of weight loss. One such study reported in 1998 (56) tracked the long-term outcomes of a cognitive-behavioral weight control intervention based on lifestyle change in independent-living elders. Maintenance of weight loss was very good in this population as mean BMI gradually continued to decrease to 2 years with no significant increase or decrease at 3 years. Absolute weight loss was small, representing approximately 3.2 kg at 2 years or a 4% decrease in initial body weight. The other health parameters that showed positive changes were a significant decrease in fasting glucose levels and among those who walked more than 20 minutes per day, a higher HDL-C level.

More typical are lifestyle change studies aimed at reducing cardiovascular risk factors. Two recent reports of the weight loss components of lifestyle change interventions will be discussed. The first concerns the factors associated with successful weight loss in a one year period (57) in a randomized trial examining the effect of a diet only or a diet-plus-exercise program on cardiovascular disease risk factors. The major part of the study was reported in 1991. Successful weight loss

was defined as the loss of at least 2 BMI units in a 1-year period. This translates to a loss of approximately 5-6 kg and 38% of the original sample was able to reach this goal. The factors associated with this successful weight loss were participation in the diet-plus-exercise program, less initial body dissatisfaction as measured by a score of ≤ 23 on the body dissatisfaction scale of the Eating Disorder Inventory (EDI), and no history of repeated weight loss as measured by a question asking whether they had lost more than 10 lb at least one time in an average year. Among the variables that did not predict successful weight loss was initial body weight or BMI, initial percentage of caloric intake from fat, perceived stress, or social support. A high level of body dissatisfaction was associated with being female and initially being less physically fit as measured by maximal aerobic capacity.

The second study measured the effect of weight loss on blood pressure in the Trials of Hypertension Prevention II (TOHP II) study and was originally reported in 1997 (58). A goal was set to lose at least 4.5 kg (about 10 lb) over the first 6 months and to maintain that weight loss for the next 30 months. Although mean weight loss of 4.4 kg was close to the goal at 6 months, weight regain commenced so that net weight loss was 2 kg at 18 months and 0.2 kg at 36 months. Though blood pressure did improve at 6 months, weight regain thereafter caused blood pressure to revert to baseline levels. Among the 13% of subjects who lost 4.5 kg and maintained the loss, improvements in both diastolic and systolic blood pressure were maintained when compared to baseline blood pressure readings. Of note is that this group's average weight loss and maintenance was greater than 4.5

kg at approximately 10 kg. This study shows that weight loss is an effective intervention in reducing blood pressure but is extremely difficult to achieve and maintain with lifestyle dietary and physical activity interventions as represented by the 13% success rate. Thirty-three percent of the subjects were classified as achieving no weight loss, 22% as weight regainers, and 33% could not be classified due to different weight loss patterns or missing data. The preceding study with its 38% success rate is not much better.

National Weight Control Registry (NWCR)

The body of research represented by the studies using data from the National Weight Control Registry (NWCR) served as the inspiration for the current research. As mentioned in the introduction, the primary aim of the NWCR studies was to describe the characteristics of long-term effectiveness in maintenance of weight loss in a sample of individuals already successful at maintaining a substantial weight loss (≥ 13.6 kg or 30 lb) for ≥ 1 year. In order to find these people, local and national media coverage of the NWCR as well as mailings to current members of several commercial weight loss programs were utilized (12). In the reports reviewed, total sample size ranged from 784 (12) to 2628 (59) since recruitment of participants for the NWCR is ongoing. After recruitment, each subject was sent a questionnaire packet including questions about demographics, weight, and behavioral characteristics (12, 13). Another packet was sent at 1 year

follow-up and is the basis for follow-up data presented in 2 of the reported studies (16, 60).

Descriptive Characteristics of the NWCR Study

The earliest study of the NWCR reported the descriptive characteristics of individuals successful at long-term maintenance of weight loss (12). Eighty percent of these self-selected 784 subjects were women and 97% were white. Although minimum weight loss required for entry into the registry was 13.6 kg, average weight loss was 30 kg and registry members had maintained the minimum 13.6 kg weight loss for an average of 5.5 years. Average maximum lifetime BMI was 35 and average current BMI at time of registry entry ranged from 24 for women to 26 for men. Most of the registry participants reported childhood onset obesity with approximately 71% becoming overweight before age 19. Ninety-one percent of the sample reported previous weight loss attempts which is reflected in their average total lifetime weight-loss scores of 270 kg (565 lb). Approximately 55% of the sample reported use of a formal program or professional assistance to lose weight during this successful weight loss episode while the remaining 45% reported losing weight on their own. Forty-two percent of the sample felt that weight maintenance was easier than weight loss, 33% rated the 2 processes as having similar levels of difficulty, and 25% found weight maintenance to be more difficult than weight loss. The most frequently reported improvements in their life as a result of their successful weight loss and reported by greater than 85% of the sample, were

improvements in quality of life, level of energy, mobility, general mood, self-confidence, and physical health. Negative results included an increase in time spent thinking about their weight in 20% of the sample and an increase in time thinking about food in 14% of the sample. For self-monitoring, 75% of registry members weighed themselves at least once per week. Mean current energy intake as measured by the Block Food Frequency Questionnaire (Block FFQ) was 1382 kcal/day with a large standard deviation of 526 kcal/day. Percentage energy intake from fat was $24 \pm 9\%$. Average energy expenditure from physical activity as measured by the Paffenbarger physical activity questionnaire was approximately 400 kcal/day.

Measures of Psychopathology in the NWCR Study

The second published report of the NWCR studied the same 784 subjects and looked at their current scores on measures of psychopathology in order to test the hypothesis that there is an association between long-term suppression of body weight and psychological distress (13). In other words, the effort of constantly trying to suppress body weight would cause a person to be distressed psychologically. The questionnaires administered to test this hypothesis included the Center for Epidemiological Studies Depression Scale (CES-D), the Symptom Checklist-90 Revised (SCL-90-R) which is a self-report checklist of psychiatric symptoms, the Eating Inventory which measures dietary behavior associated with cognitive restraint, disinhibition, and hunger, and 2 questions from the Eating

Disorder Examination-Questionnaire that address binge eating and purging behaviors. The results showed that scores on the CES-D ranged from 0 to 52 with a mean of 9.0 ± 8.6 (mean \pm SD). The authors report that selected studies report means of 4.1 to 10.4 in non-depressed community controls. A score of 16 on the CES-D differentiates between those with possible clinical depression and no depression. Eighteen percent of their sample had scores of 16 or higher on the CES-D suggesting possible depression. The Global Severity Index on the SCL-90-R ranged from 0 to 2.58 with a mean of 0.39 ± 0.38 and appear similar to scores observed in obese and normal weight, non-psychiatric samples. The results from the Eating Inventory were reported for women only since there were significant differences between men and women on cognitive restraint and disinhibition and the sample was primarily female. Scores on the cognitive restraint scale ranged from 0 to 21 with a mean score of 15.1 ± 3.7 . On the disinhibition scale, scores ranged from 0 to 16 with a mean of 7.1 ± 3.5 . For the hunger scale, scores ranged from 0 to 14 with a mean of 4.7 ± 3.1 . The authors point out that this pattern of the Eating Inventory subscale scores is very similar to patients recently treated for obesity in that they show high levels of cognitive restraint but disinhibition and hunger scores fall within the normal range. Concerning frequency of binge eating and purging, only 0.8% (6 subjects) of the sample reported engaging in binge eating and purging in the previous month and only half of them met the minimum frequency criteria for bulimia nervosa. The authors' conclusions were that there

was little evidence that long-term suppression of body weight is associated with psychological distress.

Weight Maintenance Strategies Depending on Method of Weight Loss

A third study of the NWCR examined the weight loss maintenance strategies of individuals who either lost weight successfully on their own, used organized programs for weight loss, or used formal programs with liquid formula diets (15). Those individuals who lost weight on their own had maintained their weight losses for longer periods of time, had more difficulty losing weight and less difficulty maintaining their weight loss, weighed themselves more frequently, had lower scores on cognitive restraint, had lower percentages of energy coming from protein, expended more calories in strenuous physical activity each week, and were more likely to be male (27% compared to 21% in the liquid formula group and 6% in the organized program group). Of note, is that all groups reported eating less than 1460 kcal/day and having less than 30% of their energy from fat. There were no significant differences between groups in the energy expended in all physical activity each week. The liquid formula and organized program groups often differed significantly from those who lost weight on their own but were similar to each other. Those in both the liquid formula and organized program groups were more likely to count calories, use exchange lists, and continue to participate in a structured weight loss program as methods of maintaining weight loss. They also had higher cognitive restraint scores on the Eating Inventory than the group who

had lost weight on their own. Where the liquid formula groups differed is that they were more likely to be older, to have been heavier at their maximum weight, to be heavier at registry enrollment, to be more likely to have been diagnosed with a medical disorder like heart disease, hypertension or diabetes, and to have had a medical event as a trigger to lose weight. They also reported more difficulty maintaining weight loss than losing weight; just the opposite of the on own group.

Dietary Intake Analysis in the NWCR Study

The fourth study of the NWCR (14) only studied the first 463 enrollees in the registry and went into more depth in describing the dietary intake of those who lost weight on their own compared to those who received assistance with weight loss. There were no significant differences between estimated intakes of iron, calcium, and vitamins A, C, and E between those who lost weight on their own or those who received assistance. Both men and women met the RDA's for calcium and vitamins A, C, and E but women did not meet the RDA for iron. When compared with the 40-49 year old cohort in the third National Health and Nutrition Examination Survey (NHANES III), participants in the NWCR had significantly lower total energy intake and percent energy from fat and a higher percentage of energy from protein and carbohydrate. Women in the NWCR also had higher intakes of calcium, vitamins A and C than the corresponding NHANES III group. It is of note that different methods were used to estimate dietary intake in the NWCR and the NHANES III studies.

Subsequent Weight Gain or Continued Weight Maintenance in the NWCR

The fifth (16) and sixth (60) published reports of the NWCR were based on 1-year follow-up data. The fifth study (16) attempted to differentiate the characteristics of those who had gained greater than 5 lb since their initial assessment compared to those who hadn't gained weight. The sixth study (60) focused primarily on the differences that emerged with duration of weight maintenance and were delineated by a group of questions specifically asked for this purpose at the 1-year follow-up time point.

The fifth study (16) reported that 35% of their 714-subject sample was classified as regainers at 1 year from the initial assessment. Fifty-nine percent were maintainers with weight within ± 5 lb of their weight at the initial assessment while 6% continued to lose weight at a rate of greater than 5 lb in the past year. The group of continued weight losers was not included in comparisons between the regainers and maintainers. The regainers had an average weight gain in the past year of 15.5 ± 11.3 lb; however 81% still met initial criteria for registry entry of a net weight loss of 30 lb. Among the maintainers, 50% reported that their weight had been stable in the last year while 41% reported a series of gains and losses over the past year. The regainers had higher lifetime scores for total weight loss, were heavier at lifetime maximum weight, and had lost a larger percentage of their initial weight in their most recent weight loss attempt. The risk of weight regain increased significantly among those with initial weight losses of $>30\%$ of body weight when

compared to those with weight loss of 10-25% of initial body weight. This significant increase in risk was not present among those who initially lost 25-30% of their body weight. Regainers were more likely to have used a liquid formula diet to lose weight. Also, they maintained their weight losses for fewer years prior to study entry. In fact, further analysis showed that maintaining a weight loss for 2-5 years decreased risk of subsequent regain by 50%.

A repeated administration of the same food intake, activity, and psychological questionnaires administered at baseline (the Block Food Frequency Questionnaire, the Paffenbarger Physical Activity Questionnaire, the Eating Inventory, the Center for Epidemiological Studies Depression Scale, and the bingeing and purging questions from the Eating Disorder Examination-Questionnaire) were analyzed to detect differences between the regainers and maintainers. At baseline, there were no significant differences in caloric intake, percentage of energy from fat, or energy expended in physical activity between those who subsequently maintained their weight loss and those who started gaining weight. However after 1 year, the maintainers had a percentage of energy intakes from fat consistent with their baseline intake while the regainers had increased in their percentage of energy intake from fat. Both groups had decreased the amount of energy expended in physical activity over the past year, but the regainers decreased their energy expenditure by an average of 1000 kcal/week while the maintainers decreased by an average of 500 kcal/week. At baseline the regainers had higher CES-D scores (10.3 ± 9.2) than maintainers (7.9 ± 8.1). After 1 year,

both groups increased their CES-D scores over time and the amount of increase was not significantly different between maintainers and regainers. At baseline, regainers had higher scores on the disinhibition subscale of the Eating Inventory (7.7 ± 3.4 for regainers versus 6.2 ± 3.4 for maintainers) as well as a higher prevalence of objective binge episodes in the past month (1.5 ± 3.9 binge episodes per month in regainers versus 0.7 ± 2.7 binge episodes per month in the maintainers). Over the course of the year, regainers generally showed increases in disinhibition, hunger, and binge eating and a decrease in cognitive restraint while the maintainers' scores were consistent with their scores at baseline (16).

The additional questions asked at the 1-year follow-up for the sixth study (60) included questions about the weight control strategies employed in the past year, the effort required to follow these weight control strategies, and the amount of pleasure derived from engaging in these various weight control strategies. Subjects with longer duration of weight maintenance were older, had greater total weight loss, and a smaller weight regain in the past year. Though this may seem to conflict with the finding that those who gained weight in the past year had greater total weight losses (16), keep in mind that those with longer duration of weight loss were past the initial 2-5 years maintenance of weight loss that was discussed earlier. Age, degree of total weight loss, and weight regain were controlled for in the analyses for other factors independently associated with weight loss maintenance. One of the primary findings was that longer duration of weight maintenance was associated with use of fewer food-related strategies for weight maintenance. For

instance, they didn't particularly use strategies such as stocking up the house with low fat foods or avoid keeping high fat foods in the house. They were less likely to report keeping food and activity records in the past year. In fact, these subjects with longer duration of weight maintenance reported that it took less effort to diet and maintain their weight and required less attention than did those who had maintained their weight losses for shorter periods of time. The authors suggested that changes in habits had occurred thus making the changes easier to maintain.

Duration of weight maintenance did not predict daily energy intake. All subjects reported approximately 1400 kcal/day and 25-26% of their energy from fat. Also, duration of weight maintenance was not associated with total energy expended through physical activity, though the amount of energy expended in medium and light intensity exercise was greater in those with a longer duration of weight maintenance. While those with longer duration of weight maintenance reported less effort to diet and maintain their weight over time, this decrease in effort did not extend to exercise. There was no decrease in effort required to exercise with the duration of weight loss maintenance. Also, duration of weight loss maintenance was not associated with frequency of self-weighing.

Pleasure derived from a regular exercise regimen, eating a low fat meal, maintaining weight or derived from sedentary activities was not different between those with longer duration of weight maintenance versus shorter duration. The amount of effort and attention required to maintain weight loss was consistently rated lower than the amount of pleasure derived from successful weight control

across all durations of weight loss maintenance. Thus, the authors pointed out that subjects with even the shortest duration of weight loss maintenance may believe that the satisfaction obtained outweighs the effort expended.

Confirmation of Findings in a Random Population Sample

The NWCR researchers then went on to try and confirm the findings they had made with the NWCR in a random population sample. Prevalence of weight loss maintenance was studied (17) as well as differences between weight loss maintainers, non-maintainers, and controls (61). They used a random digit dial telephone survey based on census tract information (17). The measures administered over a 20-30 minute telephone interview were generally simpler than the instruments administered to NWCR participants and included demographic information, weight loss history, methods used for weight loss, the Food Habits Questionnaire that measures strategies used to lower fat intake, the Godin Leisure Time Physical Activity Questionnaire, frequency of self-weighing, and the Herman and Polivy Revised Restraint Scale (61), which measures concern about body weight and people's tendency to diet chronically to control it (31).

Approximately 54% of the sample (255 out of 474) had lost more than or equal to 10% of their weight from their lifetime maximum weight (excludes weight during pregnancy) (17). However, only about half of them (or 1/3 of the entire sample) had intentionally lost weight. The authors pointed out that this represents a high prevalence for significant weight loss in the general population. Next, they

focused just on those subjects who were overweight at their lifetime maximum weight (BMI ≥ 27) and found that 48% of the sample (228 out of 474) had been overweight at their maximum lifetime weight. Of these 42% (95 out of 228) had lost $\geq 10\%$ of their maximum weight and 49% of them (47 out of 95) had maintained this weight loss for greater than or equal to 1 year. Twenty-six percent (25 out of 95) had maintained the weight loss for ≥ 5 years. When based on the total sample, ten percent of the subjects had been overweight, lost $\geq 10\%$ of their maximum lifetime weight, and maintained that weight loss for at least 1 year (17).

By re-categorizing the subjects, the researchers ended up with 3 comparison groups; maintainers (n = 69, intentional weight loss of $\geq 10\%$ of maximum lifetime weight, currently $\geq 10\%$ below maximum lifetime weight, and had maintained weight losses for at least 1 year), regainers (n = 56, intentional weight loss of $\geq 10\%$ of maximum weight, and not currently $\geq 10\%$ below maximum lifetime weight), and controls (n = 113, had never lost 10% of their maximum weight, had never been $\geq 10\%$ above their current weight, and had maintained their current weight ± 10 lb for the past 5 years) (61). The reason these sample sizes are larger than those previously mentioned is because they did not exclusively focus on subjects who had been overweight at their maximum weight. There were normal weight and overweight people in all 3 groups. Instead, intentionality of weight loss was the deciding factor. Maintainers had maintained an average weight loss of 37.7 lb ± 28.7 lb for 7.7 ± 8.4 years. While maintainers and regainers weighed significantly more at their maximum weight than did controls, maintainers and

controls had similar weights at the time of the survey. The regainers weighed significantly more at the time of the survey. The most common method of weight loss for both maintainers and regainers was losing weight on their own without use of assistance or formal programs. This represented 26% of the maintainers and 32% of the regainers with no significant difference in prevalence between the two groups. The other methods used to lose weight were a diet prescribed by a physician (20% in maintainers and 11% in regainers), a commercial program (15% in maintainers and 5% in regainers) and smaller percentages by over-the-counter meal replacements, prescribed medication, over-the-counter medications, a liquid diet, and a self-help program.

Among the behavioral differences between the maintainers, regainers, and controls were lower scores on the Food Habits Questionnaire for the maintainers compared to the regainers and controls (61). This indicated that the maintainers used more strategies to lower their dietary fat intake. The maintainers engaged in more strenuous and sweat producing exercise each week and had higher total physical activity intensity scores. Mean scores for total physical activity intensity were 27.8 ± 28.2 for maintainers, 16.2 ± 17.6 for regainers, and 18.2 ± 19.5 for controls. Further analysis showed that the higher strenuous activity scores were entirely accounted for by the male population of all 3 groups, which ranged from 30% male for the maintainers to 39% male for the regainers, and 53% male for the controls. There were no differences found in the female portion of the subgroups in the amount of strenuous activity engaged in each week. Both maintainers and

regainers reported higher levels on the “concern for dieting” and “weight fluctuation” subscales as well as higher total scores for Hermann and Polivy’s Revised Restraint Scale than did controls. Significantly more maintainers (55%) reported weighing themselves at least once per week compared to regainers and controls (approximately 35% in each group).

Comparison of the NWCR Results with Other Studies

Since publication of the NWCR studies, 2 additional studies have used a similar study design to explore the characteristics of successful weight loss maintainers. The first was a British study (62) that administered questionnaires to members of a “slimmers club” and then classified respondents as weight loss maintainers, regainers, and stable obese. Subjects either previously or currently had BMI’s ≥ 30 . The criteria for successful weight loss maintenance were a previous BMI ≥ 30 , a weight loss to a BMI of < 30 , and to have maintained this weight loss for 3 or more years. As a group, weight loss maintainers were older than the stable obese and had dieted longer than regainers and the stable obese. They also had lower lifetime minimum and maximum BMI’s as adults than the regainers. This conforms with NWCR results showing that subsequent regainers had higher lifetime maximum BMI’s than did continued weight loss maintainers (16).

Another finding in this study (62) was that successful weight loss maintainers had tried “healthy eating” as a weight loss method more frequently than had regainers and the stable obese. They were less likely to endorse medical

causes as the reason for their obesity and more likely to endorse psychological consequences for obesity, like depression, anxiety, phobias, low self-esteem, and lack of confidence. The weight loss maintainers were more likely to report confidence, such as increase in self-esteem, liking themselves more, and feeling better about themselves, as motivations for weight loss than were the stable obese or regainers. All groups reported health, attractiveness, symptom relief, and external pressure as motivations for weight loss to an equal extent. As a result of these findings, the author suggests that emphasis on the psychological consequences of obesity and psychological motivations to change may be a better treatment intervention for long-term success than the current medical model for treatment of obesity. This is in contrast to the medicalization of the treatment of obesity by using a disease model to characterize the chronic nature of the problem and to encourage third party payment for treatment (63).

The second study was a two-part American survey focusing on consumer satisfaction with commercial diet programs initially, followed by a second part focusing on body image, dieting, and weight loss (64). From the 21,909 who returned the second part of the survey, the researchers identified 3% of the sample (277 men and 329 women) as weight loss maintainers. They had lost weight equivalent to $\geq 10\%$ of their highest adult weight and had been maintaining the weight loss for at least 3 years prior to the survey. Average weight loss was 39 lb \pm 27 lb. Twenty-five percent of the sample (2217 men and 3275 women) were classified as regainers and conformed to the less rigid criteria of reporting never

being able to maintain a significant weight loss but reporting losing and regaining a minimum of 10-19 lb at least once. Due to the difference in sample sizes, the regainers were randomly matched by gender and age to the maintainers so that 2 equal groups of 606 subjects were compared.

Maintainers had significantly lower total weight fluctuations than did regainers (64). This is consistent with the NWCR results showing subsequent regainers to have higher lifetime scores for total weight loss (16). The other factors that differentiated between maintainers and regainers (64) were direct-coping and help-seeking. These are two of the 9 factors aggregated by factor analysis that were used to compare the groups. Direct coping was described as a response to a relapse and an increase in score was made for responses like treating the relapse as a small mistake, recover, and lose again, increasing exercise, and starting to watch food intake more carefully. Responses to a relapse of feeling terrible, going off the diet, and regaining weight were subtracted from the direct coping score. Maintainers had significantly higher scores in direct coping. Help-seeking was another response to a relapse and included asking a friend, spouse, or family member for help and starting a weight-loss program. Regainers were more likely to report help-seeking as a response to a relapse. There was no difference between the 2 groups on skipping meals or fasting as a response to a relapse, total usual exercise, to what they attribute the cause of their excess weight (such as biology, negative affect, personal traits, or lack of exercise), or current negative affect.

Primary Prevention of Weight Gain

The Pound of Prevention Study in the Minneapolis/St. Paul area of Minnesota represents a recent comprehensive study that not only endeavored to determine if weight gain with age in adults could be prevented (65) but also how weight gain or loss was associated with behavioral variables (18, 66, 67, 68). Over a 3-year period, three different participant groups in 2 interventions and a control group were followed in regards to numerous behavioral variables (65). The subjects were initially 20-45 years of age and consisted of high-income men and women (family income greater than \$25,000/year) and low-income women (family income \leq \$25,000/year) comprising the participant groups (65). All 3 participant groups had baseline BMI's >25 (66). Body weight was not a study entry criterion since previous research had shown overweight adults at greater risk for continued weight gain than normal weight adults. Thus, prevention of weight gain was deemed important for both normal weight and overweight individuals by the researchers (65). Half of the subjects were randomized to a no intervention control group and 25% were randomized to an education intervention group that received monthly newsletters covering weight control topics. An addressed stamped postcard, which was designed to show that the subjects had at least opened the newsletter and to encourage behavior change by asking short response questions related to the targeted 5 weight control messages in the study outlined later, was included with each newsletter. The remaining 25% of the subjects received the same newsletter

intervention but were included in a \$100 monthly lottery if they returned the enclosed postcard.

The 5 major themes in the intervention educational messages were to 1) weigh yourself at least once a week, 2) eat 2 servings of fruit each day, 3) eat 3 servings of vegetables daily, 4) reduce intake of high fat foods, and 5) walk 3 times per week for at least 20 minutes. Compliance with these three messages was reported at the 1-year assessment time point (65). Those in the intervention groups significantly increased the frequency that they weighed themselves. Change in frequency of self-weighing among the intervention groups continued to be significant at the 3-year assessment. No significant differences in the change in percent of energy from fat, number of servings of fruit and vegetables, and frequency of walking were noted between the control and intervention groups at the 1-year time point (65). Compliance with these messages was not specifically addressed at the 3-year time point though several other similar behavioral measures were compared as are noted later (69, 66, 18). Regardless of intervention group, an increase in weighing frequency during the first year was associated with less weight gain in all participant groups. At 1 year, increased walking was associated with less weight gain in both low-income and high-income women but not in men (65).

All groups, whether divided by intervention or participant group, had a mean net weight gain over the first year (65). That continued through the 3-year assessment time point (69). There were no significant differences in weight change

between the control and intervention groups (65, 69). Over the 3 years, the change in total energy intake was positively associated with weight change while the change in total exercise and the frequency of self-weighing were negatively associated with weight change (69). More specifically an increase in the percent of energy from fat was associated with weight gain while an increase in the number of methods used to lower fat intake was associated with a decrease in weight (18). Complex statistical analyses (random coefficients regression analysis) showed that men who added 1 high intensity exercise session per week decreased weight 0.54 kg in 3 years and that women who added 1 high intensity exercise session per week decreased weight by 0.15 kg in 3 years (18). Women also showed an effect with moderate intensity exercise with addition of 1 moderate intensity exercise session per week decreasing weight by 0.10 kg in 3 years (18). The change in total physical activity from baseline to 3 years decreased by 1.2 points in successful weight maintainers (no weight gain in first year and still at or below baseline weight at 3 years, 24.5% of sample) and decreased by 9.1 points in weight gainers (net weight gain over 3 years, rest of sample) from the 1 to 3 year assessment time points (66). Obviously, on average most individuals reported decreases in total physical activity over the 3 year study period.

Another conclusion by the authors was that relatively few men and women were successful at either losing weight or avoiding weight gain over the 3 year period (66). In fact, 54% of the sample had already gained weight during the first 12 months. Successful weight losers, defined as those losing $\geq 5\%$ of their baseline

weight in the first year and remaining $\geq 5\%$ below baseline weight at 3 years, comprised only 4.6% of the sample. Successful weight maintainers, at or below baseline weight at both 1 and 3 year time points, comprised only 24.5% of the subjects (66).

Review of Research Using the Same Instruments as the NWCR and the Current Research

The NWCR used a set of standardized instruments for their major findings that have also been used in the current research. Below is a review of each of these instruments along with descriptions of other research in which they have been used.

Block Food Frequency Questionnaire (Block FFQ)

The Block FFQ was developed by utilizing information about the relative contribution of various foods to nutrient intake and about usual portion sizes from NHANES II food intake data (70). Conceptually similar foods are grouped together so that respondents indicate frequency of intake for food groupings and check whether their usual portion size is small, medium, or large based on the medium portion size listed (70). These food groupings are augmented with foods that are sources of dietary fiber, with the major cruciferous vegetables, coffee and tea, and foods particularly important for various geographical areas and ethnic groups in the U. S. (70). According to the authors, this list of foods represents 93% of the

populations' energy intake, 96% of intake of vitamins A and C, 95% of the intake of total fat, and equal to or greater than 90% of 13 other nutrients.

The authors validated the food frequency in 2 steps. First, they compared nutrient intakes derived by recoding food intake from a single 24-hour recall to standard results of a 24-hour recall. Next, the results of questionnaire completion by 1000 subjects were compared with nationally representative nutrient intake data. In both cases, the researchers found no significant differences in energy and fat intake with some individual differences for particular nutrients (70).

In another report, validation of the Block FFQ was carried out in 2 groups of middle-aged women (277 subjects) with differing fat intake by comparing results of the Block FFQ with two 4-day diet records over the course of 6 months (71). They found no significant differences in energy, total fat or protein intake between the two estimates of intake. Estimates of the percent of kilocalories from fat were overestimated in the low fat group and estimates of carbohydrate intake underestimated in the low fat group. The usual diet group, with an average of 38% of kilocalories from fat, had no significant over or underestimates of nutrient intake (71). The mean correlation between the 4-day food records and the food frequency was 0.55 when all 17 nutrients were considered. The authors concluded that the Block FFQ gave a moderate to good ability to place individuals along the distribution of intake (71).

Another report compared the Hutchinson/Block FFQ, along with the Willett Food Frequency Questionnaire, a single 24-hour recall, and a 7-day food record,

with total energy expenditure as measured by the doubly labeled water technique (72). The Hutchinson/Block FFQ is actually the modification used in the study mentioned above (71). It was modified in an effort to improve the precision of fat intake estimates (71). Analysis in that same previously described study indicated that the modifications had essentially no effect on the correlations with reference data in the usual diet group and only gave trivial improvement for correlations in the low fat intake group (71), thus the Hutchinson/Block version should provide very similar results as the unmodified Block FFQ. The 20 subjects in the doubly labeled water study were evenly divided between young women in their 20's and 30's and older women in their late 60's to age 80 (72). Results showed that all methods underestimated caloric intake in these weight stable women. In particular, the Hutchinson/Block FFQ underestimated caloric intake by approximately 28% in young women and 15% in older women (72). This is similar to results reported for a European food frequency questionnaire (73) of a 20% underestimate of energy intake when the food frequency questionnaire was compared to the doubly labeled water method for estimating total energy expenditure.

Though not using a doubly labeled water method, a comparison of serial, multiple-pass 24-hour recalls with estimated needs for weight maintenance in a group of men and women being closely monitored for weight maintenance provides a good comparison of the results for a group compared to the results for an individual (74). The researchers found a 12% underestimation of caloric intake when the group was compared as a whole (74). Next the limits of agreement were

compared between the 24-hour recall estimate and the estimate of needs for weight maintenance; this gives a way to assess the accuracy of a method in estimating caloric intake in individuals. They found the individual limits of agreement ranging from -1818 kcal/day to +1315 kcal/day. The 24-hour recalls grossly under or overestimated actual caloric intake and there was no clustering of results around the mean difference between the 2 energy intake methods. The authors concluded that the multiple-pass 24-hour technique was good at estimating energy intake for groups but not for individuals (74). This lends support to the authors' conclusion in the Hutchinson/Block FFQ validation study, that no method of dietary assessment does a really good job of predicting actual energy intake in individuals (72).

A suggestion has been made that the Block FFQ is better at evaluating percentage of kilocalories from fat and carbohydrate than is the Willett FFQ when compared with serial 24-hour recalls (75). Though they used the reduced (60-item) Block FFQ in this study, they found the strongest linear relationship between the 24-hour recalls and the Block FFQ in total fat and protein, and the percentage of kilocalories from fat, carbohydrate and monounsaturated fat (75). The authors suggested that the different portion size choices makes the Block FFQ particularly good at ranking individuals on these particular items. In contrast, the Willett FFQ does a better job of estimating intake of vitamins A and C because it offers a large number of possibilities for fruits and vegetables (75).

Since the purpose of the Block FFQ is to estimate the usual intake of individuals (70), the distinction in the relative weight subjects give to recent versus

remote intake is worth considering. In the doubly labeled water study of various methods of dietary intake assessment (72), serial completion of the food frequency questionnaires showed a lower intake when the food frequency questionnaires were preceded by a 1 week period of filling out a 7 day food record compared with before the food record was completed (72). Other authors have suggested that food frequency questionnaires use a different kind of memory than 24-hour recalls do (75). Twenty-four hour recalls use recent episodic memory. Since recent episodic memory decays rapidly, food frequency questionnaires rely more on generic memory of personal diet with some influence of short term episodic memory (75). The influence of recent short food intake on completion of food frequency questionnaires is shown above (72).

Besides the NWCR studies, the Block FFQ has been used in both the RENO Diet Heart Study (76) and a weight control study of the effects of various exercise prescriptions on weight loss (50). The RENO Diet Heart Study used several methods of dietary intake assessment; a single 24-hour recall, a 7-day food record, and a Block FFQ (77). The highest correlations were found between the 24-hour recall and the 7-day food record. The correlations between the 7-day food record and the Block FFQ ranged from 0.36 to 0.44 for energy, the macronutrients, and the percentage of energy from the various macronutrients (77). This is lower than the correlations reported by the Block FFQ validation study with the three 4-day food records showing a mean correlation of 0.55 for all nutrients (71). Though the difference in means between methods was not compared statistically in this

report; review of the estimates of macronutrient intake between the Block FFQ (76) and the 7-day food record (78) show that the Block FFQ is lower in estimates of energy, carbohydrate, protein, and percentages of energy from carbohydrate and protein in both men and women. The Block FFQ estimates fat intake as lower in men and slightly higher in women than the 7-day food record. The percentage of energy from fat is higher in both men and women in the Block FFQ than the 7-day food record (76, 78).

When the Block FFQ was used in the weight control study comparing weight loss with 3 different exercise interventions, a significant difference in total energy intake and the percentage of energy consumed as fat was shown from beginning to end of the 18-month program (50). The subjects in this study were 148 overweight (BMI 32.8 ± 4.0) middle-aged (age 37 ± 6) women (50).

The Block FFQ used in the present study is actually version 98.2 instead of the generic Block FFQ reported in these other studies. It has been reformulated with data from the NHANES III survey instead of being based on data from the NHANES II survey (personal communication Torin Block of Block Dietary Data Systems August, 2000). No studies were found specifically validating version 98.2 of the Block FFQ or reporting its use.

The Eating Inventory

The Eating Inventory grew out of questions raised in the 1970's regarding the role of restraint in eating to control body weight. Initially, Herman and Polivy

had theorized that restraint actually caused an increase in food intake and weight gain (79). Though their Revised Restraint Scale was able to show this effect in normal weight college women, it did not explain eating behavior in overweight and obese populations (80). The Eating Inventory, originally called the Three-Factor Eating Questionnaire (TFEQ) and still referred to by that name in some recent research, was empirically derived by factor analysis from items on existing restraint scales and additional items added based on the researchers' clinical experience (80). The result was a 51-item questionnaire with 3 subscales; cognitive restraint, disinhibition, and hunger (80). Cognitive restraint describes the tendency to restrict food intake to control body weight (81). The item that serves as an example of this tendency is "I do not eat some foods because they make me fat." (80) Cognitive restraint has been shown to be highly correlated with food intake (80, 81). Another recent study has shown energy intake to be significantly lower in women with high cognitive restraint (scores of 13 to 21) as measured by both a Block FFQ and researcher observed and weighed 24-hour intake (82). Disinhibition is the opposite of cognitive restraint and describes the disinhibition of restraint in the control of eating (81). It is characterized by one of the items indicating disinhibition of "Sometimes when I start eating, I just can't seem to stop." (80) The hunger scale measures perceived hunger (81) and is characterized by the item "I often feel so hungry that I just have to have something to eat." (80)

Though the Eating Inventory Manual (83) and other reviews of the instrument (80) report pooled estimates and standard deviations for normal

populations and descriptions of results in obese populations, they are based on relatively small sample sizes (16-270 subjects) and are drawn from at least 6 different countries (80, 83). More recently, the RENO Diet Heart Study reported norms in a sample of approximately 500 U.S. subjects evenly divided by gender and weight status (81). While other studies including the NWCR (13, 84) have shown significantly lower scores on cognitive restraint and disinhibition among men compared to women, the RENO Diet Heart Study showed significantly lower scores on all 3 subscales for men including hunger (81). They also show significant differences for all 3 subscales based on weight status; either normal weight or overweight, the latter described as weight $\geq 120\%$ of the midpoint for a medium frame on the 1959 Metropolitan Life Insurance Tables (85). Mean \pm standard deviation scores for cognitive restraint in normal weight women were 11.8 ± 5.0 while in overweight women they were 10.1 ± 4.8 . Among men, cognitive restraint scores were 9.2 ± 4.4 among normal weight men and 8.8 ± 4.4 among overweight men. Disinhibition and hunger scores were generally higher among the overweight (116), which coincides with earlier reports (80). Disinhibition scores were 6.0 ± 3.6 for normal weight women, 10.0 ± 3.6 for overweight women, 4.4 ± 2.5 for normal weight men, and 8.0 ± 3.6 for overweight men. While cognitive restraint showed a small negative correlation with BMI in the RENO Diet Heart Study, disinhibition showed a strong positive correlation with BMI (81). Hunger scores were 4.7 ± 3.2 for normal weight women, 6.7 ± 3.6 for overweight women, 3.7 ± 2.9 for normal

weight men, and 6.1 ± 3.5 for overweight men (81). Hunger also showed a moderate positive correlation with BMI (81).

Another recent U.S. study has provided normative data for the Eating Inventory from a large (223 subject) treatment-seeking sample of obese women (86). Mean BMI was 37.2 ± 5.6 in this sample. Pre-treatment mean Eating Inventory scores in this sample were 8.2 ± 4.3 for cognitive restraint, 10.8 ± 3.1 for disinhibition, and 6.6 ± 3.3 for hunger (86). These scores agree with the scores for disinhibition and hunger in overweight women in the RENO Diet Heart Study, but are slightly lower in cognitive restraint (81). The cognitive restraint scores are similar to baseline values in a Finnish group of women seeking VLCD treatment (cognitive restraint 8.8 ± 4.4) (34) but lower than the women in a Swedish study seeking treatment with either a LCD or VLCD (cognitive restraint means 9.3-9.7 depending on treatment group for maintenance) (29). The only relationship the U. S. study found between baseline Eating Inventory scores and weight loss was that the lowest scores on cognitive restraint were associated with more weight lost in treatment (86). Baseline disinhibition and hunger scores were not related to weight loss (86). Though the Swedish study (29) relates higher baseline hunger scores to attrition, weight loss was not correlated with baseline Eating Inventory scores in other studies (21, 31) likely because the weight loss treatment was a VLCD.

With weight reduction, cognitive restraint increases (80) and is paralleled by corresponding decreases in disinhibition and hunger (81). The recent U. S. study in obese treatment-seeking women confirms these changes and quantifies the

change in cognitive restraint as a 90% increase to a mean score of 15.3 ± 3.3 (86). While the increase in cognitive restraint in this study explained 7% of the variance in weight loss, keep in mind that initial BMI explained the biggest variance in weight loss of 16% (a higher initial BMI resulted in more weight loss) (86). The Finnish study with a VLCD agrees with the magnitude of these changes in cognitive restraint (34, 21) and a Dutch study goes on to report that a significant increase in cognitive restraint during treatment was shown in those who later were successful at maintenance of weight loss for 2 years while unsuccessful or only partly successful weight loss maintainers did not show this significant increase (31).

In the U. S. study again, disinhibition and hunger scores both decreased but to a lesser extent than cognitive restraint increased (86). They each showed a 19% decrease to post-treatment disinhibition scores of 8.6 ± 3.5 and to a hunger score of 5.4 ± 3.5 (86). Disinhibition explained an additional 3% of the variance in weight loss in this study while hunger did not significantly explain any of the variance in weight loss (86). The post-treatment disinhibition and hunger scores are still somewhat higher than the scores for normal weight women in the RENO Diet Heart Study (81) but are consistent with the changes noted in hunger in the Finnish study (21). The Finnish study showed an even greater decrease in disinhibition to 6.6 (34) that is more consistent with disinhibition scores reported for normal weight women in the RENO Diet Heart Study (81).

Changes in Eating Inventory scores over a longer period of weight maintenance are shown in only one study. The Finnish study showed 2-year follow-up scores for both cognitive restraint and disinhibition after their year-long treatment and maintenance program (34). Though no change was noted in cognitive restraint and disinhibition between the end of the weight reduction phase and the end of the intensive 40-week maintenance phase, both cognitive restraint and disinhibition relapsed toward baseline by the 2-year follow-up. The 2-year follow-up score for cognitive restraint was 12.1, still higher than the baseline score of 8.8. The 2-year follow-up score for disinhibition was 7.5, lower than the baseline score of 9.5 (34).

Another area of interest for treatment of obesity concerns the relationship between scores on the Eating Inventory and problems with binge eating. In general, reviews report that high cognitive restraint with concurrent high disinhibition is associated with bulimia (80); but according to recent research, the high cognitive restraint seems to be missing in those with binge eating problems. When Eating Inventory subscales were compared with severity of binge eating, cognitive restraint was lower than normal while both disinhibition and hunger scores were elevated (87). Specifically, those with scores on the Binge Eating Assessment Scale (BES) indicating severe problems with binge eating had cognitive restraint scores of 6.6 ± 2.9 , disinhibition scores of 13.5 ± 1.9 , and hunger scores of 11.0 ± 2.8 (87). Those categorized as having no problem with bingeing to moderate problems with bingeing as determined by the Binge Eating Assessment Scale (BES) had more

normal levels of cognitive restraint at 9.5 ± 3.6 , and still elevated disinhibition and hunger scores of 11.5 ± 2.3 and 7.3 ± 2.9 respectively (87). Likewise in a larger previously mentioned study of obese women seeking treatment (86), those at low risk of binge eating as determined by Binge Eating Assessment Scale scores had disinhibition scores of 7.2 ± 1.8 and hunger scores 3.4 ± 1.3 . Those at moderate risk of binge eating had disinhibition scores of 14.1 ± 1.0 and hunger scores of 11.1 ± 1.7 (86). With treatment of binge eating disorder, a general review indicates disinhibition falls and cognitive restraint rises (81). In a recent treatment study of those with binge eating disorder, disinhibition and hunger scores fell significantly but no change was observed in cognitive restraint (88). Another sample of primarily obese men and women showed that the Eating Disorder Inventory bulimia subscale and the Eating Inventory hunger and disinhibition scales gave similar results and explained 28.8 % of the variability in that sample (89).

Westenhoefer's Rigid and Flexible Control of Eating Behavior

This scale represents a refinement and an addendum to the cognitive restraint scale in the Eating Inventory. The subscales were not used in the NWCR research but are used in the current research. Westenhoefer determined that some of the items on the cognitive restraint scale correlated with disinhibition while others did not (84). He felt that this could explain the apparently inconsistent findings that high cognitive restraint is associated with both successful weight loss and disordered eating behavior. Using a very large German sample enrolled in a

computer-assisted weight loss program (more than 50,000 people), he used factor analysis to determine that cognitive restraint could be further divided into 2 subscales. One was called rigid control, was highly correlated with disinhibition, and was characterized by an all-or-nothing approach to eating, dieting, and weight. The other he called flexible control, was not correlated with disinhibition, and was characterized by a more flexible approach to eating in which small amounts of so called fattening foods were eaten without guilt. Since the original sample was enrolled in a weight loss program, he found on re-administration of the Eating Inventory to a subsample, that subjects with higher flexible control scores near the beginning of the program and who increased their flexible control scores during the program had more successful weight loss than those with lower initial flexible control scores and who did not increase their scores during the program. According to the authors, rigid control was not associated with successful weight loss for all practical purposes (84).

Unfortunately, the two new subscales were only modest in internal consistency and highly correlated with each other. In an effort to improve them, Westenhoefer used a sample of 85 men and women (both normal weight and overweight) to test additional items for flexible and rigid control subscales that reflected their distinctive characteristics (84). As a result, 5 items were added to the original 7 items on flexible control and 9 items were added to the original 7 items in rigid control. The new items greatly increased the reliability of the 2 subscales. As a further test of these subscales, the Eating Inventory was administered to a

large (approximately 2000 subjects) representative sample of West German people between 14 and 87 years of age (84). Since this was not a weight control population, scores on the flexible and rigid control subscales were compared with BMI, purging behavior, exercise, and binge eating behavior. What they found was that flexible control was associated with a lower BMI, a lower risk of using diuretics or appetite suppressants for weight control, a higher likelihood of using exercise or body-building for weight control, and with lower binge eating scores. Conversely, rigid control was associated with a higher BMI, use of diuretics, laxatives, appetite suppressants, and vomiting for weight control, and with higher binge eating scores (84). The authors conclude that cognitive restraint is adequately explained as a linear combination of flexible control and rigid control. They also feel that the expanded flexible and rigid control subscales should have diagnostic clinical utility for use with individuals. The norms they propose, based on their representative West German sample, are for men, flexible control of 3.5 ± 3.0 and rigid control 3.3 ± 3.0 . For women, normative scores for flexible control are 5.4 ± 3.4 and for rigid control 5.5 ± 3.7 . As was noted with the other Eating Inventory scores, scores for women are significantly higher than those for men on flexible and rigid control (84).

Two additional studies have attempted to replicate Westenhoefer's findings but both had access to only his original 7-item subscales. The first study was undertaken with a small sample of women (31 subjects) with personality disorders (90). This sample was chosen due to the high incidence of eating disorders. Just as

Westenhoefer found with his shorter subscales, scores for cognitive restraint, flexible control, and rigid control were significantly associated with each other. Interestingly, disinhibition was not correlated with either flexible or rigid control. Based on how the rigid control subscale was derived, according to the correlations individual items showed with disinhibition, this is surprising. Overall, results did offer some support that flexible control was associated with successful control of body weight, albeit a somewhat disordered control known as anorexia. Rigid control was significantly correlated with a history of a bulimia diagnosis and a history of weight fluctuation but not with some other indications of bulimia such as the bulimia subscale on the Eating Disorder Inventory (90).

The second study was part of the Pound of Prevention study previously described (68). They found the shorter flexible and rigid control subscales as well as the full cognitive restraint subscale similarly and significantly associated with changes in weight and weight controlling behaviors. This does not replicate Westenhoefer's findings that rigid control is not associated with successful weight loss. The authors from the Pound of Prevention study suggest that the difference may be that the additional items are needed in samples smaller than the 50,000 Westenhoefer used for his original derivation of the short subscales or his sample may have had a higher proportion of binge eaters in it.

No studies were found describing the use of the expanded 12-item flexible control and 16-item rigid control subscales in an overweight treatment-seeking sample. The current research does use these subscales in such a sample.

Godin Leisure Time Physical Activity Questionnaire (Godin Questionnaire)

The Godin Questionnaire was developed to provide a reliable, valid, easy, and quick to complete activity questionnaire (91). The Godin Questionnaire measures frequency of various levels of physical activity and then calculates a total activity intensity score by assigning higher intensity factors to more strenuous types of physical activity. The 3 categories of physical activity are strenuous, moderate, and mild and respondents indicate how many times in a 7-day week they have performed that level of physical activity (See appendix G for a copy of the questionnaire). It also includes one question asking the frequency of sweat inducing activity in a week (91). While the Paffenbarger Physical Activity Questionnaire was used in the NWCR study (12), the Godin Questionnaire was used in the general population telephone survey done by the NWCR researchers to confirm results from the NWCR study (17). It's characteristics of being simple and quick to fill out were the reason it was chosen for the current research. Validity and reliability results for the Godin Questionnaire were conducted by the researchers at the time of development (91) and also by an independent team of researchers evaluating several physical activity questionnaires (84). Of note is that the developing researchers used other existing questionnaires, including the Paffenbarger Physical Activity Questionnaire, in choosing appropriate items for the Godin Questionnaire (91). Both research groups found acceptable validity for the Godin Questionnaire in correlations with VO₂ Max (91, 92), treadmill exercise test results, and results of a 4 week activity history (92). The questionnaire was able to

correctly identify more than 80% of the fit subjects as physically fit; though unfit subjects were not identified as accurately with only 48% correctly identified as unfit (91). Thus, the Godin Questionnaire is a reasonable questionnaire to use in the current study in terms of simplicity and validity.

Representative results are reported only from the general population telephone survey conducted by the NWCR researchers (17). Mean scores for total physical activity intensity were 27.8 ± 28.2 for maintainers, 16.2 ± 17.6 for regainers, and 18.2 ± 19.5 for controls (17).

The large standard deviations are similar to results obtained for the Godin Questionnaire in the independent validity and reliability study of 10 physical activity questionnaires (84). That study showed means \pm SD's for total physical activity intensity of 37.5 ± 34.3 for men and 35.1 ± 31.7 for women. The Paffenbarger Physical Activity Questionnaire also had large standard deviations for the total index score (1949 ± 1608 kcal expended /week for men and 1594 ± 1186 kcal expended /week for women) and for the sports score (1242 ± 1517 kcal/week for men and 844 ± 1030 kcal/week for women) (84). Apparently large standard deviations, indicating much individual variability, are common among a number of physical activity questionnaires where strenuous or heavy physical activity is either directly measured or heavily weighted in the total score (as it is in the Godin Questionnaire). This is noted in heavy or vigorous activity scores in the Minnesota Leisure Time Physical Activity Questionnaire, the Seven Day Recall, and the

Stanford Usual Activity Questionnaire and in the total leisure index score for the Minnesota Heart Health Program Questionnaire (84).

Center for Epidemiologic Studies Depression Scale (CES-D)

The CES-D measures recent depressive symptomatology by having respondents indicate the frequency of various feelings during the past week (93). Though developed in the latter 1970's (94), the general report of the RENO Diet Heart Study provides a good description of its use as well as sample results for a general population of normal weight and overweight people (93). Its strengths are that it is brief and easy to complete, it has outstanding validity and internal consistency and has acceptable reliability (93). It can be used as a research tool in epidemiological studies, a depression screening tool, or a tool to monitor symptoms of depression during treatment. One of its advantages is that it is a public document without restrictions on its use. It does have an inability to differentiate types of depression so cannot be used to diagnose depression. A score of 0-16 indicates no depression, 17-22 indicates possible depression, and scores of ≥ 23 as probable depression (93).

The RENO Diet Heart Study found that overweight people had significantly higher CES-D scores but that the means (6.5 ± 7.0 for overweight women and 6.6 ± 7.4 for overweight men) were still well within the normal range (93). When the percentage of subjects with scores >16 were compared (indicating possible or

probable depression), the percentage was not significantly different in normal weight and overweight subjects (93).

Estimation of Resting Energy Expenditure by the Mifflin Equation

The Mifflin equation was developed in response to concerns about obvious differences in body size and composition, levels of physical activity and diet in subjects used to develop the classic Harris Benedict equation and our modern population (95). The 239 subjects used to develop the Harris Benedict equation likely had more lean body mass at a particular body weight due to higher levels of habitual physical activity, were lighter in body weight, and relatively young (95). As a result, the Harris Benedict equation tends to overestimate basal energy expenditure in current samples of healthy men and women (95). Another change in the 80 years since the development of the Harris Benedict equation has been the improvement in technology for measuring resting energy expenditure (REE) by both direct and indirect calorimetry (95).

The sample used to develop the Mifflin equation was the participants in the RENO Diet Heart Study. This sample was stratified for age, weight, and sex and included approximately 500 subjects. REE was measured by indirect calorimetry with use of a metabolic measurement cart fitted with a canopy hood. Several different predictive equations were developed by stepwise multiple regression and results of actual measurements were compared with predictive estimates. The final equations are (95):

$$\text{Females: REE} = (10 \cdot \text{weight in kg}) + (6.25 \cdot \text{height in cm}) - (5 \cdot \text{age in years}) - 161$$

$$\text{Males: REE} = (10 \cdot \text{weight in kg}) + (6.25 \cdot \text{height in cm}) - (5 \cdot \text{age in years}) + 5$$

Note that the only difference in equations for men and women is the last added or subtracted constant. This increases the ease of use. One of the main advantages of this study is that the mean BMI's of 26 for women and 27 for men mirror the increase in body weight occurring in the U. S. population in recent decades. Hence their use may be particularly useful for moderately overweight people (95). One note is that the researchers did try developing equations based on subsets of the populations according to weight status. They did not find any predictive equations that performed better than the above equations developed with the whole sample, which explained 71% of the variability in REE in the sample.

Examination of the differences between predicted and measured REE by weight status in the RENO Diet Heart Study (96) shows a general overestimation of mean REE by the predictive equations. This overestimation ranged from 12.8% in normal weight men to 16.0% in normal weight women. Overestimation of REE for overweight men and women was between these two values at 15.7% and 14.6% respectively (96).

Use of the Mifflin equation in a sample of obese women and men (mean BMI of 35.2 ± 7.2 for women and 41.5 ± 8.5 for men) again showed a tendency to overestimate REE compared to measured REE (97). In their cross validation of several predictive equations for REE in an obese sample, they found the Mifflin

equation to predict 60% of the variability in measured REE compared to 71% in the Mifflin study (95). Heshka et al. (97) found that equations based on body surface area rather than linear regression for height and weight do much better in estimating the REE for obese people. Examples of body surface area based equations are the Robertson and Reid equation published in 1952 and the Fleisch equation published in French in 1951 (97). Apparently the Mifflin equation is appropriate in overweight samples; but when frank obesity is involved, body surface area based equations for estimating REE are better.

METHODS

Study Design

The current research consisted of before and after study of current participants in Providence Health System's Smart CHOICES program and one-time follow-up of past participants in the CHOICES program.

Subjects

Group I consisted of current enrollees in 3 groups of the Smart CHOICES 10-week weight control program in the Portland, OR metropolitan area starting 9/13/00 to 9/19/00. Their participation in the research and their informed consent was requested at the end of the first group meeting. Those agreeing to participate received a survey booklet containing all questionnaires as described later. Among the 40 participants registered for the Smart CHOICES program, 30 agreed to participate and received survey booklets. After program completion, this group was divided into successful weight loser and non-successful weight loser comparison groups. Successful weight losers lost ≥ 5 lb from beginning to end of the Smart CHOICES program and non-successful weight losers lost < 5 lb.

Group II consisted of past CHOICES program registrants who registered for groups beginning between 5/28/98 and 9/28/98, approximately 2 years ago. There were 144 potential subjects in this group. Due to Providence Health System

requirements that only staff members with legitimate access to identifying information about potential subjects must request subject participation, a letter was sent to potential subjects by the coordinator of the Health Education Services Department on 10/25/00. This first pass mailing requested their participation regardless of how many CHOICES sessions they had attended and included informed consent and a stamped response postcard. On the postcard, identified only with the potential subject's name, they checked willingness to participate or declined participation. The coordinator of Health Education Services gave the names and addresses of subjects willing to participate to the graduate student researcher. The graduate student researcher sent survey booklets with an enclosed stamped return envelope to them.

In an effort to increase sample size, a second solicitation letter as part of a second pass mailing was sent on 12/2/00 to Group II registrants from whom no response was received. The same procedure of an enclosed stamped response postcard with notification of the researcher by the coordinator of Health Education Services of positive responses was followed. As noted in Table 1, the second pass mailing was not nearly as effective in getting a response as the first pass mailing had been. Only 10 more individuals agreed to participate and only half of them returned completed surveys. Apparently, most willing participants responded to the first mailing.

Group II subjects were screened for successful weight loss during program participation using the same criterion as current participants; those reporting a loss of ≥ 5 lb during program participation were successful weight losers and those

Table 1—Comparison of the results for first and second pass mailings for past participants in the CHOICES program

	1 st pass		2 nd pass	
Solicitation letters sent	144		74	
Declined	22		7	
Agreed to participate	35 of 144	24%	10 of 74	14%
Returned survey	29 of 35	84%	5 of 10	50%
Overall return rate	34 of 45 (76%)			

reporting < 5 lb loss became non-successful weight losers. The eleven identified non-successful weight losers are briefly described in the Results and Discussion but were not analyzed further as a research focus. Remaining Group II subjects were divided into weight loss maintainer and non-maintainer comparison groups for study. The weight loss maintainers had either continued to lose weight or regained less than 5 lb since program completion. The non-maintainers had regained greater than or equal to 5 lb since program completion 2 years before.

The study received approval from Oregon State University's Institutional Review Board for use of human subjects and from Providence Health System's Institutional Review Board (See Appendices A and B).

Data Collection

Participation in the study was encouraged by offering subjects estimated energy and nutrient intake results from their Food Questionnaire (Block Food Frequency Questionnaire version 98.2) at the end of the study. This information

was included in the brief verbal informed consent and the formal informed consent letter for Group I and on the subject solicitation letter for Group II. This decision was made based on observations from the RENO Diet Heart Study that overweight individuals consider education and feedback on their results as an incentive to participate in research studies (98).

Group I subjects received a survey at the first group meeting of the Smart CHOICES program to provide baseline data. They filled out a pre-numbered form, matching the subject number in the survey booklet, with their name, address, and phone number. This form was returned to the graduate student researcher. Subjects then had the option of filling out the survey at that time or taking it with them to complete at home and mail within 1 week. All of the subjects chose the second option as they had already attended a 2-hour group and the survey takes another 30-60 minutes to fill out. Stamped survey return envelopes were provided.

The name and address forms allowed follow-up to encourage return of unreturned surveys and to provide subjects with results on their Food Questionnaire later as promised. Follow-up was by a modified Dillman method (99). Those who did not return their surveys within 1 week were sent a postcard reminding them to return the survey. Those not returning the survey within 2 weeks of distribution were sent a reminder letter along with a second survey booklet.

At the last group meeting of each 10-week session, 11/15/00-11/21/00, the graduate student researcher distributed surveys to subject volunteers who had previously returned the baseline survey. Subjects who provided baseline data but

did not attend this meeting were mailed a survey with a stamped return envelope. The Follow-up procedure changed slightly; a reminder postcard was sent 1 week later, a reminder phone call was made 2-3 days later, and a reminder letter with a second copy of the survey was sent 2 weeks later. The change in procedure was made after further reading in Salant and Dillman (99) indicated that the personal contact from a phone call greatly improved response rate. Table 2 shows the response rates and confirms Salant and Dillman's findings that a reminder phone call made shortly after the reminder postcard is sent increases the response rate and decreases the necessity of sending the second copy of the survey.

Group II subjects received surveys by mail and also received a reminder postcard 1 week after original mailing for unreturned surveys. Two to three days later a reminder phone call was made. Two weeks after the original mailing, they were sent a reminder letter along with a second survey.

Providence Health System's criterion for successful completion of the Smart CHOICES and CHOICES programs is attendance at a minimum of 7 out of 10 weekly sessions. Originally this was among the subject selection criteria for both Group I and Group II participants and participants were given the option of not filling out the rest of the survey if they had attended fewer than 7 of the 10 weekly sessions. Due to the small sample size, it was later decided to include as many subjects as possible in comparison studies. Two of the 18 Group I subjects attended only 5 and 6 sessions, respectively, of the complete ten. Both of these subjects lost < 5 lb during the program and thus were categorized as

Table 2—Response description for questionnaire distribution

Current Participants		Past Participants	
Number registered for class	40	Number registered for class	144
Before:			
Questionnaires distributed	30	Questionnaires distributed from 1st and 2nd pass mailings	45
Reminder postcard sent	17 of 30 (57%)	Reminder postcard sent	35 of 45 (78%)
		Reminder phone call made	25 of 45 (56%)
Second questionnaire sent	14 of 30 (47%)	Second questionnaire sent	15 of 45 (33%)
After:			
Questionnaires distributed	20		
Reminder postcard sent	11 of 20 (55%)		
Reminder phone call made	9 of 20 (45%)		
Second questionnaire sent	3 of 20 (15%)		

non-successful weight losers. Both were included in all current participant comparisons and note is made in the results section when results without these two subjects is significantly different from when they are included. Four of 34 Group II subjects also reported attending fewer than 7 out of 10 sessions. All 4 of these subjects were in either the non-successful weight loss group or could not be categorized as to successful or non-successful weight loss due to missing weight information. Thus, none of them were included in the study.

Approximately 4 months after completion of data collection, all subjects in both groups were sent a letter on 5/11/01 describing their personal results on the Food Questionnaire. For Group I subjects it included results at the start and end of the program and for Group II, just 1 set of results from their single completed survey.

Instruments

The questionnaires included in the survey booklet were a weight history questionnaire, a Block Food Frequency Questionnaire (Block FFQ) version 98.2, Stunkard and Messick's Eating Inventory, Westenhoefer's additions to the Eating Inventory to differentiate between flexible and rigid control of cognitive restraint, the Godin Leisure Time Physical Activity Questionnaire (Godin Questionnaire), and the Center for Epidemiologic Studies Depression Scale (CES-D).

The weight history questionnaire was written by the researcher based on information reported for the NWCR study (12) and recommended wording from the RENO Diet Heart Study baseline weight history questionnaire (100). The questionnaire was adapted for each group of subjects who received it. For instance, all subjects had questions included about their current weight and how they felt about it. Current participants just beginning the Smart CHOICES program (Group I) and all past participants (Group II) were asked what their goal weight was, lifetime maximum weight, when they perceive they became overweight, which life events contributed to weight gain, and information about previous weight loss

attempts. Group I subjects at the end of the program were given an abbreviated version that omitted historical data they had already provided. Both Group I subjects at the end of the program and Group II subjects were asked how many sessions of the program they attended. They were directed on the questionnaire that if they attended fewer than 7 sessions they had the option of returning the survey booklet at that time and leaving the rest of the questionnaires blank. They were thanked for their participation and time. They were also told that if they chose to fill out the Food Questionnaire, a report of the results would be sent to them.

The Block FFQ is a semi-quantitative food frequency consisting of 100 food categories based on national food consumption data. The subject fills in frequency of consumption for each food category along with an indication of the size of their usual serving compared to a standard serving size. The Block FFQ provides an estimate of usual intake for all macro- and micronutrients.

Stunkard and Messick's Eating Inventory consists of 3 scales; cognitive restraint, disinhibition, and hunger. The cognitive restraint scale indicates the degree to which individuals consciously try to decrease their food intake. The disinhibition scale indicates the degree to which individuals lose control of eating and the hunger scale measures perceived hunger. Westenhoefer's additional questions to the cognitive restraint scale measure rigid control, which is purported to be associated with more disturbed eating patterns, and flexible control, which is purported to be associated with more successful weight reduction and maintenance.

The Godin Questionnaire is a short, self-administered questionnaire that asks the number of times per week the subject engages in strenuous, moderate, and mild exercise and thus can give a numerical score for total activity intensity and for each of the 3 intensity categories. It also asks one additional question about how often subjects engage in a physical activity long enough to work up a sweat or have their heart beat rapidly.

The CES-D is a 20-item questionnaire with a Likert type scale that screens for symptoms of depression within the past week. Scores range from 0 to 60. A score of 16 or below screens out those not depressed, while a score of 17-22 indicates possible depression and a score of ≥ 23 as probable depression.

All of the above questionnaires were used in the NWCR study except in that study the Block FFQ used was an earlier version, Westenhoefer's additions to the Eating Inventory were not used, and the Paffenbarger Physical Activity Questionnaire was used instead of the Godin Questionnaire. Both the Block FFQ and the Eating Inventory were purchased for use in this study. Dr. Westenhoefer gave permission to the researcher to use his additional questions for the Eating Inventory and Dr. Godin gave permission for use of the Godin Questionnaire. The CES-D is part of public domain.

Copies of each version of the weight history questionnaire, the Block FFQ, Westenhoefer's additional questions for rigid and flexible control, the Godin Questionnaire, and the CES-D are found in Appendices C through F and H through

J. Source information for a sample copy of the Eating Inventory and contact information for purchasing it are located in Appendix G.

Data Analysis

Statistical consultation was used both during the planning stages of the current research and after data collection to plan and carry out the analysis. Block Dietary Data Systems calculated estimates of daily caloric intake and percentage of energy from fat from the Block FFQ for each subject. To correct for variations in total caloric intake due to differences in body size, gender, and age, comparisons of relative caloric intake were made based on calculations of the ratio of energy intake to resting energy expenditure (EI/REE). Resting energy expenditure calculations were made using the Mifflin equation (95).

The researcher, according to standard instructions accompanying each of the instruments, did the scoring for the Eating Inventory, Westenhoefer's flexible and rigid control of cognitive restraint, the Godin Questionnaire, and the CES-D. Numerical scores were obtained for each instrument and each scale of each instrument with a higher score indicating more of that particular characteristic.

In Group I, current participants, change in the variables relative caloric intake, percentage of energy intake from fat, total activity intensity, flexible control, and disinhibition were calculated by subtracting before-program values from after-program values for each subject. Thus, a decrease in value from beginning to end of the program is indicated by a negative change in value. The

difference between the change in each of these variables was compared between successful weight losers and non-successful weight losers (hypotheses #1, 3, 5d, & 5e) as was the difference between the baseline values for flexible control, disinhibition and CES-D scores for these two groups (hypotheses #5a, 5b, and 5c).

For Group II, past participants, comparisons of relative caloric intake (EI/REE), percentage of energy intake from fat, total leisure time physical activity, strenuous exercise, flexible control, disinhibition, and rigid control (hypotheses #2, 4, 6a, 6b, & 6c) were made for the single time the questionnaires were administered 22-26 months after CHOICES program completion. These comparisons were made between weight loss maintainers and non-maintainers.

Many of the variables exhibited non-normal distributions and unequal variances. Sample sizes were small, between 6 and 12 subjects in each comparison group, and the sample sizes differed between groups being compared with one group usually at least 1 ½ times larger than the other comparison group. Parametric tests such as the 2-sample t-test, paired sample t-test, and ANOVA can be untrustworthy under these circumstances (101). For consistency, equivalent non-parametric tests were used with all comparisons regardless of individual variable sample characteristics.

The Mann-Whitney U test was used for between-group comparisons to compare current participant successful weight losers with non-successful weight losers and past participant weight loss maintainers with non-maintainers for hypotheses #1 through #6. Wilcoxon Signed Rank tests were used for within group

comparisons on the variables of interest to evaluate significance of change from beginning to end of the program in current participant successful weight losers and non-successful weight losers. A value of $p \leq .05$ was considered significant.

The Chi-Square test using the SPSS Crosstabs procedure was used to compare frequency of response between all 4 comparison groups (two current participant comparison groups and two past participant comparison groups). This was used for comparison of basic characteristics between groups and for individual items on the Eating Inventory and Westenhoefer's scales for rigid and flexible control. When the Chi-Square test indicated a significant difference among the 4 groups, follow-up pairwise comparisons between each of the current participant and past participant groups were evaluated with Fisher's Exact test with Bonferroni's adjustment of significance for multiple comparisons (101). The Median test was used to evaluate differences between the 4 groups in weight and diet related, exercise related, and behavior related variables with follow-up pairwise comparisons of significant differences between groups using Fisher's Exact test with Bonferroni's adjustment of significance for multiple comparisons. The Median test is especially suitable for comparison of several groups when sample sizes are small (101). Logistic regression analysis for categorical dependent variables was used to evaluate relative importance of variables in determining successful weight loss or non-successful weight loss in current participants (hypothesis #7) or weight loss maintenance or non-maintenance in past participants

(hypothesis #8). SPSS for Windows Release 10.0.7, copyright © SPSS Inc., 1989-1999 Chicago, IL was used for all statistical evaluations.

RESULTS AND DISCUSSION

Overview of Results

Table 3 shows results for subject response rates. Of those current participants who agreed to participate and attended 7 or more of the class sessions, 89% returned questionnaires both before and after program participation. With this high response rate, the sample of current participants is likely representative of the

Table 3—Subject response rates

Current Participants		Past Participants	
Number registered for class	40	Number registered for class	144
Registrants attending \geq 7 of 10 sessions	18 of 40 (45%)	Registrants attending \geq 7 of 10 sessions	76 ²
Those attending \geq 7 of 10 sessions and agreeing to participate in research	16 of 18 (89%)	Unable to contact	12 of 144 (8%)
		Responded to solicitation letter	74 of 144 (51%)
Additional subject volunteers¹	2	Declined to participate	29 of 74 (39%)
		Agreed to participate	45 of 144 (31%)
Total # subjects	18	Returned questionnaires	34 of 45 (76%)
Useable questionnaires	18	Useable questionnaires	30 ³ of 76 ² (39%)

¹ Two additional subjects returned both before and after questionnaires but attended only 5 and 6 of 10 sessions.

² Seventy-six represents an approximate number as 2 of the 12 classes had incomplete attendance information and summary information could not be tallied.

³ One subject attend $<$ 7 sessions and declined to complete the survey. Three surveys were missing the ending program weight and could not be classified as a maintainer or non-maintainer.

participants meeting Providence Health System's criterion for successful program completion of attending ≥ 7 of 10 program sessions. Attrition however was high as only 45% attended ≥ 7 of 10 program sessions. Since Before and After questionnaires were available for 2 additional participants attending either 5 or 6 sessions, their data was included as well.

Among past participants, agreement to participate was low at only 31% of those registered for classes. A usual rate of return for mailed surveys is 50-60% according to Salant and Dillman (142). While we did receive a response from 51% of the possible subjects, only 45 of the 74 agreed to participate. The past participants that we were trying to reach were those who attended ≥ 7 of 10 program sessions. We had indications that many of the registrants did not fit this category since 48% (14 of 29) of those declining to participate indicated that they had attended fewer than 7 of the 10 sessions. Complete attendance records were not kept, but summary attendance records show that approximately 76 registrants (attendance summaries not available for 2 classes as attendance records were incomplete) completed ≥ 7 of 10 program sessions during this time period. Based on useable questionnaires received, this gives an approximate 39 % response rate for past participants attending 7 or more sessions. This less than 50% response rate suggests that the past participant subjects may not be a representative sample.

Achievement of Weight Loss

Overall, current participants lost a median of 6.5 lb (range 0-25 lb loss) during the 10-week course and past participants reported a median loss of 7.0 lb (range 0-23 lb loss). Both of these figures average out to 0.7 lb/week and are slightly less than the average weight loss of 0.9 lb/week (.4 kg/week) reported in cognitive behavioral programs (9). They are consistent with recommendations for modest sustainable losses in general lifestyle change weight loss programs (51), which is the type of program that the Smart CHOICES and CHOICES programs represent. This translates into a median 3.5% weight loss during a 10-week weight loss program in both current and past participants. Though this is not impressive when compared with recommendations for a 5-10% weight loss for improvement in health status (53), successful weight losers among both current and past participants did lose a median of 5% of body weight during the 10 weeks of the Smart CHOICES and CHOICES program (range of 2-11% loss of body weight).

Maintenance of Weight Loss

Past participants had a median weight gain of 5.5 lb in the two years since the end of the program, which translates into a net median weight loss of 3.0 lb. The individual variation was large with a range of 35 lb net loss to 22 lb net weight gain. Twenty-four percent of the sample was weight loss maintainers at 2 years with less than 5 lb weight regain since CHOICES program end. These results

compare favorably with 2 recent studies of lifestyle change that report 38% of subjects with successful weight loss maintenance at 1 year in one study of diet-only or diet-plus-exercise on cardiovascular disease risk factors (57) and the 13% of subjects with successful weight loss maintenance at 36-months in the other TOHP II study (58).

Descriptive Characteristics of Current Research Compared to Other Recent Studies

Table 4 shows the descriptive characteristics for each of the sample study groups as well as the past participant non-successful weight losers who were not included in the study. The study groups were predominantly white, middle-aged, moderately overweight, and female. By Chi-Square contingency table analysis and the Median test, there were no significant differences between any of the included 5 groups for the listed characteristics. While subsequent regainers in the NWCR study (16), the regainers in the British “slimmer’s club” study (62), and the regainers in the U. S. consumer survey (64) showed higher lifetime maximum BMI and higher lifetime weight loss scores (a measure of cumulative lifetime weight loss; higher scores indicate more weight fluctuation), there were no significant differences between past participant weight loss maintainers and non-maintainers for these variables in the current research. Despite the high frequency of weighing themselves at least once per week among past participant weight loss maintainers in the current research, there were no significant differences in weighing frequency

Table 4—Descriptive characteristics of sample by individual study group ¹

	Current Participants		Past Participants		
	Successful Weight Losers	Non-Successful Weight Losers	Weight Loss Maintainers	Weight Loss Non-Maintainers	Non-Successful Weight Losers
	n = 11	n = 7	n = 7	n = 12	n = 11
Gender:					
Male	3 (27%)	1 (14%)	0	1 (8%)	1 (9%)
Female	8 (73%)	6 (86%)	7 (100%)	11 (92%)	10 (91%)
Age (in years)	49 (30-55) ²	45 (27-62)	49 (33-77)	52 (42-64)	48 (29-78)
Ethnicity:					
White	11 (100%)	6 (86%)	6 (86%)	12 (100%)	10 (91%)
Hispanic	0	1 (14%)	0	0	0
Other	0	0	1 (14%)	0	1 (9%)
Age when weight problem began:					
Childhood	1 (9%)	2 (29%)	1 (14%)	0	2 (18%)
Adolescence	1 (9%)	2 (29%)	2 (29%)	6 (50%)	0
Young adulthood	3 (27%)	1 (14%)	2 (29%)	2 (17%)	5 (46%)
Middle adulthood	4 (36%)	0	2 (29%)	2 (17%)	4 (36%)
No particular age	2 (18%)	2 (29%)	0	2 (17%)	0
Biological Parents Overweight:					
Mother	6 (55%)	4 (57%)	0	5 (42%)	2 (18%)
Father	4 (36%)	1 (14%)	2 (29%)	2 (17%)	4 (36%)
Neither	1 (9%)	1 (14%)	2 (29%)	2 (17%)	1 (9%)
Both	0	1 (14%)	3 (43%)	3 (25%)	2 (18%)
Don't know	0	0	0	0	1 (9%)

¹ Chi-Square contingency table analysis and the Median test indicated no significant differences between groups ($p > .05$)

² Median (range).

Table 4—Continued descriptive characteristics of sample by individual study group ¹

	Current Participants		Past Participants		
	Successful Weight Losers	Non-Successful Weight Losers	Weight Loss Maintainers	Weight Loss Non-Maintainers	Non-Successful Weight Losers
	n = 11	n = 7	n = 7	n = 12	n = 11
Current BMI²	28.9 (25.0-36.6) ³	26.9 (22.5-34.8)	25.9 (20.2-43.5)	30.1 (23.2-53.8)	32.9 (23.8-36.7)
Lifetime Maximum BMI	31.1 (27.2-38.5)	28.5 (24.1-36.7)	31.7 (21.7-45.0)	31.0 (24.4-54.9)	35.3 (28.1-37.8)
Lifetime weight-loss score⁴	116 (22-254)	73.5 (22-168)	110 (58-345)	145 (22-605)	52 (22-168)
Frequency of weighing self					
At least once per week⁵	4 (36%) ⁶	2 (29%)	6 (86%)	7 (58%)	6 (55%)
Less than once per week	7 (64%)	5 (71%)	1 (14%)	5 (42%)	5 (45%)
Have used other weight loss methods since CHOICES program	Not applicable	Not applicable	5 (71%)	9 (75%)	7 (64%)

¹ Chi-Square contingency table analysis and the Median test indicated no significant differences between groups ($p > .05$)

² Represents Body Mass Index at end of program for current participants. Body Mass Index (BMI) equals weight in kg/height in meters squared.

³ Median (range)

⁴ Lifetime weight loss score is the total of the number of times particular amounts of weight have been lost in subject's lifetime.

⁵ After program participation for current participants.

⁶ Frequency (percentage of group)

between this group and any of the other groups ($p = .197$ on 2-sided Pearson Chi-Square test). Our data does not support the suggestion by the NWCR random population telephone survey that weight loss maintainers are more likely to weigh themselves at least once a week than are regainers (61). The small sample sizes in this study may have limited the possibility of achieving significant results.

Current Participant Characteristics

Tables 5, 6, and 7 show an overview of weight- and diet-related characteristics, exercise-related characteristics, and behavior-related characteristics for current participants before and after program participation. Since weight loss was used to distinguish the successful weight losers from the non-successful, a change in median weight is understandably more apparent in Table 5 from beginning to end of the program among successful weight losers. At the beginning of the program the median weight was no different for successful weight losers from that of non-successful weight losers (2-tailed Mann-Whitney U test, $p = .221$). The BMI category frequencies confirm that most of the subjects were in the moderately overweight to obese range, but some of the non-successful weight losers had Before and After program BMI's within the healthy range of 18.5-25 (105). Caloric intakes reflect the wide ranges common with estimation of self-reported dietary intake. In fact, reported caloric intakes from the Block FFQ were so low in some instances that they raised questions of their accuracy. For instance,

Table 5—Weight and diet related characteristics for current participants before and after Smart CHOICES program

	Successful Weight Losers		Non-Successful Weight Losers	
	Before	After	Before	After
	n = 11	n = 11	n = 7	n = 7
Weight and Energy Intake ¹				
Weight in lbs.	180 (155-235) ²	170 (150-225)	170 (125-205)	170 (123-205)
BMI ³				
18-25	0	0	2 (29%)	2 (29%)
25-29.9	5 (46%) ⁴	10 (91%)	2 (29%)	2 (29%)
30-34.9	5 (46%)	0	2 (29%)	3 (43%)
≥ 35	1 (9%)	1 (9%)	1 (14%)	0
Kcal intake	2020 (1620-2555) ^{2 a}	1630 (955-2265)	1490 (1015-1785) ^b	1310 (1090-1840)
Relative caloric intake ⁵	1.34 (.83-1.80) ^a	1.17 (.49-1.26)	1.16 (.56-1.26) ^b	1.00 (.60-1.63)
Percentage kcal as fat	36.7 (31.6-46.0)	31.2 (22.4-40.1)	36.7 (23.4-39.6)	35.0 (24.3-42.3)

¹ Values with different superscripts in the same row are significantly different at $p < 0.05$ using the Mann-Whitney U test.

² Medians (Ranges)

³ Body Mass Index (BMI) equals weight in kg/height in meters squared

⁴ Frequency (% of sample)

⁵ Estimated daily kcal intake from Block FFQ / REE (Estimated Resting Energy Expenditure)

one 30-year-old man in the non-successful weight losers group reported caloric intake based on his completed Block FFQ's of approximately 1000 kcal/day before the program and 1100 kcal/day after the program. This translated into relative caloric intakes of .56 before the program and .60 after the program, which would put him in a state of extremely negative energy balance. Since he was not losing significant amounts of weight, it is very likely that he was unable to accurately complete the Block FFQ in order to provide an estimate of intake. Lack of awareness of what he is eating could cause this inability to fill out the questionnaire accurately. Though there have been many reports of underreporting of food intake in the literature, particularly among the obese (102), many of these reports have focused on 24-hour recalls and food records rather than food frequency questionnaires. Recent studies using food frequency questionnaires and the doubly labeled water estimation of energy expenditure (72, 73) do suggest a trend toward greater underestimation of energy intake as total energy expenditure goes up (72, 73) and a correlation of increasing underreport of caloric intake as BMI increases (73). Though this may explain part of the under-reporting variation noted, this particular subject was moderately overweight with a BMI of approximately 27. It is more likely in his case that the food frequencies reported what he "thought" he was eating. This is related to suppositions that food frequencies call on a different type of memory than 24-hour recalls. They use generic memory of personal diet supplemented with recent episodic memory while 24-hour recalls rely entirely on recent episodic memory (75). It is impossible to say whether other subjects had

similar difficulties in filling out the Block FFQ's as their results were not so dramatic.

The use of relative caloric intake was intended to decrease the range of caloric intakes by taking gender and body size into account. This procedure was not effective. Calculation of relative caloric intake was not successful in narrowing the range of caloric intakes. In fact, the top of each group's range of caloric intake was 1.9 times higher than the lowest value but the highest relative caloric intake value was approximately 2.4 times higher than the lowest relative caloric intake value.

As shown in Table 5, both the beginning caloric intake and the beginning relative caloric intake were significantly higher for the successful weight losers than for the non-successful weight losers (2-tailed Mann-Whitney U test, $p = .001$ for beginning caloric intake and $p = .03$ for beginning relative caloric intake). The median caloric intakes both before and after the program for non-successful weight losers were similar to those reported by NWCR participant successful weight loss maintainers at registry entry (mean of 1382 ± 526 kcal/day (12)). While successful weight losers in the current study had an After-program median caloric intake similar to the After-program value for non-successful weight losers, their Before-program median caloric intake was consistent with the level for a general population of non-weight-reducing overweight women in the RENO Diet Heart study of 1884 ± 762 kcal/day (76). Our study's slightly higher median caloric intake than the RENO Diet Heart study may have been because 3 of the 11 subjects were male in the successful weight loser group. Though beginning program

percentage of energy intake as fat was above the recommended levels of no more than 30% of energy intake as fat (Table 5), both the successful and non-successful weight loss groups had median intakes below the RENO Diet Heart study values of $40\% \pm 8\%$ for women and $38\% \pm 7\%$ for men during the late 1980's (12) possibly reflecting the general population decrease in percentage of calories as fat reported in the NHANES surveys (103). In the early 1970's NHANES I showed 36-37% of energy as fat in the general population and later in the 1990's NHANES III showed 33-34% of energy as fat. These levels are admittedly lower than corresponding values in the current research or the RENO Diet Heart study, but the general trend for a decrease is still consistent for the relative timing of the current research in relation to the RENO Diet Heart study.

Table 6 shows an increase in physical activity among successful weight losers as reflected by increases in the total activity intensity score and the frequency of moderate activity over the course of the program. There were no significant differences between successful and non-successful weight loser groups either before or after the program. Scores for both groups after the program on the Godin Questionnaire were more similar to the weight loss maintainers than the regainers and controls in the NWCR general population telephone survey (61). Among maintainers in the NWCR telephone survey, means were approximately 28 for total activity intensity, 3 times/week for frequency of sweat inducing exercise, 3 times/week for frequency of mild activity, once/week for frequency of moderate activity, and once/week for frequency of strenuous activity (61).

Table 6—Exercise related characteristics for current participants before and after Smart CHOICES program

	Successful Weight Losers		Non-Successful Weight Losers	
	Before n = 11	After n = 11	Before n = 7	After n = 7
Leisure Time Physical Activity ¹				
Frequency of strenuous activity ²	0 (0-3) ³	1 (0-6)	0 (0-6)	0 (0-5)
Frequency of moderate activity	2 (0-7) ^a	4 (1-7) ^b	1 (0-3)	2 (0-5)
Frequency of mild activity	2 (0-7)	2 (0-7)	1 (1-7)	2 (1-7)
Frequency of physical activity hard enough to perspire	1 (0-2)	2 (0-2)	1 (0-2)	1 (0-2)
Total activity intensity score ⁴	26 (3-56) ^a	40 (16-102) ^b	17 (3-75)	26 (3-91)

¹ Values with different superscripts in the same row show within group before to after program differences significantly different from zero at $p \leq 0.01$ using the Wilcoxon Signed Ranks test. There were no between group significant differences between successful weight losers and non-successful weight losers either before or after the program (Mann-Whitney U test $p > .05$)

² Number of times in last 7 days each type of activity was performed.

³ Medians (Ranges)

⁴ Total of (strenuous activity x 9) + (moderate activity x 5) + (mild activity x 3)

In Table 7, median Eating Inventory scores for successful and non-successful weight losers before the Smart CHOICES program are quite similar to values reported for obese treatment-seeking women in a large U. S. study (86). In that study, beginning means for cognitive restraint were 8.2 ± 4.3 , for disinhibition 10.8 ± 3.1 , and for hunger 6.6 ± 3.3 (86). The beginning scores for flexible control in the current study are lower than Westenhoefer's general West German population and the beginning scores for rigid control are higher than

Table 7—Behavior related characteristics for current participants before and after Smart CHOICES program

	Successful Weight Losers		Non-Successful Weight Losers	
	Before	After	Before	After
	n = 11	n = 11	n = 7	n = 7
Eating Inventory Subscale Scores ^{1,2}				
Cognitive Restraint	8.0 (4-18) ^{3 a} (n = 9) ⁴	15.0 (9-19) ^b (n = 9)	8.5 (5-14) ^a (n = 6)	12.5 (8-16) ^b (n = 6)
Disinhibition	11.0 (5-15) ^a (n = 11)	9.0 (1-13) ^b (n = 11)	9.5 (4-16) ^a (n = 6)	7.5 (4-15) ^b (n = 6)
Hunger	7.5 (3-10) ^a (n = 10)	3.0 (0-8) ^b (n = 10)	5.5 (1-9) (n = 6)	4.5 (2-7) (n = 6)
Flexible Control	3.0 (0-11) ^a (n = 9)	9.0 (2-12) ^b (n = 9)	4.0 (1-8) ^a (n = 6)	7.0 (3-10) ^b (n = 6)
Rigid Control	9.0 (2-11) (n = 8)	8.0 (4-10) (n = 8)	6.5 (4-9) (n = 6)	7.5 (6-11) (n = 6)
CES-D ⁵	7 (1-23)	5 (0-18)	10 (2-30)	7 (3-16)

¹ Values with different superscripts in the same row show within group differences from beginning to end of the program using the Wilcoxon Signed Rank test at $p \leq .05$. There are no significant between group differences using Mann-Whitney U test.

² Individual scores represent whole numbers. Possible scores for:

Cognitive Restraint range from 0-21

Disinhibition range from 0-16

Hunger range from 0-14

Flexible control range from 0-12

Rigid control range from 0-16

Higher scores indicate that the factor is stronger in that subject.

³ Medians (ranges)

⁴ Sample size varies from subscale to subscale due to one or more questions left blank for that particular subscale by some subjects.

⁵ Center for Epidemiological Studies Depression Scale. Possible scores range from 0-60 with a higher score representing more symptoms of depression.

Westenhofer's population (84). Westenhofer found mean flexible control scores of 5.4 ± 3.4 and mean rigid control scores of 5.5 ± 3.7 for women. Changes in our study during treatment for successful weight losers do parallel both Foster et al.'s

(86) for Eating Inventory scores and Westenhoefer's for the shorter flexible control score (84). That is, scores for cognitive restraint and flexible control increased during treatment and scores for disinhibition and hunger decreased. The non-successful weight losers also increased scores for cognitive restraint and flexible control and decreased scores for disinhibition but their scores for hunger did not change in response to the weight loss program.

CES-D medians are well within the non-depressed score region of ≤ 16 among subjects in this study. For comparison, the RENO Diet Heart study also found relatively few symptoms of depression in overweight women with mean CES-D scores of 6.5 ± 7.0 (93). Though examination of the ranges in the current research shows some subjects with scores in the possible depression range (17-22) and probable depression range (≥ 23), it is encouraging that the top of these ranges dropped after treatment.

Past Participant Characteristics

Tables 8, 9, and 10 show an overview of the same characteristics for the past participants. In Table 8, the current weight for weight loss maintainers is not different from that for non-maintainers (2-tailed Mann-Whitney U test, $p = .076$). The weight loss maintainer results for caloric intake and percentage of energy as fat do not agree with the extremely low values found in the NWCR study (12). The NWCR study found average caloric intake of 1380 kcal/day and 24% of energy as fat on Block FFQ's among their successful weight loss maintainers.

Table 8—Weight and diet related characteristics of past participants

	Weight Loss Maintainers	Non-Maintainers
	n = 7	n = 12
Weight and Energy Intake ¹		
Weight in lbs.	160 (129-277) ²	183 (145-300)
BMI ³		
< 25	2 (29%) ⁴	2 (17%)
25-29.9	3 (43%)	4 (33%)
30-34.9	1 (14%)	3 (25%)
≥ 35	1 (14%)	3 (25%)
Kcal Intake	1635 (805-2430) n = 6 ⁵	1870 (695-4425)
Relative Caloric Intake ⁶	1.08 (0.67-1.87) n = 6	1.43 (0.41-2.00)
Percentage Kcal as Fat	36.1 (32.9-45.2) n = 6	35.4 (24.5-49.3)

¹ No significant differences between groups using the Mann-Whitney U test ($p \geq .05$)

² Medians (Ranges)

³ Body Mass Index (BMI) equals weight in kg/height in meters squared

⁴ Frequency (% of sample)

⁵ One subject had unreasonably low intake on Block Food Frequency Questionnaire and was omitted from sample for all indices based on the Block Food Frequency Questionnaire.

⁶ Estimated daily kcal intake from Block FFQ / REE (Estimated Resting Energy Expenditure)

As with the current participants, a wide range of estimated caloric intake is noted among past participants. Use of the Block FFQ error analysis program flagged the results for 3 subjects as possibly erroneous due to too few foods eaten on a daily basis and for one of the 3 subjects, too many foods marked as small portions. The subject with too many foods marked as small portions had an estimated caloric intake of 360 kcal/day and a relative caloric intake of .26. Since 2

error messages marked her data and estimated caloric intake was unreasonably low, her results for data based on the Block FFQ were excluded from analyses in order that results would not be unduly influenced by these outlier values. This subject was in the weight loss maintainer group. The two other women subjects with error messages were in the non-maintainer group and had estimated caloric intakes of 700 and 760 kcal/day. Since another subject without an error message in the maintainer group reported an approximate caloric intake of 800 kcal/day, it was impossible to tell which of these subjects may have inaccurately filled out the Block FFQ. As a result, all of the remaining subjects were included in the dietary intake analyses. Of note is that neither including nor excluding any of these subjects changed the significance of the results for relative caloric intake and % of energy intake as fat, the 2 Block FFQ parameters addressed by the study hypotheses.

Table 9 shows exercise-related data for the maintainers that are more similar to the regainers in the NWCR random telephone survey (61) and data for the non-maintainers (regainers) that are more similar to the maintainers in the NWCR random telephone survey. In other words, the current research results are exactly the reverse of the findings of the NWCR random telephone survey. In the NWCR random telephone survey, mean total activity intensity score was 27.8 ± 28.2 for maintainers and 16.2 ± 17.6 for the regainers (61). This difference in results could reflect that the NWCR telephone sample represented a random sample while the current research does not. It is possible that weight loss maintainers in the

past participant sample who do exercise regularly did not choose to participate in the study. In contrast, the NWCR random telephone survey had a representative sample based on an investigator initiated system of choosing a random sample.

Table 9—Exercise related characteristics of past participants

	Weight Loss Maintainers	Non-Maintainers
	n = 7	n = 12
Leisure Time Physical Activity ¹		
Frequency of strenuous activity ²	0 (0-0) ³	0 (0-3)
Frequency of moderate activity	2 (0-5)	3 (0-5)
Frequency of mild activity	1 (0-3)	1.5 (0-5)
Frequency of physical activity hard enough to perspire	1 (0-2)	1 (0-2)
Total activity intensity score ⁴	18 (0-25)	27 (0-53)

¹ There are no significant differences between groups using Mann-Whitney U test ($p > .05$)

² Number of times in last 7 days each type of activity was performed.

³ Medians (Ranges)

⁴ Total of (strenuous activity x 9) + (moderate activity x 5) + (mild activity x 3)

Comparison of the weight loss maintainer and non-maintainer median scores on the Eating Inventory in Table 10 with the NWCR study show cognitive restraint to be quite a bit lower among weight loss maintainers than the mean score of 15.1 ± 3.7 among successful weight loss maintainers in the NWCR study (13). Weight loss maintainers and non-maintainers had lower cognitive restraint scores

and higher disinhibition scores than the only study found in the literature reporting 2-year follow-up Eating Inventory scores. This Finnish study reported a mean 2-year follow-up score for cognitive restraint of 12.1 and for disinhibition 7.5 (34).

Table 10—Behavior related characteristics of past participants

	Weight Loss Maintainers	Non-Maintainers
	n = 7	n = 12
Eating Inventory Scale Scores ¹		
Cognitive Restraint	10.0 (3-17) ^{2,3}	11.5 (3-16)
Disinhibition	11.0 (7-15)	12.0 (5-16)
Hunger	3.0 (2-12)	7.0 (0-14) (n = 11) ⁴
Flexible Control	6.0 (1-11)	6.0 (1-11)
Rigid Control	8.0 (4-15)	10.0 (3-15)
CES-D ⁵	12 (0-33)	9.5 (3-33)

¹ There are no significant differences between groups using the Mann-Whitney U test ($p > .05$)

² Medians (ranges)

³ Individual scores represent whole numbers. Possible scores for:

Cognitive Restraint range from 0-21

Disinhibition range from 0-16

Hunger range from 0-14

Flexible control range from 0-12

Rigid control range from 0-16

Higher scores indicate that the factor is stronger in that subject.

⁴ Sample size varies for hunger subscale due to one or more questions left blank for that particular subscale by a subject.

⁵ Center for Epidemiological Studies Depression Scale. Possible scores range from 0-60 with a higher score representing more symptoms of depression.

Besides possible cultural differences between the current research and the Finnish study, treatment was different as well. The Finnish study was based on VLCD treatment for 12 weeks followed by a 40-week weight maintenance program. They had actually been without professional contact for only one-year post-maintenance program.

Again, median CES-D scores are well within the non-depressed range of ≤ 16 . The scores for weight loss maintainers and non-maintainers are not significantly different from the ending scores for the current participant successful weight losers and non-successful weight losers ($p = .528$ by the Median test) (data not shown in tabular form).

Hypotheses Testing

Hypothesis #1—Current Smart CHOICES participants

Successful weight losers (≥ 5 lb weight loss) in the current Smart CHOICES program will have decreased relative caloric intake and the percentage of energy intake from fat more than non-successful weight losers (< 5 lb weight loss) from the beginning to the end of the program.

Table 11 shows the results for testing hypothesis #1 that successful weight losers in the Smart CHOICES program would decrease in relative caloric intake and percentage of energy intake from fat more than non-successful weight losers. The hypothesis was partly true as evidenced by a significant difference in the percentage point decrease in the percentage of energy from fat between the current

participant successful weight losers and the non-successful weight losers ($p = .013$ by the Mann-Whitney U test). This difference became non-significant when the 2 subjects in the non-successful weight losers group who attended < 7 of the 10 sessions were omitted from the testing ($p = .069$ by the Mann-Whitney U test). This occurred because one of these 2 subjects actually showed an increase in percentage of energy intake from fat from before to after the program. She showed an increase in caloric intake as well. It is possible that the program made her more aware of her actual intake that was reflected in more accurate reporting of usual food intake on the Block FFQ. Change in relative caloric intake and percent decrease in relative

Table 11—Change in relative caloric intake and the percentage of energy from fat in current participants from beginning to end of the program.

	Successful Weight Losers	Non-Successful Weight Losers
	n = 11	n = 7
Change in Relative Caloric Intake¹	-.23 (-0.61 to 0.12) ²	-.05 (-0.42 to 0.47)
Percent Decrease in Relative Caloric Intake³	-15% (-41% to 12%)	-4% (-34% to 41%)
Percentage Point Decrease in % Kcal as Fat	-6.6 (-14.3 to -0.41) ^a	-1.7 (-3.2 to 4.5) ^b

^{a, b} Values with different superscripts in the same row are significantly different at $p < 0.05$ using the Mann-Whitney U test.

¹ Ending relative caloric intake minus beginning relative caloric intake. Relative caloric intake = kcal intake/ REE (Estimated Resting Energy Expenditure)

² Medians (ranges)

³ Change in relative caloric intake/beginning relative caloric intake.

caloric intake was however, not different between successful and non-successful weight losers either with or without the 2 non-successful weight losers attending less than 7 sessions.

Further analysis as shown in Table 12 with all successful and non-successful weight losers included, indicates that the successful weight losers had a decrease in both relative caloric intake and the percentage of energy as fat significantly different from zero from Before to After program participation ($p = .008$ for relative caloric intake and $p = .003$ for percentage of energy from fat by the Wilcoxon Signed Ranks test). In contrast, the non-successful weight losers did not significantly change in either relative caloric intake or the percentage of energy as fat ($p = .74$ for relative caloric intake and $p = .87$ for percentage of energy from fat by the Wilcoxon Signed Ranks test). This does show that successful weight losers in the Smart CHOICES program were more likely to make dietary changes to achieve their weight losses. It may have been easier for successful weight losers to make some of these changes since they reported their relative caloric intake at a significantly higher level than the non-successful weight losers before the program ($p = .03$ by 2-tailed Mann-Whitney U test). Another explanation is that the successful weight losers may have been more in tune with their actual intake as reflected by their reports of a higher initial caloric intake. This increased awareness may have made it easier to decide on and make appropriate changes to lose weight. The higher relative caloric intake in successful weight losers is graphically illustrated in Figure 1; the majority of the successful weight losers are above the

Table 12—Comparison of relative caloric intake and percentage of kilocalories as fat before and after Smart CHOICES program in current participants.

	Successful Weight Losers		Non-Successful Weight Losers	
	Before	After	Before	After
	n = 11	n = 11	n = 7	n = 7
Relative Caloric Intake¹	1.34 ^a (.83-1.80) ²	1.17 ^b (.49-1.26)	1.16 (.56-1.26)	1.00 (.60-1.63)
Percentage Kcal as Fat	36.7 ^a (31.6-46.0)	31.2 ^b (22.4-40.1)	36.7 (23.4-39.6)	35.0 (24.3-42.3)

^{a,b} Values with different superscripts in the same row show differences significantly different from zero at $p < 0.01$ using the Wilcoxon Signed Ranks test.

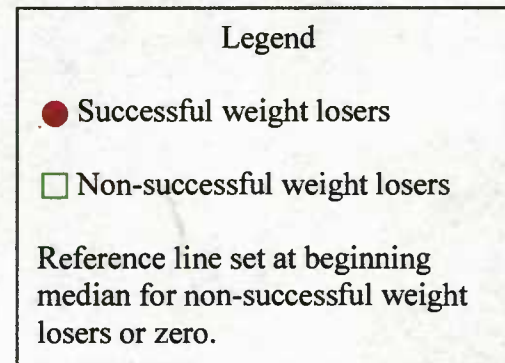
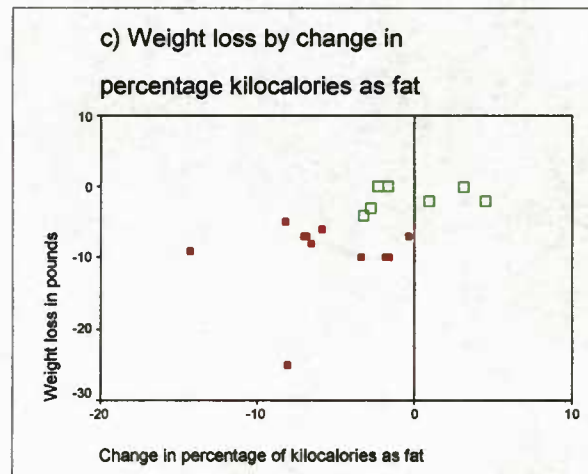
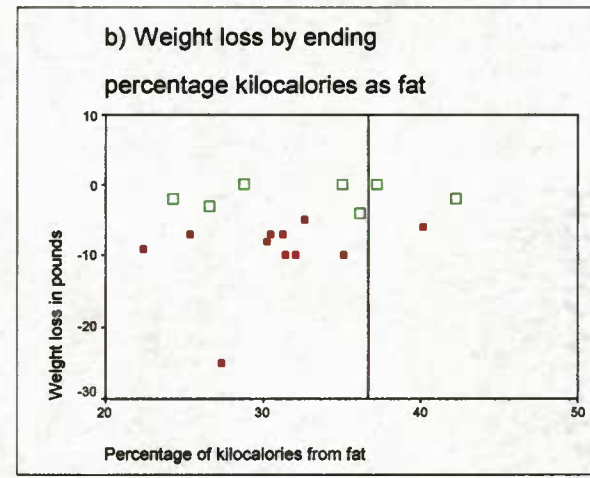
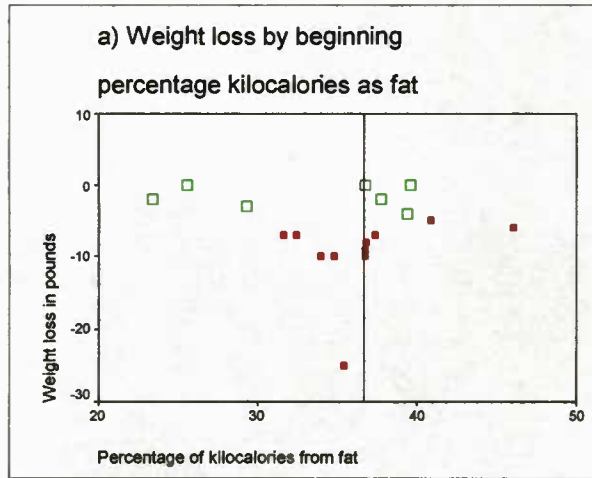
¹ Relative caloric intake = kcal intake/ REE (Estimated Resting Energy Expenditure)

² Medians (ranges)

median relative caloric intake for non-successful weight losers at the beginning of the program in Figure 1a. Though still above the median after the program in Figure 1b, the successful weight losers are now clustered close to the median. Figure 1c shows all but one of the successful weight losers with a negative change in relative caloric intake from beginning to end of the program while the non-successful weight losers are almost evenly divided between increases and decreases in relative caloric intake. Figure 2a, weight loss by percentage intake of energy as fat, does not show this difference as both successful and non-successful weight losers were distributed on both sides of the median at the beginning of the program. Figure 2c shows a much greater and more consistent negative change for percentage of energy intake as fat in successful weight losers than in non-successful weight losers. This suggests that the way successful weight losers reduced their caloric intake was to substantially reduce the percentage of energy from fat.

Thus, hypothesis #1 is not rejected. The data indicate that reductions in both relative caloric intake and the percentage of energy from fat were related to successful weight loss in the Smart CHOICES program even though testing change between successful and non-successful weight losers as initially planned was not consistently significant.

Figure 2—Weight loss by percentage of kilocalories from fat in current participants



Hypothesis #2— Past participants of the CHOICES program

At 22-26 months after completing the program, weight loss maintainers (< 5 lb regained since completion of the program) will have a lower relative caloric intake and a smaller percentage of energy from fat than non-maintainers (≥ 5 lb regained since completion of the program).

Table 13 shows the results for hypothesis #2 that past participant weight loss maintainers would have a lower relative caloric intake and percentage of energy as fat than non-maintainers. No significant differences were found between the weight loss maintainers and non-maintainers on these 2 variables. The results are illustrated graphically in Figure 3 showing the distributions of both weight loss

Table 13—Relative caloric intake and percentage of kilocalories as fat in past participants

	Weight Loss Maintainers ¹	Non-Maintainers
	n = 6 ²	n = 12
Relative Caloric Intake ³	1.08 (0.67-1.87) ⁴	1.43 (0.41-2.00)
Percentage Kcal as Fat	36.1 (32.9-45.2)	35.4 (24.5-49.3)

¹ No significant differences between groups using Mann-Whitney U test.

² One subject had unreasonably low intake on Block Food Frequency Questionnaire and was omitted from sample for all indices based on the Block Food Frequency Questionnaire.

³ Relative caloric intake = kcal intake/ REE (Estimated Resting Energy Expenditure)

⁴ Medians (ranges)

maintainers and non-maintainers on both sides of the median for relative caloric intake in Figure 3a and for percentage of energy from fat in Figure 3b. Thus, dietary factors do not differentiate between weight loss maintainers and non-maintainers in the current research and hypothesis #2 is rejected.

Concerning caloric intake, measured as relative caloric intake in the current research, the results are consistent with NWCR findings that subsequent regainers and continuing maintainers do not differ significantly on Block FFQ measures of estimated caloric intake (16). However, the data in the current study are not consistent with findings of the NWCR study regarding the percentage of energy intake from fat. The NWCR showed a significant increase in the percentage of energy intake from fat over the year from baseline for subsequent regainers while the continuing successful weight loss maintainers continued at the same low percentage of energy intake from fat (16). In the current research, there is a weak suggestion that both the weight loss maintainers and non-maintainers (regainers) have increased their percentage of energy intake from fat since program completion. Follow-up pairwise comparisons to the Median test show that the After-program percentage of energy intake for current participant successful weight losers is not significantly different from maintainers ($p = .049$ by the post hoc 2-sided Fisher's Exact test) or non-maintainers ($p = .089$ by the post hoc 2-sided Fisher's Exact test) when the Bonferroni adjustment method for p-value with multiple comparisons is applied ($p \leq .016$ in this sample with 3 groups) (101) (data not shown in tabular form). Though not significant, the direction of difference

between current participant successful weight losers and non-maintainers and maintainers suggests that not only did the non-maintainers increase in percentage of energy from fat since program completion, just like the regainers did over time in the NWCR study, but so did the weight loss maintainers. This suggests a regression toward baseline Before-program values for percentage of energy intake in both past participant groups.

Hypothesis #3—Current Smart CHOICES participants

Successful weight losers currently in the Smart CHOICES program will increase more in total leisure time physical activity from baseline to completion of the program than non-successful weight losers.

Table 14 illustrates the results for hypothesis #3 that current participant successful weight losers would increase in their total activity intensity score more than non-successful weight losers. Comparison of the change in scores from beginning to end of the program shows no significant difference between the successful weight losers and non-successful weight losers ($p = .30$ for the 2-tailed Mann-Whitney U test). Figure 4 shows this lack of significant difference graphically; see how Figure 4c shows an increase in total activity intensity scores in the majority of subjects in both the successful weight loss and non-successful weight loss groups.

Table 14—Change in total activity intensity score for current participants from beginning to end of Smart CHOICES program

	Successful Weight Losers	Non-Successful Weight Losers
	n = 11	n = 7
Leisure Time Physical Activity ¹		
Change in total activity intensity score ²	10 (0-56) ³	8 (-3 to 17)

¹ No significant differences between groups using Mann-Whitney U test ($p > .05$)

² Ending total activity intensity score minus beginning total activity intensity score. Total activity intensity score = the total of (strenuous activity x 9) + (moderate activity x 5) + (mild activity x 3)

³ Medians (Ranges)

Figure 4 – Weight loss by total activity intensity score in current participants

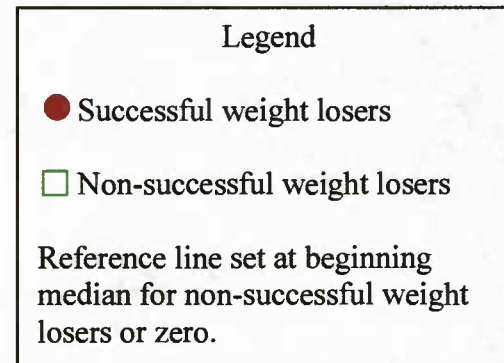
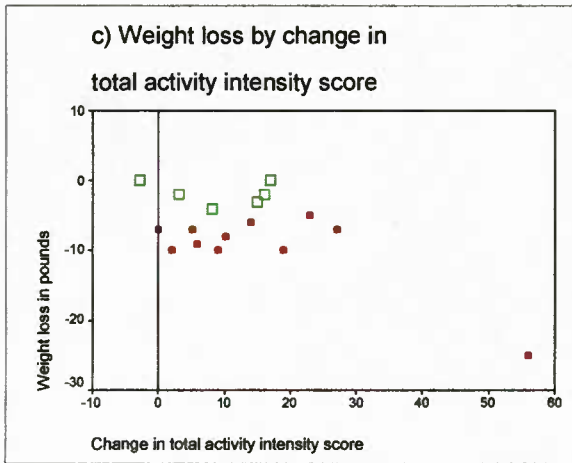
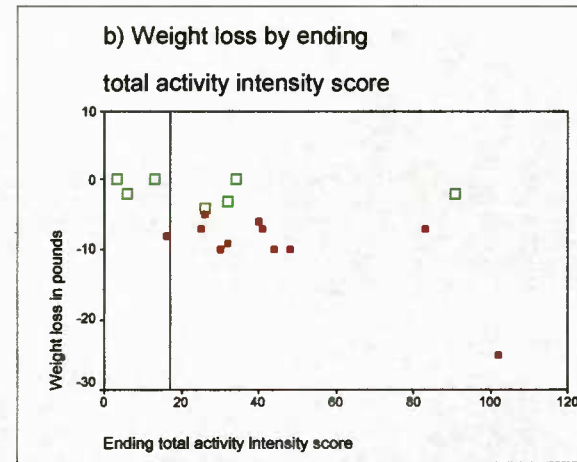
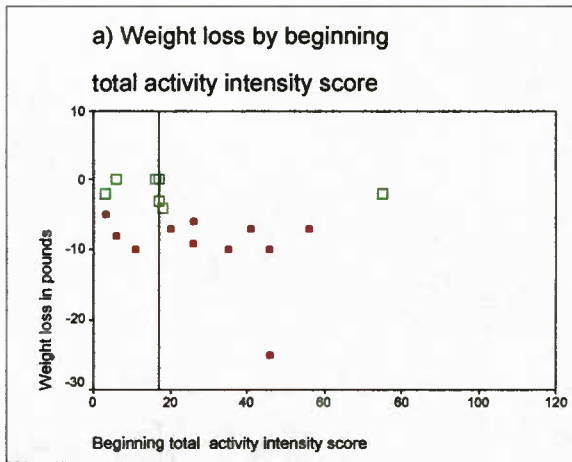


Table 15. however, illustrates a little different pattern. Just as with relative caloric intake and the percentage of energy intake from fat, the successful weight losers showed an increase significantly different from zero from Before to After program participation in their total activity intensity score and the frequency of moderate activity while the non-successful weight losers did not (2-tailed Wilcoxon Signed Ranks test, $p = .005$ for total activity intensity score and $p = .01$ for frequency of moderate activity in successful weight losers). Thus, there is some support for the hypothesis that successful weight losers increased their physical activity more than non-successful weight losers. Hypothesis #3 is not rejected but requires further study to accept it.

Table 15—Frequency of various levels of activity in past week among current participants before and after Smart CHOICES program and change in frequency over course of program.

	Successful Weight Losers		Non-Successful Weight Losers	
	n = 11		n = 7	
	Before	After	Before	After
Leisure Time Physical Activity				
Total activity intensity score¹	26 (3-56) ^{2,a}	40 (16-102) ^b	17 (3-75)	26 (3-91)
Change in total activity intensity score	10 (0-56)		8 (-3 to 17)	
Frequency of strenuous activity	0 (0-3)	1 (0-6)	0 (0-6)	0 (0-5)
Change in strenuous activity	0 (-2 to 6)		0 (-1 to 1)	
Frequency of moderate activity	2 (0-7) ^a	4 (1-7) ^b	1 (0-3)	2 (0-5)
Change in moderate activity	1 (0-3)		1 (0-5)	
Frequency of mild activity	2 (0-7)	2 (0-7)	1 (1-7)	2 (1-7)
Change in mild activity	0 (-1 to 3)		1 (-1 to 3)	
Frequency of activity hard enough to perspire	1 (0-2)	2 (0-2)	1 (0-2)	1 (0-2)
Change in activity hard enough to perspire	0 (-1 to 1)		0 (-1 to 1)	

^{a,b} Values with different superscripts in the same row show differences significantly different from zero at $p \leq 0.01$ using the Wilcoxon Signed Ranks test.

¹ Total activity intensity score = the total of (strenuous activity x 9) + (moderate activity x 5) + (mild activity x 3)

² Medians (Ranges)

Hypothesis #4— Past participants of the CHOICES program

Among past program participants, there will be a higher level of total leisure time physical activity and strenuous exercise among weight loss maintainers than among non-maintainers.

Table 16 answers hypothesis #4. Initial examination of the medians suggests that just the opposite of the hypothesis is true, that weight loss non-maintainers appear to have a higher level of total leisure time physical activity than did weight loss maintainers. However, there is no statistical difference between the 2 groups (2-tailed Mann-Whitney U test, $p = .27$ for total activity intensity scores and $p = .16$ for strenuous activity). Figure 5a illustrates that the non-maintainers had a broader range of total activity intensity scores and that all of the weight loss maintainers fell below the non-maintainers' median for total activity intensity.

Table 16—Total activity intensity and number of times of strenuous activity per week in past participants

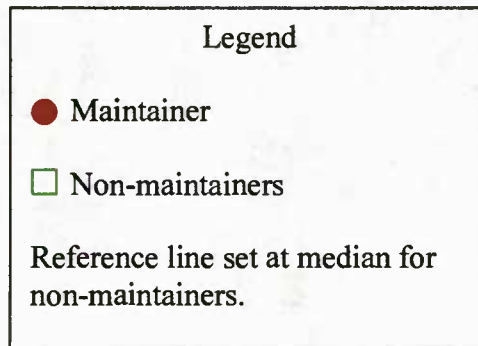
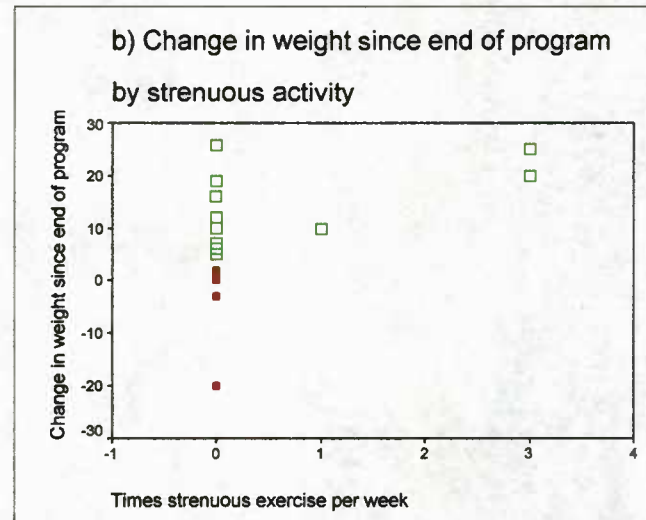
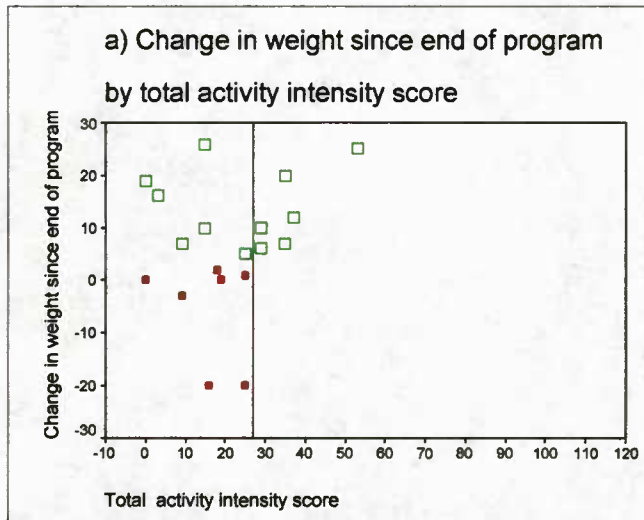
	Weight Loss Maintainers	Non-Maintainers
	n = 7	n = 12
Leisure Time Physical Activity ¹		
Total activity intensity score ²	18 (0-25) ³	27 (0-53)
Frequency of strenuous activity	0 (0)	0 (0-3)

¹ No significant differences between groups using Mann-Whitney U test ($p > .05$)

² Total activity intensity score = the total of (strenuous activity x 9) + (moderate activity x 5) + (mild activity x 3)

³ Medians (Ranges)

Figure 5 – Distribution of weight loss maintenance by total activity intensity and strenuous activity per week in past participants



Almost all of the maintainers and non-maintainers report no strenuous physical activity on a weekly basis on the Godin Questionnaire (Figure 5b).

Hypothesis #4 is rejected in the current research due to lack of statistical support. Physical activity levels do not differentiate between the weight loss maintainers and the non-maintainers in this study. This doesn't mean that physical activity wouldn't be an effective way to prevent weight regain. It just doesn't appear to be used by these subjects.

Again, there is some suggestion that both non-maintainers and maintainers may have regressed towards baseline since the end of the program. Since the maintainers and non-maintainers were successful weight losers previously and according to the coordinator of the Health Education Services Department the emphasis on physical activity in the program has not changed between the past participant CHOICES program and the current participant Smart CHOICES program, it can be argued that the maintainers and non-maintainers may have had previous physical activity scores similar to the current participant successful weight losers at the end of the program. Past participant maintainers and non-maintainers both had total activity intensity scores and frequency of strenuous activity significantly lower than the current participant successful weight losers (2-sided Fisher's Exact test follow up to the Median test shows $p = .004$ for total activity intensity scores and $p = .000$ for frequency of strenuous activity for comparisons both between maintainers and successful weight losers and between non-

maintainers and successful weight losers. Bonferroni's adjustment for multiple comparisons shows significance at $p \leq .016$) (data not shown in tabular form).

Hypotheses #5a, 5b, & 5c—Current Smart CHOICES participants

- 5a Successful weight losers will have higher scores in flexible control, as measured by Westenhoefer's flexible control scale, at the beginning of the program compared to non-successful weight losers.
- 5b Non-successful weight losers will have higher scores on disinhibition, as measured by the Eating Inventory at the beginning of the program, compared to successful weight losers.
- 5c Successful weight losers will have fewer symptoms of depression as measured by the CES-D at baseline than those who are non-successful weight losers.

Tests of hypotheses #5a, 5b, and 5c are shown in Table 17. Of note is that previous research has indicated a significant difference in scores between men and women for all Eating Inventory scores (81) as well as flexible and rigid control scores (84). Since the majority of the current sample are women, statistical tests were run both including and not including the men in the sample. No difference in the significance of the results was noted when males were excluded except for the change in hunger from the beginning to the end of the program. Thus, all results are reported for scores from men and women combined, though clarification of the difference in the significance of hunger results will be noted later.

Table 17—Beginning scores for Eating Inventory subscales and CES-D⁴ in current participants

Beginning¹	Successful Weight Losers	Non-Successful Weight Losers
Cognitive Restraint	8.0 (4-18) ^{2,3} (n = 10) ⁴	8.5 (5-14) (n = 6)
Disinhibition	11.0 (5-15) (n = 11)	9.5 (4-16) (n = 6)
Hunger	7.5 (3-10) (n = 10)	5.5 (1-9) (n = 6)
Flexible Control	3.0 (0-11) (n = 9)	4.0 (1-8) (n = 6)
Rigid Control	9.0 (2-11) (n = 8)	6.5 (4-9) (n = 6)
CES-D⁵	7 (1-23) (n = 11)	10 (2-30) (n = 7)

¹ No significant differences between groups using Mann-Whitney U test ($p > .05$)

² Medians (ranges)

³ Individual scores represent whole numbers.

⁴ Sample size varies from subscale to subscale due to one or more questions left blank for that particular subscale by some subjects.

⁵ Center for Epidemiological Studies Depression Scale

Hypothesis #5a tested Westenhoefer's finding that successful weight losers had higher flexible control scores at the beginning of the program than non-successful weight losers (84). In the current research, there was no significant difference in beginning flexible control scores between successful weight losers and non-successful weight losers ($p = .66$ by 2-tailed Mann-Whitney U test). The difference in sample size between Westenhoefer's weight control sample of 7400 subjects (84) and the current research is enormous and even with his expanded version of the flexible control scale the current research does not replicate his

results. Of note is that Westenhoefer's sample completed the Eating Inventory from which the flexible control score was derived about 3 months after they had started the computer-assisted weight control program (84). Those already experiencing some success with weight loss may have influenced the results by already having increased their flexible control scores. One of his additional findings was that successful weight loss was also associated with an increase in flexible control during the program (84). The current research does have similar results to the Pound of Prevention study that did not show any relationship between baseline flexible control or any of the other measures of restraint (cognitive restraint and rigid control) and changes in weight (68). Hypothesis #5a is rejected.

Hypothesis 5b tested whether a high beginning score for disinhibition leads to a poorer outcome in efforts at weight loss. Higher scores on disinhibition can suggest a problem with binge eating which could make weight loss more difficult (87, 86, 104). In the current research, there were no significant differences in beginning disinhibition scores between successful weight losers and non-successful weight losers ($p = .48$ by 2-tailed Mann-Whitney U test). This could suggest that either binge eating was not a problem in this sample or that it was similarly present among both successful weight losers and non-successful weight losers and did not adversely affect weight loss outcome. Examination of the ranges for disinhibition scores indicates that some subjects did have very high scores of 15 or 16 out of a possible maximum score of 16. Since weight loss outcome was not significantly affected by high disinhibition scores, hypothesis 5b is rejected.

Hypothesis 5c, that successful weight losers would have fewer symptoms of depression than non-successful weight losers at the beginning of the program is based on the premise that more symptoms of depression, as reflected by a higher baseline CES-D score, would interfere with successful weight loss. This hypothesis is also rejected since there was no significant difference between baseline CES-D scores for successful and non-successful weight losers (2-tailed Mann-Whitney U test, $p = .68$). Figure 6 confirms that those with very high CES-D scores at the beginning of the program (Figure 6a) dropped their scores over the course of the program (Figure 6b) so that there does not seem to be a reason to exclude people with high CES-D scores in the program.

Hypotheses 5d & 5e—Current Smart CHOICES participants

- 5d Successful weight losers will increase more in flexible control as measured by the difference between beginning and ending scores on Westenhoefer's scale than non-successful weight losers.
- 5e Successful weight losers will decrease more in disinhibition, as measured by the difference between beginning and ending scores on the Eating Inventory, than non-successful weight losers.

Results for hypotheses #5d and 5e are shown in Table 18. Hypothesis #5d reflects Westenhoefer's findings mentioned earlier that successful weight loss is associated with an increase in flexible control (84). Hypothesis #5e reflects findings that disinhibition decreases with weight loss (86). The changes in flexible control and disinhibition over the course of the program were not significantly different between current successful and non-successful weight losers (2-sided Mann-Whitney U test, $p = .26$ for change in flexible control and $p = .42$ for change in disinhibition). Table 19 shows that both successful and non-successful weight losers significantly increased flexible control and significantly decreased disinhibition over the course of the program. The magnitude of change from beginning to end of the program as shown in Table 19 does suggest that Westenhoefer's finding that flexible control may increase more in successful weight losers than in non-successful weight losers is supported. In fact, Figure 7c shows the highest increases in flexible control among successful weight losers. The distribution of the change in disinhibition, which is not shown, similarly had the largest decreases among successful weight losers. Hypothesis 5d and 5e are not

Table 18—Change in Eating Inventory subscales from beginning to end of the program in current participants

	Successful Weight Losers ¹	Non-Successful Weight Losers
	n = 11	n = 6
Change in Flexible Control	5.0 (-1 to 9) ^{2,3} (n = 9) ⁴	3.0 (2-6)
Change in Rigid Control	-0.5 (-5 to 5) (n = 8)	1.5 (-1 to 3)
Change in Cognitive Restraint	4.0 (0-11) (n = 9)	3.0 (2-5)
Change in Disinhibition	-3.0 (-11 to 1) (n = 11)	-1.5 (-5 to 0)
Change in Hunger	-3.5 (-8 to 1) (n = 10)	0 (-5 to 1)

¹ No significant differences between groups using Mann-Whitney U test ($p > .05$)

² Medians (ranges)

³ Individual scores represent whole numbers.

⁴ Sample size varies from subscale to subscale due to one or more questions left blank for that particular subscale by some subjects.

Table 19—Scores for Eating Inventory subscales in current participants before and after program

	Successful Weight Losers			Non-Successful Weight Losers		
	n = 11			n = 6		
	Before	After	Significance	Before	After	Significance
Flexible Control	3.0 (0-11) ^{1, 2, a} (n = 9) ³	9.0 (2-12) ^b (n = 9)	< .02	4.0 (1-8) ^a	7.0 (3-10) ^b	< .03
Rigid Control	9.0 (2-11) (n = 8)	8.0 (4-10) (n = 8)	ns ⁴	6.5 (4-9)	7.5 (6-11)	ns
Cognitive Restraint⁵	8.0 (4-18) ^a (n = 9)	15.0 (9-19) ^b (n = 9)	< .02	8.5 (5-14) ^a	12.5 (8-16) ^b	< .03
Disinhibition	11.0 (5-15) ^a	9.0 (7-13) ^b	< .01	9.5 (4-16) ^a	7.5 (4-15) ^b	< .05
Hunger	7.5 (3-10) ^a (n = 10)	3.0 (0-8) ^b (n = 10)	< .02	5.5 (1-9)	4.5 (2-7)	ns

^{a, b} Values with different superscripts in the same row for each group are significantly different using the Wilcoxon Signed Rank test.

¹ Medians (ranges)

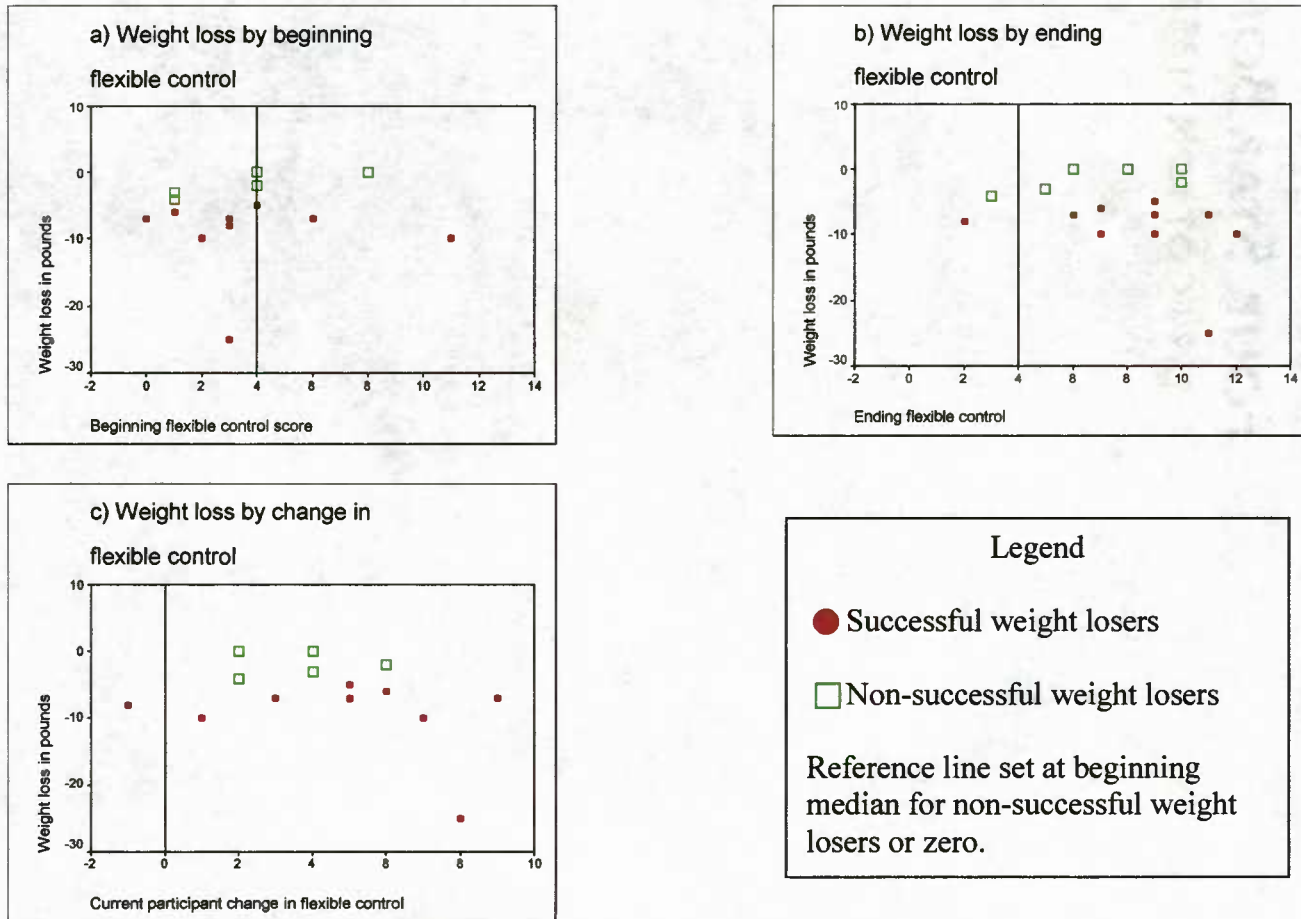
² Individual scores represent whole numbers.

³ Sample size varies from subscale to subscale due to one or more questions left blank for that particular subscale by some subjects.

⁴ “ns” indicates a non-significant difference

⁵ Flexible and rigid control represent subscales made from various parts of the cognitive restraint subscale

Figure 7—Distribution of weight loss by flexible control and its change over the course of the program in current participants

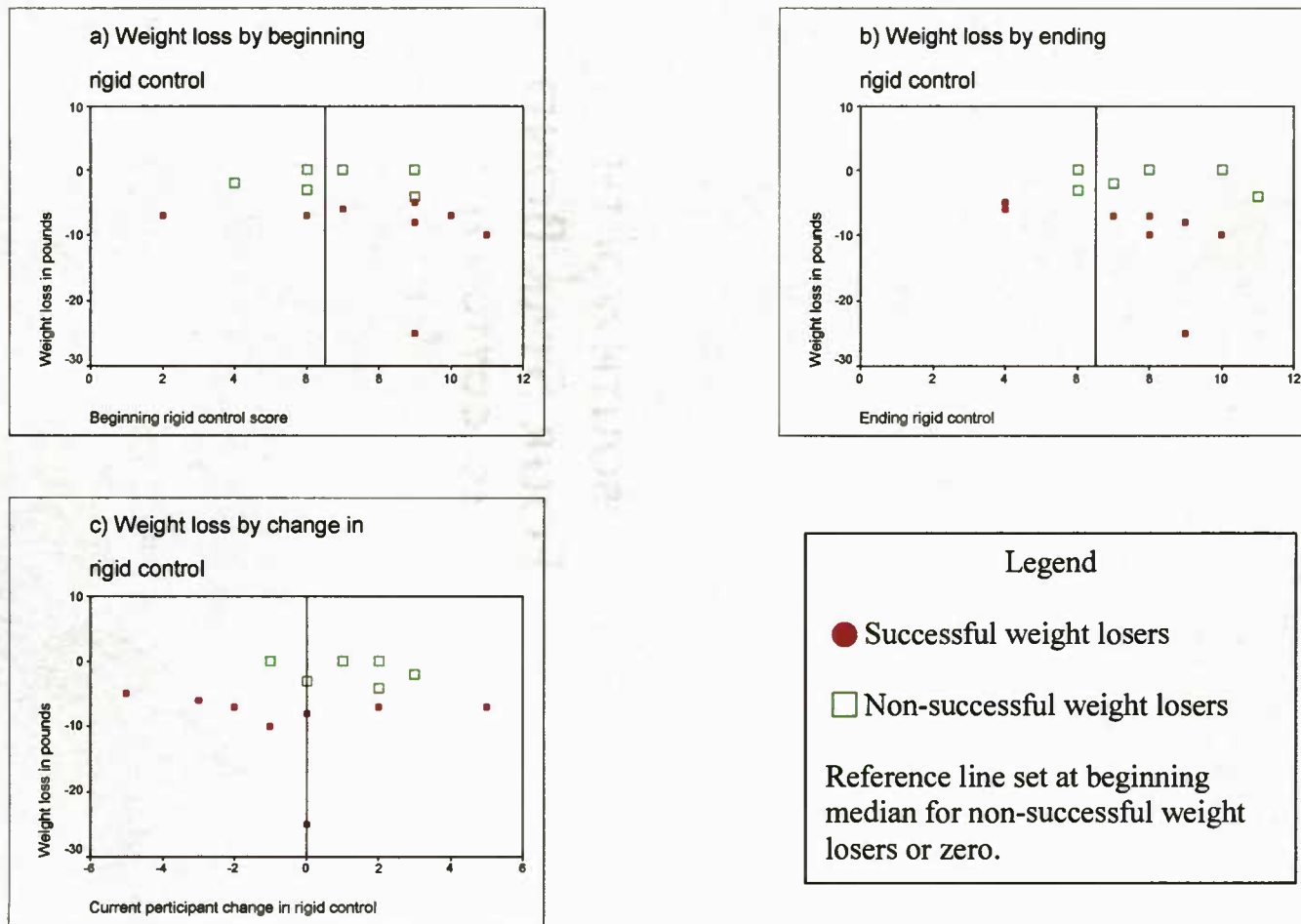


rejected but need further study to see if the suggested differences in magnitude of change actually exist. The current sample sizes may have been too small to indicate a significant difference if one existed.

Though not addressed by one of the study hypotheses, significant increases in cognitive restraint mirrored the changes in flexible control in both groups (see Table 19). The direction of the data suggests a slightly higher increase in cognitive restraint among the successful weight losers than among the non-successful weight losers. This makes sense, as flexible control is part of the concept of cognitive restraint. Rigid control, which according to Westenhoefer is another part of cognitive restraint and should not be associated with successful weight loss (84), shows an interesting direction of change despite the fact that beginning, ending, and change scores were not significantly different between the groups and neither of the groups individually showed a significant change during the program. Figure 8c illustrates this point, showing that some subjects actually increased in rigid control and this change may have been somewhat more prevalent among non-successful weight losers. While this does not confirm Westenhoefer's results, especially with such small sample sizes, it does suggest that his theory that rigid control works against successful weight loss is worth further testing.

As mentioned previously, change in hunger scores, which were not significantly different when men were included in the sample ($p = 0.61$ by 2-tailed Mann-Whitney U test), became significantly higher in successful weight losers when men were excluded from the sample ($p = .049$ by 2-tailed Mann-Whitney U

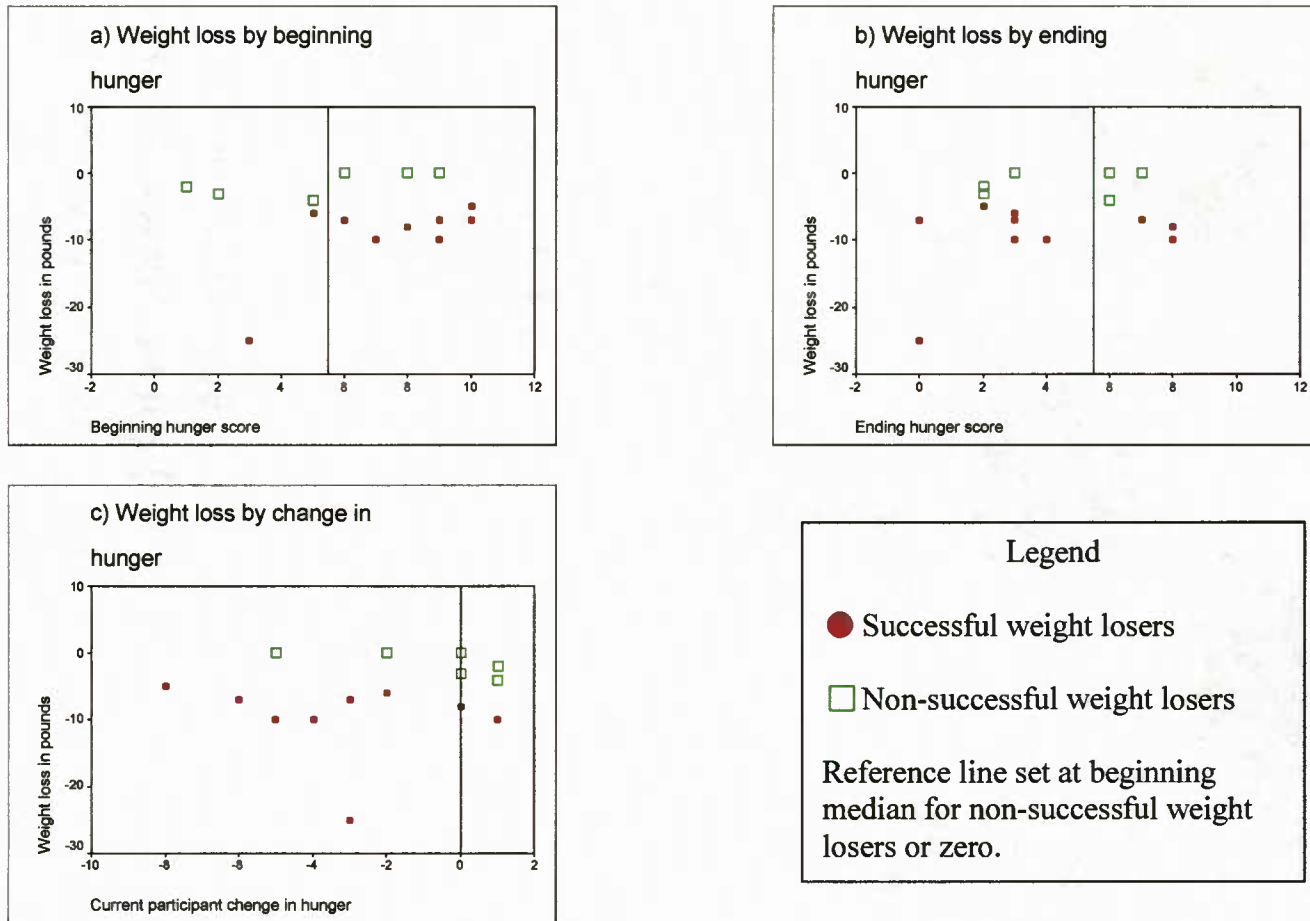
Figure 8—Distribution of weight loss by rigid control and its change over the course of the program in current participants



test). This tends to support the results in Table 19 that successful weight losers showed a significant decrease in hunger over the course of the program while the non-successful weight losers did not. Figure 9c shows the dramatic decrease in hunger scores among the successful weight losers. It is unclear how cognitive behavioral therapy decreases perceptions of hunger but apparently this decrease is helpful for successful weight loss.

Examination of the hunger items that successful weight losers indicated were a problem before the program but which decreased in frequency after the program suggests that successful weight losers developed more self-confidence in controlling their intake as well as decreasing their general perceptions of hunger. Five of the 8 items that were marked positively before the program but not after the program by successful weight losers suggested an increase in self-confidence in controlling food intake. Those items less likely to be marked after the program were “Dieting is so hard for me because I just get too hungry” (item #5), “Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat” (item #8), “Being with someone who is eating often makes me hungry enough to eat also” (item #19), “I am always hungry so it is hard for me to stop eating before I finish the food on my plate” (item #26), and a decreased difficulty for “How difficult would it be for you to stop eating halfway through dinner and not eat for the next 4 hours? Easy, slightly difficult, moderately difficult, or very difficult” (item #41). Changes in

Figure 9—Distribution of weight loss by hunger and its change over the course of the program in current participants



hunger in successful weight losers may reflect an increase in self-efficacy. This suggests a hypothesis to be tested in future research.

Hypotheses #6a, 6b, & 6c—Past participants of the CHOICES program

- 6a At 22-26 months after completing the program, weight loss maintainers will have higher scores in flexible control than non-maintainers on Westenhoefer's scale.
- 6b Non-maintainers will have higher dietary disinhibition scores than weight loss maintainers on the Eating Inventory.
- 6c Non-maintainers will have higher rigid control scores than weight loss maintainers on Westenhoefer's scale.

Table 20 shows testing of hypotheses #6a, 6b, and 6c in past participants. Again, no change in significance was noted when tests were run with and without men, so all results are reported for men and women combined. Hypothesis 6a that past participant weight loss maintainers would have higher scores in flexible control than would non-maintainers is based on Westenhoefer's untested theory that high flexible control scores will be associated with maintenance of weight loss (84). Not only was there no significant difference between maintainers and non-maintainers (2-tailed Mann-Whitney U test, $p = .897$), medians and ranges were similar for both groups. There were no significant differences between maintainers and non-maintainers for disinhibition (hypothesis 6b) (2-tailed Mann-Whitney U test, $p = .671$) or rigid control (hypothesis 6c) (2-tailed Mann-Whitney U test, $p = .734$).

Table 20—Scores for selected Eating Inventory subscales included in the hypotheses for past participants

	Weight Loss Maintainers ¹	Non-Maintainers
	n = 7	n = 12
Flexible Control	6.0 (1-11) ^{2,3}	6.0 (1-11)
Disinhibition	11.0 (6-15)	12.0 (5-16)
Rigid Control	8.0 (4-15)	10.0 (3-15)

¹ No significant differences between groups using Mann-Whitney U test ($p > .05$)

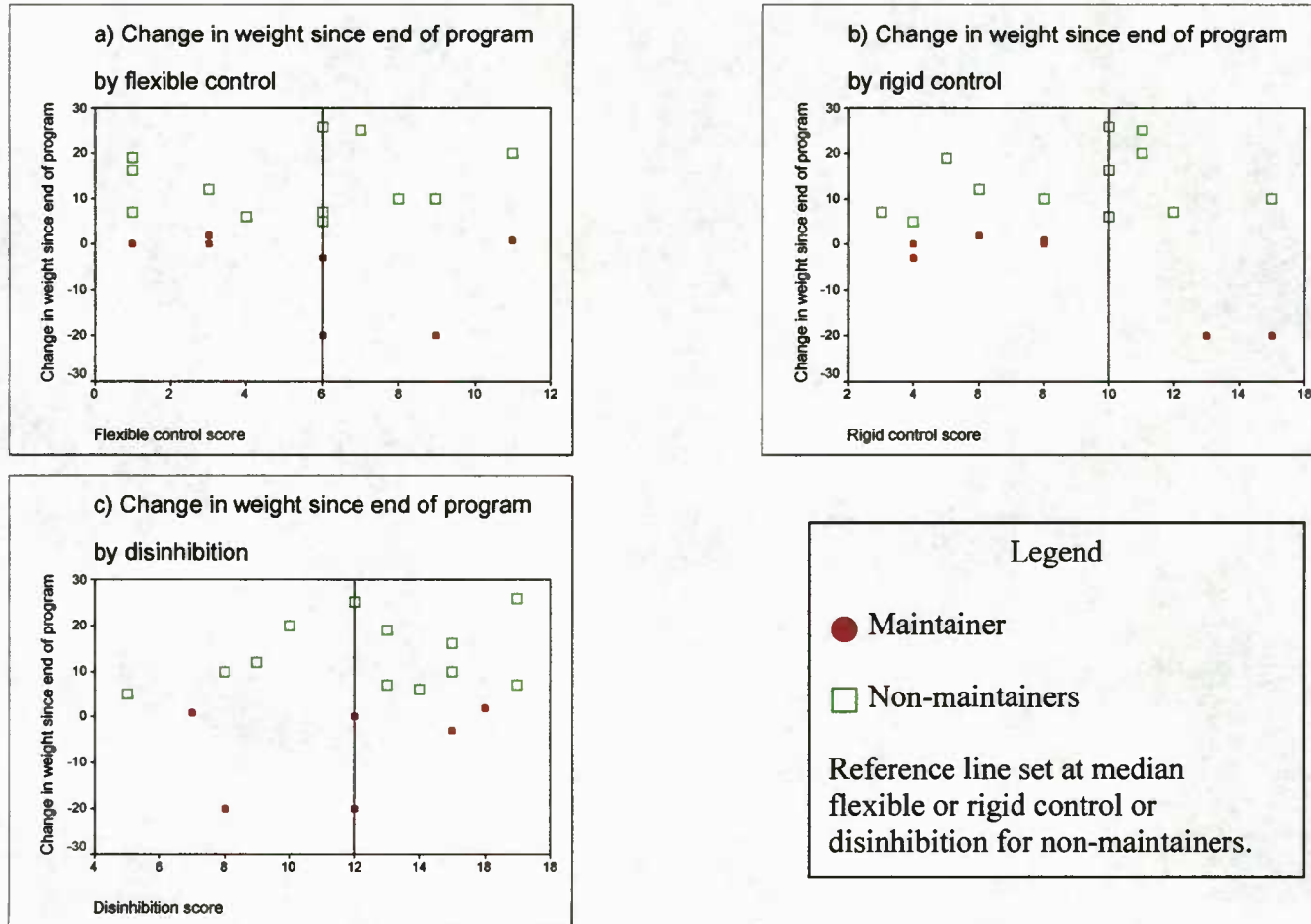
² Medians (ranges)

³ Individual scores represent whole numbers.

This is illustrated in Figure 10 a, b and c that shows an equal distribution on both sides of the median for scores for flexible control, disinhibition and rigid control in maintainers and non-maintainers.

Comparison with current participant scores on these variables does suggest that non-maintainers may have decreased in flexible control since the end of the program (data not shown in tabular form). The data for current participant successful weight losers was in the direction of a higher percentage of subjects with flexible control scores above the median score of 6 at the end of the program than data for non-maintainers ($p = .050$ by 2-sided Fisher's Exact Test). This is definitely just a data direction since the p -value is less than the Bonferroni adjustment of $p = .016$ for multiple comparisons in 3 groups and since the difference between maintainer and non-maintainer scores for flexible control was not significant. Based on Westenhoefer's theory that flexible control is associated with maintenance of weight loss, the direction of the difference with past

Figure 10—Distribution of weight loss maintenance by selected Eating Inventory subscale scores in past participants



participant non-maintainers being lower in flexible control compared to current participant successful weight losers is in the right direction. For this reason, hypotheses 6a, 6b, and 6c are rejected in the current research but further study of hypothesis #6a in larger samples and with a longitudinal study design is warranted to see how flexible control is associated with successful maintenance of weight loss.

A brief comparison of individual Eating Inventory and flexible and rigid control item responses between current participant and past participant study groups shows very few items meeting the Bonferroni's adjustment of $p \leq .008$ for 4 groups for a significant difference in responses. Four items met this criterion for significant differences and in each case they concerned the difference in response between current participant successful weight losers after program completion and past participant maintainers or non-maintainers. The first item was hunger scale item #24, "I get so hungry that my stomach often seems like a bottomless pit." Current participant successful weight losers all disagreed with this statement while past participant non-maintainers were divided between true and false answers (2-sided Fisher's Exact test, $p = .005$ for a difference in responses between the 2 groups). The item "I am always hungry enough to eat at any time" (hunger scale item #34) was more likely to be marked true for past participant weight loss maintainers while current participant successful weight losers all answered false (2-sided Fisher's Exact Test, $p = .002$ for difference in responses between groups). These two items suggest that there is a difference in perception of hunger that

decreased during active treatment of current participant successful weight losers and may have increased again over time in both groups of past participants. The disinhibition scale item (#49) “Do you go on eating binges even though you are not hungry” was more likely to be answered “sometimes” or “at least once a week” by past participant weight loss maintainers and non-maintainers than it was by current participant successful weight losers (2-sided Fisher’s Exact test, $p = .002$ for comparison between maintainers and successful weight losers and $p = .003$ between non-maintainers and successful weight losers). While bingeing became less of a problem for successful weight losers after the program, over time it looks like these binge problems may have increased in frequency again for past participant maintainers and non-maintainers. Responses to both of these hunger and disinhibition items suggest regression toward baseline in past participants over time. Of note is that the past participant maintainer and non-maintainer responses were not significantly different from the current participant successful weight losers before current participant successful weight losers attended the program.

The last item with significantly different responses between groups was the rigid control item #10 “Quick success is most important for me during a diet.” This item was more likely to be answered as true among past participant non-maintainers while all the current participant successful weight losers answered this as false after program completion ($p = .001$ by 2-sided Fisher’s Exact test). While this may suggest a reason for the past participant non-maintainers’ difficulty in maintaining their weight loss, the fact that the past participant weight loss

maintainers did not respond in a manner significantly different from the non-maintainers ($p = .170$ by 2-sided Fisher's Exact test) means further study with larger samples would be necessary to confirm this. In order for this to suggest a reason that past participant non-maintainers are having difficulty maintaining a weight, it would be expected that there would be no difference between past participant weight loss maintainers and current participant successful weight losers. This was the case. There was no difference between current participant successful weight losers and past participant weight loss maintainers in how they answered this item. Still, the finding could represent a regression to baseline in attitudes toward weight loss among past participant non-maintainers and not an explanation for why non-maintainers had difficulty maintaining their weight loss.

Hypothesis #7—Current Smart CHOICES participants

Among current participants, relative caloric intake at the end of the Smart CHOICES program will be more strongly related to successful weight loss than the percentage of energy from fat and leisure time physical activity.

Hypothesis #8—Past participants of the CHOICES program

Among past participants, total leisure time physical activity, and strenuous exercise in particular, will be more strongly related to successful maintenance of weight loss than will be relative caloric intake and the percentage of energy from fat.

Hypotheses #7 and #8 were both tested by logistic regression for categorical variables to see if some variables were more likely to explain categorization of current participants as successful weight losers (loss of ≥ 5 lb weight loss) or past participants as weight loss maintainers (< 5 lb regain since end of program). Among current participants, none of the variables of relative caloric intake, percentage of energy from fat, or total leisure time physical activity had coefficients significantly different from zero when run individually in the logistic regression equation for successful weight loss. In other words, none of these variables were able to explain the likelihood that a current participant would be categorized as part of the successful weight loss group. Similar results were achieved with past participants when tested with logistic regression analysis. Total leisure time physical activity, frequency of strenuous exercise, relative caloric intake, and the percentage of energy from fat had logistic regression coefficients that were not significantly different from zero. These variables were not able to explain the likelihood that someone would be a weight loss maintainer rather than a non-maintainer. Small sample sizes may have impacted these results for logistic regression analysis. Both hypotheses #7 and #8 are rejected. Conclusions will be drawn from the earlier hypotheses #1-#6 only.

LIMITATIONS

The first limitation for interpretation of the current research concerns how accurately subjects can fill out the lengthy questionnaires included in the study. The full survey took 30-60 minutes to fill out. The fact that later questionnaires in the booklet were more likely to have sections left blank than the earlier questionnaires suggests subject fatigue in filling out the full survey. This was most noticeable in the difference between sample sizes for disinhibition and rigid control scales on the Eating Inventory among current participant successful weight losers. Subjects left some of the individual items associated with one or more of the scales blank resulting in scores for 11 of 11 subjects for disinhibition but only 8 of 11 subjects for rigid control.

All of the measures in the current research rely on self-report data. This has its own inherent error compared to more objective measures. Considering the key role of past and current body weight in categorizing study groups and subsequent testing of the research hypotheses, it was unfortunate that all body weights had to be obtained by self-report. This was a function of the Smart CHOICES and CHOICES policies that no regular independent data is collected on program participants. The seriousness of the problem is illustrated by the exclusion of all studies using self-report measures of body weight from consideration in preparation of the Evidence Report on the Clinical Guidelines on the Identification, Evaluation,

and Treatment of Overweight and Obesity in Adults (105). The reason cited for this was adherence to good research technique.

Several studies have suggested that self-reported weights are quite reliable. One previous study reports that subjects tend to underestimate self-reported weight by about 5% and while this inaccuracy increases with increasing weight, it does not change with the percentage above ideal body weight (106). Thus, that study does not suggest differential underreporting by level of obesity. In the RENO Diet Heart Study year-1 weight recalled at year-5 was compared with the measured weight at year-1 (107). The correlation showed that the average discrepancy was 2% or less in this highly motivated sample (willingness to fill out multiple questionnaires over a 5 year period was a condition for participation in the study) (107). While a trend existed for normal weight women to remember past weight higher than it was measured and overweight women to remember past weight lower than measured, the difference between the 2 groups was not statistically significant. In addition, self-reports of weight change over time were consistent with values calculated from actual measured weights and did not differ in their reliability between normal weight and overweight subjects (107). The NWCR also verified recalled weight in a subsample of their subjects using independent documenters such as medical doctors and weight loss counselors (16). They found that the correlation between subject's and documenter's reported weight was .98 and the mean weight discrepancy between the 2 weights was 5.4 lb \pm 12.3 lb (16).

While these studies are reassuring, a number of subjects in the current study weigh themselves very infrequently. Fifteen to 70% of some of the study groups report weighing themselves less than once per week. This includes 6 subjects (or 16% of the entire study sample) who reported weighing themselves once per year or less. The accuracy of self-reported weights for these subjects who rarely weigh themselves is highly questionable.

Self-reports of dietary intake are a problem no matter which tool is used to estimate intake. However, self-reports are the only way to get estimates of dietary intake in free-living populations. While the Block FFQ tends to underestimate caloric intake by most reports (72), it does appear to be reasonably accurate in reporting percentage energy intake as fat (71, 75). The Block FFQ has the advantage of decreasing subject burden in comparison to filling out multiple diet records. The question remains, how accurately are individual subjects able to fill them out to show their usual dietary intake. The current study has 2 subjects with unreasonably low estimated intakes and 3 additional subjects with possibly underestimated intakes based on the Block FFQ. It is impossible to tell whether other subjects may have inaccurate estimated intakes as well. Trial analyses excluding and including past participants with error messages related to energy intake revealed no difference in significance for the hypotheses variables of relative caloric intake and percentage of energy intake as fat between maintainers and non-maintainers. In the end, only 1 subject's results were omitted as an extreme outlier with estimated caloric intake at 360 kcal/day. Since other studies have suggested

that the Block FFQ is reliable in ranking individuals in regard to relative nutrient intake (72, 77) and the current research relied on pooled results for groups of subjects, it is not likely that inherent inaccuracies in subjects' ability to fill out the Block FFQ substantially affected the results.

Another limitation of the current research concerns the effects of sampling bias on the generalizability of results. This is primarily an outcome study for a particular program and, as such, all findings are specific to the current program. With the current participants, it is likely that results are very representative of Smart CHOICES groups held in the Fall of 2000. Sixteen of the 18 participants who attended ≥ 7 of 10 sessions (89%) were subjects in the current study. With an approximate 39% response rate among past participants completing 7 of 10 sessions, the possibility exists that non-response bias affecting results occurred in this group. Besides making the results among past participants in this study somewhat unreliable, this limits the reliability of comparisons between current participants and past participants, as was done on a limited basis in this study.

The small sample sizes varying from 6 to 12 subjects per comparison group probably limited the current study's ability to detect small differences between groups. This was compounded by the large individual variability shown by the range of scores in relative caloric intake, total activity intensity, the Eating Inventory scales, and the flexible control and rigid control subscale scores. The effects were particularly noted in measuring differences in diet-, exercise-, and behavior-related variables between past participant maintainers and non-

maintainers with only one time point available for measuring differences. When change over time was measured, in before and after program values for current participants, small sample sizes and large individual variability were not so critical. Still, it is possible that differences exist between the groups on measured parameters that could not be detected statistically in these small groups with large individual variability.

CONCLUSIONS

Current participant successful weight losers decreased their percentage of energy intake from fat over the course of the program more than did non-successful weight losers. Successful weight losers also decreased their relative caloric intake and increased total physical activity over the course of the program while non-successful weight losers did not. While successful weight losers changed their eating attitudes as measured by the Eating Inventory over the course of the program in directions expected by previous weight control research, non-successful weight losers had some of the same changes and there was no significant difference in the degree of change between successful and non-successful weight losers. Cognitive restraint and flexible control increased in successful weight losers and disinhibition and hunger decreased. Non-successful weight losers showed all of these same changes except that hunger did not change for them over the course of the program. Depressive symptoms as measured by the CES-D were not a significant factor in successful outcome and since they tended to decrease with time, do not seem to be a risk for participation in the Smart CHOICES program.

The current research was unable to differentiate between past participants who were weight loss maintainers and non-maintainers with respect to the factors investigated. There was a suggestion that regression towards baseline occurred over time after completion of the weight loss program on several measures for both past

participant maintainers and non-maintainers. Further research would be helpful in confirming this finding.

RECOMMENDATIONS

The Smart CHOICES and CHOICES weight control programs have been designed as community service offerings by the Providence Health System and thus have few baseline and follow-up objective measures built into their program delivery system. Despite this lack, it does appear that the program has been effective in promoting at least temporary behavior change. Since health-oriented, effective programs are not widely available in the Portland, OR area, consideration should be given to converting this program to one that is more clinically based. This would allow more comprehensive baseline and follow-up assessment of participants.

As a minimum, measurement of weight and height at baseline and weight at program completion would greatly improve the outcome documentation in the program. Working out a follow-up method that includes a measured weight would be helpful too. Since program participants are not used to weighing themselves, this would likely increase the accuracy of future follow-up conclusions. Also, objective measurement of the behavior changes targeted by the program, dietary intake and physical activity, should be made at baseline, after program completion, and at various follow-up time points. The Godin questionnaire used in the current research seems appropriate for continued use since it is brief and was also sensitive enough to show changes in the participants in this study. The Block FFQ, however, does not seem to be accurate enough for individuals to warrant the time and effort it

takes participants to fill it out (about 20-30 minutes are required to complete this questionnaire). Instead, consideration could be given to using an average of 3 serial, multiple-pass 24-hour recalls. This method also has problems in accuracy when used in individuals (74), but reduces participant burden in filling out records like the Block FFQ does and decreases the need for participants to interpret their usual intake into a specific format. Methods are described in the literature for use of a telephone-based, computer-assisted 24-hour recall that could ease delivery for such an instrument (20).

Additional research with Westenhoefer's subscales for rigid and flexible control is recommended. The current research suggests that flexible control may be associated with successful weight loss and that an increase in rigid control may be associated with non-successful weight loss. Continuing research with larger sample sizes over time, and a longitudinal design so that weight loss maintainers and non-maintainers are included, would clarify these findings.

Maintenance of weight loss does seem to be a problem in the CHOICES program as evidenced by 63% of the past participant successful weight losers being non-maintainers in the current research. The current Smart CHOICES program is a detailed functional analysis for individual participants, as described in current behavior modification techniques, of current eating and exercise behaviors that can be targeted for change in achieving successful weight loss. After completion of this functional analysis, there is little time left for practicing new behaviors while still attending the program. Support groups or opportunities for individual follow-up

could be developed and their use encouraged as a way to offer practice in these newly started behaviors. With long-term eating and exercise habits usually a stable entity, long-term effort is needed to create a new stable environment that supports new, healthier habits (27). Additionally, the findings in the current research that regression toward baseline habits after program completion occurs over time should be shared with current Smart CHOICES program participants. That way they can scrutinize the changes they are making to be sure they don't represent short-term changes but are things they can continue for the rest of their life.

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APPENDICES

APPENDIX A – Oregon State University Institutional Review Board Approval

RESEARCH OFFICE



OREGON
STATE
UNIVERSITY

312 Kerr Administration Building
Corvallis, Oregon
97331 2140

Telephone
541-737-8008
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541-737-3093
INTERNET
Laura.Lincoln@orst.edu

August 29, 2000

Principal Investigator:

The following project has been approved for exemption under the guidelines of Oregon State University's Institutional Review Board (IRB) and the U.S. Department of Health and Human Services.

Principal Investigator(s): Connie Georgiou

Student's Name (if any): Janet G. Mann

Department: Nutrition and Food Management

Source of Funding:

Project Title: Short and Long Term Effectiveness of a Weight Loss Program

Comments:

This approval is valid for one year from the date of this letter. A copy of this information will be provided to the Institutional Review Board. If questions arise, you may be contacted further.

Sincerely,

Laura K. Lincoln
IRB Coordinator

cc: IRB Chair

APPENDIX B – Providence Health System Institutional Review Board Approval

Providence | Health System

Institutional Review Board

5050 N E Hoyt
Plaza, B-Level
Portland, Oregon
97213-2967

Tel 503 215 6512



September 11, 2000

Janet Mann, RD, LD
19900 S. Meyers Rd.
Oregon City, OR 97045

re: EXPEDITED STUDY APPROVAL OF:
(00-128) Short end Long Term Effectiveness of e Weight Loss Program. P.I. Janet
Mann, RD, LD

Dear Ms. Mann,

This research study proposal (dated August 28, 2000), questionnaires (food, eating, and weight), invitation letter, and reminder notices have been reviewed and approved expeditiously by Laurie Skokan, PhD, Acting IRB Chairperson, on September 11, 2000.

This approval applies to people only currently enrolled in the CHOICES program. This approval does not apply to recruiting people who took part in the program in the past. This is due to privacy and confidentiality issues involving names and addresses of those who have taken part in the class. The dietary department must write or call and ask these people if they want to be contacted about this study – you will not be able to contact them directly.

As soon as you have developed a method to contact past class participants, you must submit it to the IRB for review.

This study is active/valid until September 11, 2001. A continuing review form and current consent form must be submitted to the IRB by this date.

The IRB must review and approve all study changes before they are initiated. These reporting forms are attached.

Members will be informed of this study approval at the September 26, 2000 Full-Board meeting.

Sincerely,

Jean Sork, RN
Research Study Coordinator
Institutional Review Board

Cc: Sandy Miller, RD
Constance Georgiou, PhD, RD, LD

APPENDIX B – Providence Health System Institutional Review Board Approval (Continued)

Providence | Health System

Institutional Review Board

5050 N.E. Hoyt
Plaza, 8-Level
Portland, Oregon
97213-2967

Tel 503 215 6512

September 28, 2000

Janet Mann, RD, LD
19900 S. Meyers Rd.
Oregon City, OR 97045

re: EXPEDITED APPROVAL OF PROTOCOL MODIFICATION FOR:
(00-128) Short end Long Term Effectiveness of a Weight Loss Program. P.I. Janet
Mann, RD, LD

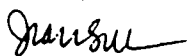
Dear Ms. Mann,

This letter acknowledges the protocol modifications regarding the recruitment process for
past participants in the CHQICES program.

Expedited approval is granted by Laurie Skokan, PhD, IRB Acting Chairperson, on
September 22, 2000.

Members will be notified of this report at the October 24, 2000 Full-Board meeting.

Sincerely,



Jean Sork, RN
Research Study Coordinator
Institutional Review Board

Cc: Sandy Miller, RD
Constance Georgiou, PhD, RD, LD

APPENDIX C – Weight History for Current Participants Before Program

WEIGHT HISTORY

1. Are you currently starting the Smart C.H.O.I.C.E.S. PROGRAM?
 YES NO

1a. Did you sign up for the C.H.O.I.C.E.S. program in 1998?
 NO YES

1b. How many sessions did you attend?
 (list number as best you can recall; 0 to 10)

1c. If you attended less than 7 sessions, please write in reason you did not attend more than this.

1d. What was your weight in pounds at the beginning of the Smart C.H.O.I.C.E.S. program?
 _____ pounds

1e. What was your weight in pounds at the beginning of the C.H.O.I.C.E.S. program in 1998?
 _____ pounds

1f. What was your weight in pounds when you stopped attending the C.H.O.I.C.E.S. program in 1998?
 _____ pounds

2. What is your current weight (as listed on the food questionnaire)? _____ pounds

3. What is your lifetime maximum weight (for women, not counting pregnancies)?
 _____ pounds

4. How would you describe your current weight?

extremely thin just about right extremely heavy

somewhat thin somewhat heavy

APPENDIX C – Weight History for Current Participants Before Program (Continued)

5. Would you like to weigh something different than your current weight?

NO YES

↓

5a. How much would you reasonably like to weigh? _____ pounds

↓

5b. How much does your current weight bother you?

a lot; it is a major problem

somewhat; it is a small problem

none; it is not a problem

↓

6. In your opinion, at which of the following ages, if any, were you overweight? (check all that apply)

<input type="checkbox"/> infant, young child	<input type="checkbox"/> adolescence
<input type="checkbox"/> older child	<input type="checkbox"/> young adult
<input type="checkbox"/> just before puberty	<input type="checkbox"/> middle age adult
<input type="checkbox"/> just after puberty	<input type="checkbox"/> older adult

7. Is there a particular age, which you regard as the beginning of your weight problem?

NO YES (list the age _____ years

8. Have any of the following life events triggered a period of weight gain that you consider the beginning of or the worsening of a weight problem?

<input type="checkbox"/> puberty	<input type="checkbox"/> marriage
<input type="checkbox"/> graduation from high school	<input type="checkbox"/> having children
<input type="checkbox"/> joined the military	<input type="checkbox"/> getting divorced
<input type="checkbox"/> left the military	<input type="checkbox"/> (for women) peri-menopause or menopause
<input type="checkbox"/> starting work or changing jobs	<input type="checkbox"/> surgery
<input type="checkbox"/> starting college	<input type="checkbox"/> major illness (What was it? _____)
<input type="checkbox"/> graduation from college	<input type="checkbox"/> other: _____

APPENDIX C – Weight History for Current Participants Before Program (Continued)

9. Were either of your biological parents overweight?

mother

neither

father

don't know for either one or both biological parents

10. Have you ever tried to lose weight before entering the C.H.O.I.C.E.S. or Smart C.H.O.I.C.E.S. program?

NO

YES



Which methods have you used?

Method(s) Tried	Number of times used	Greatest weight lost in pounds
Weight Watchers		
TOPS		
Overeaters Anonymous		
Medical Counseling		
Nutritional Counseling		
Counseling or Psychotherapy		
Behavior Modification		
Hypnosis		
Prescription Diet Pills		
Non-prescription Diet Pills		
Commercial liquid diet products		
Other diet products		
Injections		
Starvation diet or fasting		
Popular or fad diets		
Other commercial programs		
Exercise programs (spas, health clubs, etc.)		
Acupuncture		
Surgery		
Reducing belts or other garments		
Other:		
Other:		



APPENDIX C – Weight History for Current Participants Before Program (Continued)

11. How many times in your life would you estimate that you have lost the number of pounds shown below? (Check the number of times in each category)

Number of pounds lost	Number of times weight lost	
10-19 pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times
20-49 pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times
50-79 pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times
80-99 pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times
100+ pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times

12. How often do you weigh yourself?

- | | |
|---|--|
| <input type="checkbox"/> Usually more than once per day | <input type="checkbox"/> About once per month |
| <input type="checkbox"/> About once per day | <input type="checkbox"/> About once per year or less |
| <input type="checkbox"/> About once per week | |

APPENDIX D – Weight History for Current Participants After Program

WEIGHT HISTORY

1. How many sessions of the Smart C.H.O.I.C.E.S. program did you attend?
 _____ (list number as best you can recall; 0 to 10)

7 or more
sessions



Less than 7 sessions



1a. If you attended less than 7 sessions, please write in the reason you did not attend more than 7.

If you attended less than 7 sessions, you have the option of returning the questionnaire now in the envelope provided without completing the rest of the questions. If you choose to complete the Food Questionnaire (it is the one printed in blue and black ink), results of your caloric and nutritional intake will be sent to you.

1b. What was your weight in pounds at the beginning of the program? _____ pounds



1c. What is your weight in pounds now at the end of the program? _____ pounds



4. How would you describe your current weight?

extremely thin

just about right

extremely heavy

somewhat thin

somewhat heavy

**APPENDIX D – Weight History for Current Participants After Program
(Continued)**

5. Would you like to weigh something different than your current weight?
 NO YES



5a. How much would you reasonably like to weigh? _____ pounds

5b. How much does your current weight bother you?

a lot; it is a major problem

somewhat; it is a small problem

none; it is not a problem



12. How often do you weigh yourself?

Usually more than once per day

About once per day

About once per week

About once per month

About once per year or less

APPENDIX E – Weight History for Past Participants

WEIGHT HISTORY

1. How many sessions of the C.H.O.I.C.E.S. program did you attend in 1998?
 _____ (list number as best you can recall; 0 to 10)

7 or more
sessions



Less than 7 sessions



1a. If you attended less than 7 sessions, please write in the reason you did not attend more than 7.

If you attended less than 7 sessions, you have the option of returning the questionnaire now in the envelope provided without completing the rest of the questions. If you choose to complete the Food Questionnaire (it is the one printed in blue and black ink), results of your caloric and nutritional intake will be sent to you.

1b. What was your weight in pounds at the beginning of the C.H.O.I.C.E.S. program in 1998?
 _____ pounds



1c. What was your weight in pounds when you stopped attending the C.H.O.I.C.E.S. program in 1998?
 _____ pounds



2. What is your current weight (as listed on the food questionnaire)? _____ pounds



3. What is your lifetime maximum weight (for women, not counting pregnancies)?
 _____ pounds



4. How would you describe your current weight?

extremely thin

just about right

extremely heavy

somewhat thin

somewhat heavy

APPENDIX E – Weight History for Past Participants (Continued)

5. Would you like to weigh something different than your current weight?

NO YES

5a. How much would you reasonably like to weigh? _____ pounds

5b. How much does your current weight bother you?

a lot; it is a major problem

somewhat; it is a small problem

none; it is not a problem

6. In your opinion, at which of the following ages, if any, were you overweight? (check all that apply)

<input type="checkbox"/> infant, young child	<input type="checkbox"/> adolescence
<input type="checkbox"/> older child	<input type="checkbox"/> young adult
<input type="checkbox"/> just before puberty	<input type="checkbox"/> middle age adult
<input type="checkbox"/> just after puberty	<input type="checkbox"/> older adult

7. Is there a particular age, which you regard as the beginning of your weight problem?

NO YES (list the age _____ years)

8. Have any of the following life events triggered a period of weight gain that you consider the beginning of or the worsening of a weight problem?

<input type="checkbox"/> puberty	<input type="checkbox"/> marriage
<input type="checkbox"/> graduation from high school	<input type="checkbox"/> having children
<input type="checkbox"/> joined the military	<input type="checkbox"/> getting divorced
<input type="checkbox"/> left the military	<input type="checkbox"/> (for women) peri-menopause or menopause
<input type="checkbox"/> starting work or changing jobs	<input type="checkbox"/> surgery
<input type="checkbox"/> starting college	<input type="checkbox"/> major illness (What was it? _____)
<input type="checkbox"/> graduation from college	<input type="checkbox"/> other: _____

APPENDIX E – Weight History for Past Participants (Continued)

9. Were either of your biological parents overweight?

mother

neither

father

don't know for either one or both biological parents

10. Have you ever tried to lose weight before entering the C.H.O.I.C.E.S program?

NO

YES

Which methods have you used?



Method(s) Tried	Number of times used	Greatest weight lost in pounds
Weight Watchers		
TOPS		
Overeaters Anonymous		
Medical Counseling		
Nutritional Counseling		
Counseling or Psychotherapy		
Behavior Modification		
Hypnosis		
Prescription Diet Pills		
Non-prescription Diet Pills		
Commercial liquid diet products		
Other diet products		
Injections		
Starvation diet or fasting		
Popular or fad diets		
Other commercial programs		
Exercise programs (spas, health clubs, etc.)		
Acupuncture		
Surgery		
Reducing belts or other garments		
Other:		
Other:		

APPENDIX E – Weight History for Past Participants (Continued)

11. How many times in your life would you estimate that you have lost the number of pounds shown below? (Check the number of times in each category)

Number of pounds lost	Number of times weight lost	
10-19 pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times
20-49 pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times
50-79 pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times
80-99 pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times
100+ pounds	<input type="checkbox"/> Never <input type="checkbox"/> 1-2 times <input type="checkbox"/> 6-10 times	<input type="checkbox"/> 3-5 times <input type="checkbox"/> more than 10 times

12. How often do you weigh yourself?

- | | |
|---|--|
| <input type="checkbox"/> Usually more than once per day | <input type="checkbox"/> About once per month |
| <input type="checkbox"/> About once per day | <input type="checkbox"/> About once per year or less |
| <input type="checkbox"/> About once per week | |

APPENDIX F – Block Food Frequency Questionnaire 98 (Continued)

During the past year, have you taken any vitamins or minerals regularly, at least once a month?

- No, not regularly Yes, fairly regularly →

(IF YES) WHAT DID YOU TAKE FAIRLY REGULARLY?

VITAMIN TYPE	HOW OFTEN					FOR HOW MANY YEARS?					
	DIDN'T TAKE	A FEW DAYS per MONTH	1-3 DAYS per WEEK	4-6 DAYS per WEEK	EVERY DAY	LESS THAN 1 YR.	1 YEAR	2 YEARS	3-4 YEARS	5-9 YEARS	10+ YEARS
Multiple Vitamins. Did you take...											
Regular Once-A-Day, Centrum, or Thera type	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stress-tabs or B-Complex type	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Antioxidant combination type	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Single Vitamins (not part of multiple vitamins)											
Vitamin A (not beta-carotene)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beta-carotene	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vitamin C	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vitamin E	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Folic acid, folate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calcium, alone or combined with something else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Zinc, alone or combined with something else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Iron	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Selenium	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If you took Once-a-day, Centrum or Thera-type multiple vitamins, did you usually take types that contain minerals, iron, zinc, etc. do not contain minerals don't know

If you took vitamin C or vitamin E:

- How many milligrams of vitamin C did you usually take, on the days you took it?
 100 250 500 750 1000 1500 2000 3000+ Don't know
- How many IUs of vitamin E did you usually take, on the days you took it?
 100 200 300 400 600 800 1000 2000+ Don't know

Did you take any of these supplements at least once a month?

- Ginkgo Ginseng St. John's Wort Kava Kava Echinacea Melatonin DHEA
 Glucosamine/Chondroitin Something else Didn't take these

The next section is about your usual eating habits in the past year or so. This includes all meals or snacks, at home or in a restaurant or carry-out. There are two kinds of questions to answer for each food:

HOW OFTEN, on average, did you eat the food during the past year?
 *Please DO NOT SKIP any foods. Mark "Never" if you didn't eat it.

HOW MUCH did you usually eat of the food?
 *Sometimes we ask how many you eat, such as 1 egg, 2 eggs, etc., ON THE DAYS YOU EAT IT.
 *Sometimes we ask "how much" as A, B, C or D. LOOK AT THE ENCLOSED PICTURES. For each food, pick the picture (bowls or plates) that looks the most like the serving size you usually eat. (If you don't have pictures: A=1/4 cup, B=1/2 cup, C=1 cup, D=2 cups.)
 *Sometimes we made the "D" column a darker color. This is just to remind you to make sure you really eat that large a serving.

EXAMPLE: This person drank apple juice twice a week, and had one glass each time. Once a week he ate a "C" sized serving of rice (about 1 cup).

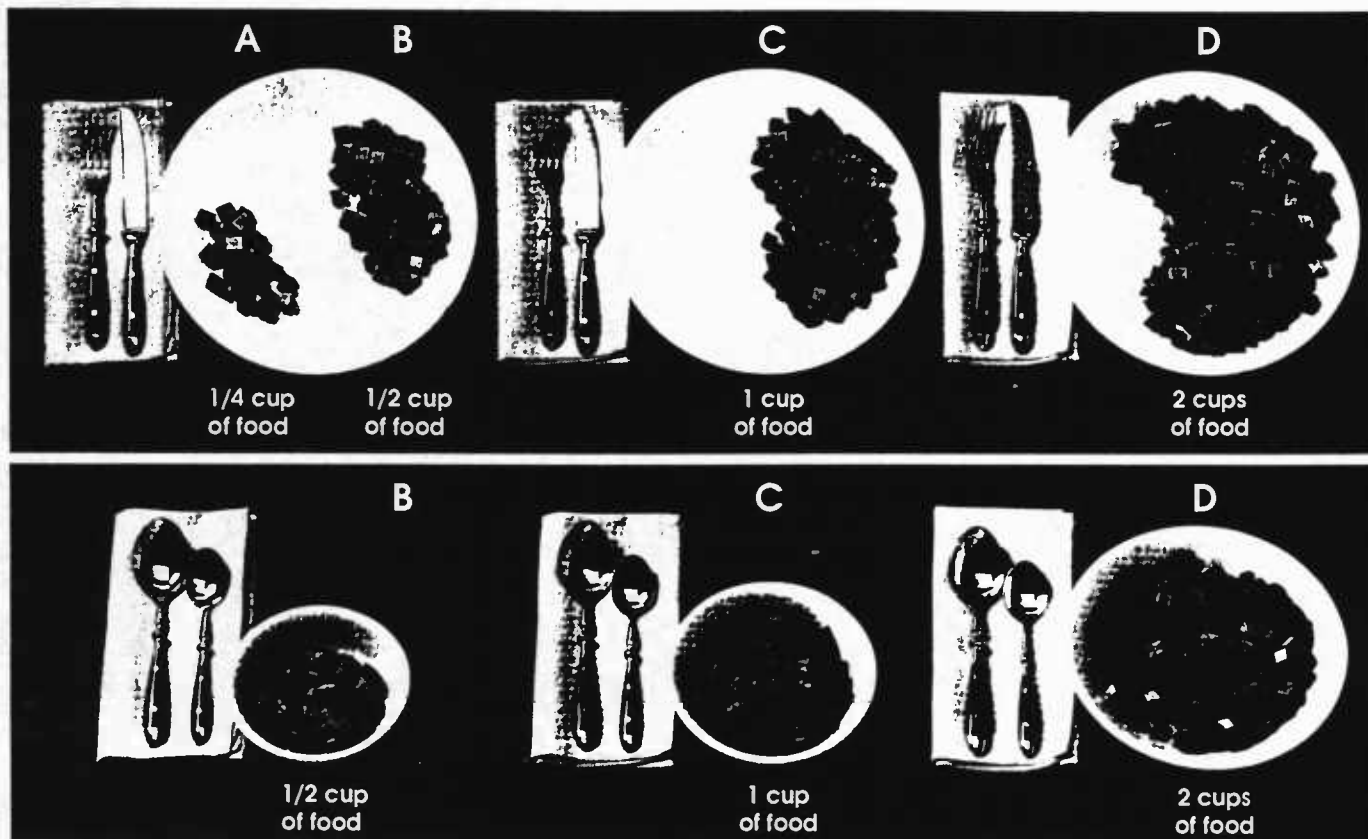
HOW OFTEN	NEVER	A FEW TIMES per YEAR	ONCE per MON.	2-3 TIMES per MON.	ONCE per WEEK	TWICE per WEEK	3-4 TIMES per WEEK	5-6 TIMES per WEEK	EVERY DAY	HOW MUCH EACH TIME SEE PORTION SIZE PICTURES FOR A-B-C-D				
										A	B	C	D	
Apple juice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many glasses each time	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
Rice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much each time	<input type="radio"/> A	<input type="radio"/> B	<input checked="" type="radio"/> C	<input type="radio"/> D

FOOD QUESTIONNAIRE

Serving Size Choices

Keep this in front of you while you are filling out The Food Questionnaire. You may use either the plates or the bowls to help you choose your serving size.

Choose A, B, C or D: **A** = 1/4 Cup of Food **B** = 1/2 Cup of Food **C** = 1 Cup of Food **D** = 2 Cups of Food



APPENDIX F – Block Food Frequency Questionnaire 98 (Continued)

HOW OFTEN	NEVER	A FEW TIMES per YEAR	ONCE per MONTH	2-3 TIMES per MONTH	ONCE per WEEK	2 TIMES per WEEK	3-4 TIMES per WEEK	5-6 TIMES per WEEK	EVERY DAY	HOW MUCH EACH TIME				
										How many glasses on the days you drink it?				
How often do you drink the following beverages?														
Tomato juice or V-8 juice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many glasses each time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Real 100% orange juice or grapefruit juice, including fresh, frozen or bottled	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many glasses each time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When you drink orange juice, how often do you drink a calcium-fortified brand? <input type="checkbox"/> Usually calcium-fortified <input type="checkbox"/> I don't know <input type="checkbox"/> Sometimes calcium-fortified <input type="checkbox"/> I don't drink orange juice <input type="checkbox"/> Hardly ever calcium-fortified														
Other real fruit juices like apple juice, prune juice, lemonade	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many glasses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kool-Aid, Hi-C, or other drinks with added vitamin C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many glasses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drinks with some juice in them, like Sunny Delight, Juice Squeeze	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many bottles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Instant breakfast milkshakes like Carnation, diet shakes like SlimFast, or liquid supplements like Ensure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many glasses or cans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Glasses of milk (any kind)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many glasses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When you drink glasses of milk, what kind do you usually drink? MARK ONLY ONE: <input type="checkbox"/> Whole milk <input type="checkbox"/> Reduced-fat 2% milk <input type="checkbox"/> Low-fat 1% milk <input type="checkbox"/> Non-fat milk <input type="checkbox"/> Rice milk <input type="checkbox"/> Soy milk <input type="checkbox"/> I don't drink milk or soy milk														
HOW OFTEN	NEVER	FEW TIMES per YEAR	ONCE per MONTH	2-3 TIMES per MONTH	ONCE per WEEK	TWICE per WEEK	3-4 TIMES per WEEK	5-6 TIMES per WEEK	EVERY DAY	HOW MUCH EACH TIME				
Regular soft drinks, or bottled drinks like Snapple (not diet drinks)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many bottles or cans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Beer or non-alcoholic beer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many bottles or cans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
What kind? MARK ONLY ONE: <input type="checkbox"/> Regular beer <input type="checkbox"/> Light beer <input type="checkbox"/> Non-alcoholic beer <input type="checkbox"/> I don't drink beer														
Wine or wine coolers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many glasses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Liquor or mixed drinks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many drinks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Glasses of water, tap or bottled	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many glasses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coffee, regular or decaf	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many cups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tea or iced tea (not herb teas)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	How many cups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
What do you usually add to coffee? MARK ONLY ONE: <input type="checkbox"/> Cream or half & half <input type="checkbox"/> Nondairy creamer <input type="checkbox"/> Milk <input type="checkbox"/> None of these														
What do you usually add to tea? MARK ONLY ONE: <input type="checkbox"/> Cream or half & half <input type="checkbox"/> Nondairy creamer <input type="checkbox"/> Milk <input type="checkbox"/> None of these														
Do you usually add sugar (or honey) to coffee? <input type="checkbox"/> No <input type="checkbox"/> Yes IF YES, how many teaspoons each cup? <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5														
Do you usually add sugar (or honey) to tea? <input type="checkbox"/> No <input type="checkbox"/> Yes IF YES, how many teaspoons each cup? <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5														

APPENDIX F – Block Food Frequency Questionnaire 98 (Continued)


PLEASE DO NOT WRITE IN THIS AREA										
86452		○○○○○○○■○○○■○○○■●○○○■●○○○■								
HOW OFTEN	NEVER	A FEW TIMES per YEAR	ONCE per MONTH	2-3 TIMES per MONTH	ONCE per WEEK	2 TIMES per WEEK	3-4 TIMES per WEEK	5-6 TIMES per WEEK	EVERY DAY	HOW MUCH EACH TIME SEE PORTION SIZE PICTURES FOR A-B-C-D
How often do you eat the following vegetables, including fresh, frozen, canned or In str-fry, at home or in a restaurant?										
Broccoli	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Carrots, or mixed vegetables or stews containing carrots	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Com	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Green beans or green peas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Spinach	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Mustard greens, turnip greens, collards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
French fries, fried potatoes or hash browns	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
White potatoes not fried, incl. boiled, baked, mashed & potato salad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Sweet potatoes, yams (Not in pie)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Cole slaw, cabbage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Green salad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Raw tomatoes, including in salad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much 1/4 <input type="radio"/> 1/2 <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/>
Salad dressing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many Tbsp. 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/>
Is your salad dressing <input type="radio"/> Usually low-fat <input type="radio"/> Sometimes low-fat <input type="radio"/> Hardly ever low-fat <input type="radio"/> Don't know/don't use										
HOW OFTEN	NEVER	FEW YEAR	ONCE MONTH	2-3 TIMES MONTH	ONCE WEEK	TWICE WEEK	3-4 TIMES WEEK	4-6 TIMES WEEK	EVERY DAY	HOW MUCH EACH TIME
Any other vegetable, like okra, squash, cooked green peppers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Refried beans or bean burritos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Chili with beans (with or without meat)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Baked beans, black-eye peas, pintos, any other dried beans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Vegetable stew	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Which Bowl B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Vegetable soup, vegetable beef, chicken vegetable, or tomato soup	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Which Bowl B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Split pea, bean or lentil soup	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Which Bowl B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Any other soup, like chicken noodle, chowder, mushroom, Instant soups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Which Bowl B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Spaghetti, lasagna or other pasta with tomato sauce	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Cheese dishes without tomato sauce, like macaroni and cheese	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input type="radio"/>
Pizza, including carry-out	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many slices 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/>

APPENDIX F – Block Food Frequency Questionnaire 98 (Continued)

HOW OFTEN	NEVER	A FEW TIMES per YEAR	ONCE per MONTH	2-3 TIMES per MONTH	ONCE per WEEK	2 TIMES per WEEK	3-4 TIMES per WEEK	5-6 TIMES per WEEK	EVERY DAY	HOW MUCH EACH TIME SEE PORTION SIZE PICTURES FOR A-B-C-D				
Do you ever eat chicken, meat or fish? <input type="radio"/> Yes <input type="radio"/> No IF NO, SKIP TO NEXT PAGE														
Hamburgers, cheeseburgers, meat loaf, at home or in a restaurant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much meat	<input type="radio"/> 1/8 lb.	<input type="radio"/> 1/4 lb.	<input type="radio"/> 1/2 lb.	<input type="radio"/> 3/4 lb.
Tacos, burritos, enchiladas, tamales, etc. with meat or chicken	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Beef steaks, roasts, pot roast, or in frozen dinners or sandwiches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
How do you like beef cooked?	<input type="radio"/> Rare <input type="radio"/> Medium <input type="radio"/> Well done <input type="radio"/> I don't eat beef													
Pork chops, pork roasts, or dinner ham	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
When you eat meat, do you <input type="radio"/> Avoid eating the fat <input type="radio"/> Sometimes eat the fat <input type="radio"/> Often eat the fat <input type="radio"/> I don't eat meat														
Veal, lamb or deer meat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Ribs, spare ribs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many ribs	<input type="radio"/> 3-4	<input type="radio"/> 5-6	<input type="radio"/> 7-8	<input type="radio"/> 9+
Liver, including chicken livers or liverwurst	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Gizzard, pork neckbones, chitlins, pigs feet, etc.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Mixed dishes with beef or pork, like stew, corned beef hash, stuffed cabbage, meat dish with noodles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Mixed dishes with chicken, like chicken casserole, chicken & noodles, pot pie or In stir-fry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Fried chicken, at home or in a restaurant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	# medium pieces	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
Chicken or turkey not fried, such as baked, grilled, or on sandwiches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
When you eat chicken, do you <input type="radio"/> Avoid eating the skin <input type="radio"/> Sometimes eat the skin <input type="radio"/> Often eat the skin														
HOW OFTEN	NEVER	FEW TIMES per YEAR	ONCE per MONTH	2-3 TIMES per MONTH	ONCE per WEEK	2 TIMES per WEEK	3-4 TIMES per WEEK	5-6 TIMES per WEEK	EVERY DAY	HOW MUCH EACH TIME				
Oysters	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Other shellfish like shrimp, scallops, crabs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Tuna, tuna salad, tuna casserole	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much of the tuna	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Fried fish or fish sandwich, at home or in a restaurant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Other fish, not fried	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Hot dogs, or sausage like Polish, Italian or chorizos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
Are your hot dogs	<input type="radio"/> Usually low-fat <input type="radio"/> Sometimes low-fat <input type="radio"/> Hardly ever low-fat <input type="radio"/> Don't know/don't eat them													
Bologna, sliced ham, turkey lunch meat, other lunch meat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many slices	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
Are your lunch meats	<input type="radio"/> Usually low-fat or turkey <input type="radio"/> Sometimes low-fat <input type="radio"/> Hardly ever low-fat													

APPENDIX F – Block Food Frequency Questionnaire 98 (Continued)

HOW OFTEN	NEVER	A FEW TIMES per YEAR	ONCE per MONTH	2-3 TIMES per MONTH	ONCE per WEEK	2 TIMES per WEEK	3-4 TIMES per WEEK	5-6 TIMES per WEEK	EVERY DAY	HOW MUCH EACH TIME SEE PORTION SIZE PICTURES FOR A-B-C-D				
										A	B	C	D	
Noodles, macaroni, pasta salad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Tofu, bean curd	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Meat substitutes, such as veggie burgers, Gardenburgers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many patties	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
Chinese food, Thai or other Asian food, not counted above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Snacks like potato chips, corn chips, popcorn (not pretzels)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Are these snacks <input type="radio"/> Usually low-fat <input type="radio"/> Sometimes low-fat <input type="radio"/> Hardly ever low-fat <input type="radio"/> Don't know/don't eat														
HOW OFTEN	NEVER	FEW YEAR	ONCE MONTH	2-3 TIMES MONTH	ONCE WEEK	TWICE WEEK	3-4 TIMES WEEK	4-6 TIMES WEEK	EVERY DAY	HOW MUCH EACH TIME				
Peanuts, other nuts or seeds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Crackers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Doughnuts, Danish pastry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4
Cake, sweet rolls, coffee cake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Are they <input type="radio"/> Usually low-fat <input type="radio"/> Sometimes low-fat <input type="radio"/> Hardly ever low-fat <input type="radio"/> Don't know/don't eat														
Cookies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many	<input type="radio"/> 1-2	<input type="radio"/> 3-5	<input type="radio"/> 6-7	<input type="radio"/> 8+
Are your cookies <input type="radio"/> Usually low-fat <input type="radio"/> Sometimes low-fat <input type="radio"/> Hardly ever low-fat <input type="radio"/> I don't know/don't eat														
Ice cream, ice milk, ice cream bars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How much	<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D
Is your ice cream <input type="radio"/> Usually low-fat <input type="radio"/> Sometimes low-fat <input type="radio"/> Hardly ever low-fat <input type="radio"/> I don't know/don't eat														
Pumpkin pie, sweet potato pie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many slices	<input type="radio"/> 1/2	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3
Any other pie or cobbler	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many slices	<input type="radio"/> 1/2	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3
Chocolate candy, candy bars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many bars	<input type="radio"/> small	<input type="radio"/> medium	<input type="radio"/> large	<input type="radio"/> large
Other candy, not chocolate, like hard candy, caramel, jelly beans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	How many pieces	<input type="radio"/> 1-2	<input type="radio"/> 3-5	<input type="radio"/> 6-7	<input type="radio"/> 8+



PLEASE DO NOT WRITE IN THIS AREA

APPENDIX G – Eating Inventory

A copy of the Eating Inventory can be found in:

St Jeor ST, ed. Appendix B27 The Three-Factor Eating Questionnaire.
Obesity Assessment: Tools, Methods, Interpretations. New York:
Chapman & Hall; 1997:824-829.

Copies of the Eating Inventory can be purchased from:

The Psychological Corporation
555 Academic Court
San Antonio, TX 78204-2498
1-800-872-1726

APPENDIX H – Westenhoefer's Additional Questions for Flexible and Rigid Control

Circle true or false for each of the following statements:

1. I alternate between times when I diet strictly and times when I don't pay much attention to what and how much I eat.	True	False
2. I prefer light foods that are not fattening.	True	False
3. If I eat a little bit more during one meal, I make up for it at the next meal.	True	False
4. Sometimes I skip meals to avoid gaining weight.	True	False
5. I avoid some foods on principle even though I like them.	True	False
6. I try to stick to a plan when I lose weight.	True	False
7. I eat diet foods, even if they do not taste very good.	True	False
8. A diet would be too boring a way for me to lose weight.	True	False
9. Without a diet plan I wouldn't know how to control my weight.	True	False
10. Quick success is most important for me during a diet.	True	False
11. If I eat a little bit more on one day, I make up for it the next day.	True	False
12. I pay attention to my figure, but I still enjoy a variety of foods.	True	False
13. I would rather skip a meal than stop eating in the middle of one.	True	False
<p>For the following question, choose the option which most applies to you and circle it.</p> <p>14. Do you deliberately restrict your intake during meals even though you would like to eat more?</p> <p style="text-align: center;">Always Often Rarely Never</p>		

©Westenhoefer, Stunkard, & Pudel, 1999.

Westenhoefer J, Stunkard AJ, Pudel V. Validation of the flexible and rigid control dimensions of dietary restraint. *Int J Eat Disord.* 1999; 26:53-64.

APPENDIX I – Godin Leisure Time Physical Activity Questionnaire

Godin Leisure-Time Exercise Questionnaire

1. Considering a **7-Day period** (a week), how many times on the average do you do the following kinds of exercise for **more than 15 minutes** during your **free time** (write on each line the appropriate number).

	Times Per Week
<p>a) STRENUOUS EXERCISE (HEART BEATS RAPIDLY) (i.e. running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)</p>	<input type="text"/>
<p>b) MODERATE EXERCISE (NOT EXHAUSTING) (i.e. fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)</p>	<input type="text"/>
<p>c) MILD EXERCISE (MINIMAL EFFORT) (i.e. yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)</p>	<input type="text"/>

2. Considering a **7-Day period** (a week), during your leisure-time, how often do you engage in any regular activity **long enough** to work up a **sweat (heart beats rapidly)**?

OFTEN	SOMETIMES	NEVER/RARELY
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

APPENDIX J – Center for Epidemiological Studies Depression Scale

SYMPTOM SCALE

How often you felt or behaved this way last week (check one for each item)

During the past week:	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
	1. I was bothered by things that usually don't bother me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I did not feel like eating. My appetite was poor.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I felt that I could not shake off the blues even with help from my family or friends.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I felt that I was just as good as other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I had trouble keeping my mind on what I was doing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I felt depressed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I felt that everything I did was an effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I felt hopeful about the future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I thought my life had been a failure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I felt fearful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. My sleep was restless.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I was happy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I talked less than usual.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I felt lonely.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. People were unfriendly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. I enjoyed life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. I had crying spells.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I felt sad.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. I felt that people disliked me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I could not get "going".	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. *Appl Psychol Meas.* 1977; 3:385-401.

APPENDIX K – Past Participant Solicitation Letter

(Printed on Providence Health Education Services letterhead.)

Dear (label with registrants name),

The Nutrition and Food Management Department at Oregon State University is conducting research among past participants of the CHOICES weight control program to identify factors that are associated with successful weight loss and weight loss maintenance. Your participation in this research would be greatly appreciated. The findings might suggest changes in our weight loss program to make it more effective.

You are part of a select group who registered for the CHOICES program between May and September of 1998. Even if you later did not attend some or all of the classes, your personal opinions are important to us. Enclosed is a stamped response postcard for your use. We request the favor of returning the postcard regardless of whether you will participate or must decline.

Your participation in this study is entirely voluntary. You will be filling out information about your weight history, eating habits, behaviors and attitudes, psychological symptoms, and usual physical activity on a survey that will be mailed to you by Janet Mann, RD LD at Oregon State University. It will take you from 30-60 minutes to complete. Your responses will be kept confidential and confined to research staff. Responses will be pooled with other subjects in reports of the results.

A benefit provided to you is an estimate of your usual caloric and nutrient intake based on your responses on the Food Questionnaire. We will send you this by mail.

If you have additional questions about this research study you can call the Institutional Review Board at Providence Health System (phone 503-215-6560).

Thank you for your consideration of this request. The best results will be obtained if as many registrants from the selected time period as possible agree to help with our research. If your address is incorrect on this letter, please indicate your correct address on the postcard. The addition of your phone number will assist us with follow up for those of you who agree to participate.

Sincerely,

Sandy S. Miller, MS, RD, LD
Coordinator of Health Education Services

APPENDIX L – Past Participant Solicitation Letter #2

(Printed on Providence Health Education Services letterhead)

December 4, 2000

Dear (label with registrant's name put here)

At the end of October, a letter requesting your participation in a research study of past participants in the CHOICES weight control program was sent to you. I imagine you were either busy at the time or forgot about the request. Would you please consider participating now and return the enclosed stamped response postcard today? You are part of a select group who registered for the CHOICES program between May and September of 1998. You and each of the other registrants are important to our research.

What the research requires from you is filling out a survey about your weight history, eating habits, attitudes, psychological symptoms, and usual physical activity. As a benefit to you, we will send you an estimate of your usual caloric and nutrient intake based on the Food Questionnaire you fill out. Your agreement to participate will be forwarded to Janet Mann, RD LD at Oregon State University and she will send you a survey as soon as possible.

I know that we are entering a particularly busy time of year. That is why we especially appreciate your consideration of this request now. Your help is very valuable to us. Just check your response on the enclosed postcard and drop it in the mail today.

Sincerely,

Sandy S. Miller, MS, RD, LD
Coordinator of Health Education Services

APPENDIX M – Past Participant Response Postcard

<p>(Label with past participants name)</p>	
<p><input type="checkbox"/> I would like to participate in the research. Please send me a survey Phone # to assist with follow up: _____ Address Correction: _____ _____ _____</p>	<p><input type="checkbox"/> I decline to participate in the research</p> <p>If you decline to participate, how many CHOICES sessions did you attend? _____</p>

APPENDIX N – Cover Letter Sent with Copy of Survey

(Printed on Department of Nutrition and Food Management Letterhead for Oregon State University)

Dear (Handwritten name put here)

Thank you for agreeing to participate in the OSU Weight Loss Program Effectiveness study. Enclosed is the survey. Please return it within the next week in the stamped return envelope provided. Fill it out by checking, filling in the blank, circling, or filling in the circles as indicated. The Food Questionnaire will be scanned so use a #2 for it if possible.

Your participation in this research really makes this study possible. As mentioned on the original information letter, you are part of a select group who registered for the CHOICES program during a particular time period and you cannot be replaced by anyone else. Even if you later did not attend some or all of the classes, your personal opinions are important to us.

Remember, we will mail you an estimate of your usual caloric and nutrient intake based on your responses on the Food Questionnaire.

If you have additional questions about this research study or the specific procedures that are being used, you can contact me or Connie Georgiou, Ph.D. by calling 541-737-3561. The Institutional Review Board at Providence Health System (phone 503-215-6560) or the IRB Coordinator at the OSU Research Office (phone 541-737-8008) can also be contacted if you have any questions about your rights as a research subject.

Thank you for your time,

Janet G. Mann, RD LD
Graduate Student Researcher

APPENDIX O – Current Participant Reminder Postcards

Reminder sent after baseline distribution.

09/25/00

Dear

Thank you for agreeing to participate in the OSU Weight Loss Program Effectiveness Study. It is very important to the success of this research for you to complete and return the survey as soon as possible. Your personal opinions are valuable to us. You are one of a small group of Smart C.H.O.I.C.E.S. participants and another person cannot replace you. We hope you can complete and return your survey this week. Remember, we will send you personal feedback on your Food Questionnaire results at the end of the study.

Thank you for your participation,

Janet Mann, RD LD
Graduate Student Researcher

Reminder sent after ending questionnaire distribution

11/22/00

Dear

Thank you for your continuing participation in the OSU Weight Loss Program Effectiveness Study. Without you, this research would not be possible. Please complete and return your survey as soon as possible. You are one of a small group of Smart C.H.O.I.C.E.S. participants and another person cannot replace you. We hope to receive your survey within the next week before the holiday rush. Remember, we will send you personal feedback on your Food Questionnaire before and after results when we receive everyone's surveys.

Thank you for your participation,

Janet Mann, RD LD
Graduate Student Researcher

APPENDIX P – Past Participant Reminder Postcards

After first pass solicitation.

11/11/2000

Dear

Thank you for agreeing to participate in the OSU Weight Loss Program Effectiveness Study. It is very important to the success of this research for you to complete and return the survey as soon as possible. Your personal opinions are valuable to us. You are one of a small group of C.H.O.I.C.E.S. participants and another person cannot replace you. We hope you can complete and return your survey this week. Remember, we will send you personal feedback on your Food Questionnaire results at the end of the study.

Thank you for your participation,

Janet Mann, RD LD
Graduate Student Researcher

After second pass solicitation

1/12/'01

Dear

Thank you for agreeing to participate in the OSU Weight Loss Program Effectiveness Study. Without you and others like you, this research would not be possible. Your personal opinions are valuable to us. If you haven't done so already, please complete and return the survey as soon as possible. You are one of a small group of C.H.O.I.C.E.S. participants and another person cannot replace you. Remember that we will send you personal feedback on your Food Questionnaire results at the end of the study.

Thank you for your participation,

Janet Mann, RD LD
Graduate Student Researcher

APPENDIX Q – Current Participant Cover Letter Sent with Second Copy of Survey

12/6/00

Dear

Thank you for agreeing to participate in the OSU Weight Loss Program Effectiveness Study being conducted by the Department of Nutrition and Food Management at Oregon State University. It is very important to the success of this research to complete and return the survey. If you have not done so already, please finish and return the survey within the next day or two. For your convenience, a second copy of the survey is enclosed along with a stamped, addressed envelope.

Your opinions are valuable to us. You are one of a small group of participants in Providence Health System's Smart CHOICES program and nobody else can replace you in the study. We hope you will complete and return the survey right away. When the study is finished, we will analyze the Food Questionnaire and send you a copy of your personal results. If you have any questions, don't hesitate to call and leave a message for me at (541) 737-3561. I will return your call.

Thank you for your participation. I look forward to hearing from you.

Sincerely,

Janet Mann, RD LD
Graduate Student Researcher

APPENDIX R – Past Participant Cover Letter Sent with Second Copy of Survey

(Printed on Department of Nutrition and Food Management letterhead for Oregon State University)

(Date)

Dear (Subject's name written here)

Thank you for agreeing to participate in the OSU Weight Loss Program Effectiveness Study being conducted by the Department of Nutrition and Food Management at Oregon State University. It is very important to the success of this research to complete and return the survey. If you have not done so already, please finish and return the survey within the next day or two. For your convenience, a second copy of the survey is enclosed along with a stamped, addressed envelope.

Your opinions are valuable to us. You are one of a small group of participants in Providence Health System's CHOICES program and nobody else can replace you in the study. We hope you will complete and return the survey right away. When the study is finished, we will analyze the Food Questionnaire and send you a copy of your personal results. If you have any questions, don't hesitate to call and leave a message for me at (541) 737-3561. I will return your call.

Thank you for your participation. I look forward to hearing from you.

Sincerely,

Janet Mann, RD LD
Graduate Student Researcher

**APPENDIX S – Cover Letter Send with Block Food Frequency Questionnaire
Results to Subjects after Study**

(Printed on Department of Nutrition and Food Management letterhead for Oregon State University)

Subject Name and
Address

Dear (Subject),

Here is your long awaited nutritional analysis from the OSU Weight Loss Program Effectiveness Study. As a reminder, last fall you filled out the survey as part of your participation in Providence Health System's Smart CHOICES program. I apologize for the length of time it took to get the information back to you.

I hope you'll find the feedback helpful. Your estimated intake of nutrients compared to recommended levels, as well as information about the 3 highest sources of selected nutrients, is shown on the front of the sheet. On the back are suggestions to improve your intake. One sheet is for the beginning of the Smart CHOICES program and one is for the end. You'll notice that your intake decreased slightly from beginning to end of the program.

I want to take the opportunity to extend my personal thanks to you for participating in this study.

Sincerely,

Janet G. Mann, RD LD
Graduate Student Researcher

APPENDIX T – Sample Block Food Frequency Results Sent to Subjects after Study

Your Nutrition Report

ID No.: xxxxxxxx

<u>Your average intake</u>	<u>Your Recommended Levels</u>	<u>Where the nutrients are coming from, in YOUR diet:</u>
Calories 2514.2 Kcal	Depends on your age, sex, and physical activity	Calories White bread Cheese Real fruit juice
Fat 94.7 g as % of cal 33.9%	For your caloric intake, 84 g or less 30% of total calories or less	Fat Cheese Salad dressing Butter
Saturated fat 35.2 g	Less than one-third of total fat	Saturated Fat Cheese Butter Cheese dishes
Mono Fat 31.1 g	About one-third of total fat	Cholesterol Cheese Eggs Mixed dishes with chicken
Poly Fat 20.4 g	About one-third of total fat	Beta-Carotene Mixed dishes with chicken Carrots Green salad
Protein 78.9 g	About 3.6 g/ every 10 lbs of body wt	Vitamin C Orange juice Real fruit juice Green salad
Carbohydrate 346.3 g	For you, at least 346 g (from grains, vegetables & fruits, not sugar)	Folate White bread Rice Baked beans, pintos
Cholesterol 254.4 mg	Less than 300 mg	Vitamins from Supplements: Vitamin A: 0.0 IU Vitamin C: 0.0 mg Vitamin E: 0.0 IU Folate: 0.0 µg Calcium: 0.0 mg Iron: 0.0 mg Zinc: 0.0 mg
Dietary Fiber 22.7 g	20-35 grams	
Alcohol % of cal 0.4	Moderately: 1 drink/day for women, 2 for men, or less	
Sweets % of cal 5.8	Moderate. Full of empty calories and fat	
<hr/>		
Antioxidants from diet		
Vitamin A 9276.6 IU	RDA: 4000 I.U.	
Beta-carotene 4701.3 µg	5000-6000 micrograms from food	
Vitamin C 150.1 mg	Good diet can provide 200-400 mg	
Vitamin E 10.5 IU	RDA: 12 IU. Some studies suggest higher levels are beneficial	
B-Vitamins from diet		
B1, B2 1.9 mg	RDA: 1.1 mg	
Niacin 20.9 mg	RDA: 14 mg	
Folate 438.8 µg	RDA: 400 µg	
Vitamin B6 1.9 mg	RDA: 1.3 mg	
Minerals from diet		
Calcium 983.9 mg	RDA: 1000 mg	
Zinc 8.7 mg	RDA: 12 mg	
Iron 15.4 mg	RDA: 15 mg	
Potassium 3303.1 mg	3000 mg or more	
Sodium (salt) 3139.4 mg	2400 mg or less	
<hr/>		
Your Food Group Servings	USDA Pyramid Recommendations	
Bread, pasta, rice 10	6-11 servings per day	
Vegetables group 2.7	3-5 servings per day	
Fruits, fruit juices 4.2	2-4 servings per day	
Milk, cheese, yogurt 2.0	2-3 servings per day	
Meat, eggs, beans 2.0	2-3 servings (total 6 ounces) per day	
Fats, oils, sweets 3.0	Very little	

APPENDIX T – Sample Block Food Frequency Results Sent to Subjects after Study (Continued)

Suggestions about YOUR diet

ID No.: xxxxxxxxx

For better health, lower your fat intake to 30% of calories or less.

To achieve this goal, eat more vegetables, fruits and grains, and fewer fatty foods. Look at your top three sources of fat. Try eating these less often or switching to smaller portions or low-fat types.

Congratulations! You are getting a good amount of folate in your diet.

Both men and women need it, to reduce the risk of heart disease and prevent birth defects. Good sources of folate are green leafy vegetables, oranges and orange juice, broccoli, and dried beans and peas. Breakfast cereals are also good sources. If you are capable of becoming pregnant, authorities recommend that you get 400 micrograms of folate from fortified foods or from vitamin supplements, because they are better absorbed.

Your calcium intake is below your requirements.

It is needed for strong bones, and for regulating blood pressure, transmitting nerve impulses, and in blood clotting. Good calcium sources are low-fat or non-fat milk and dairy products, and calcium-fortified juice. Calcium supplements are also valuable, to ensure that you are getting enough.

You're not getting your 5-a-day of fruits and veggies!

They can lower the risk of cancer and heart disease. And of course, they are usually low in fat. Getting at least five servings every day is not that hard! For example, have a glass of juice or a piece of fruit with breakfast (1), a salad with lunch (2), a piece of fruit for a snack (3), and potatoes and a vegetable with dinner (4,5).

(Note: A very low calorie estimate could mean that you eat a lot of foods that weren't on the list, or you underestimated how often you eat certain things. And, if you are not very physically active, you may in fact have quite a low calorie intake. If you're watching your weight, you may be cutting back too far on some of the foods that are good for you. It is likely that your score for percent of calories from fat is quite accurate, even if your calorie estimate is low.)