FACTORS INVOLVED WITH SUCCESSFUL WEIGHT LOSS MAINTENANCE

by

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To Rege, Mom and Russ

For their everlasting

love, support and encouragement

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(ABSTRACT)

The research was performed to determine factors associated with weight loss maintenance. Factors examined included: a) physical characteristics, b) eating habits, c) self-motivation level and d) activity level. Subjects included 19 overweight females who had participated in a nutrition and exercise program held at Virginia Polytechnic Institute and State University. Two separate groups of subjects were contacted and interviewed. Group 1 (n=11) participants in a six week treatment program, consisting of a very low calorie (530 kcal) liquid diet, and a supervised exercise program corresponding to 60% VO_2max for 30-40 min., 3 times/week. Group 2 (n=8) consisted of an eight week treatment program, consisting of mild caloric restriction (1200-1500 kcal/day), and a supervised exercise program corresponding to 70% VO_2max for 30-40 min. Group 1 was 12 months post formal treatment and group 2 6 months.

A questionnaire was developed and administered to the subjects. The first three sections were multiple choice questions concentrating on eating habits, behavior

modification techniques, and self-motivation level (SMI). The last section was an interview session ascertaining information on activity levels.

Of the factors examined, four were found to be prevalent for both groups: skipping breakfast and a strong appetite in the evening showed higher average weight gains, preplanning meals and higher self-motivation levels produced a lower average weight gain. Group 1 showed lower average weight gains for those individuals who joined another program and ate 3 meals a day. Group 2 showed individuals who had higher activity levels had lower average weight gains.

Due to the low incidence of maintenance of weight loss, it appears necessary to emphasize maintenance strategies during treatment sessions. Also it appears necessary to individualize treatment for subjects due to the range of self-motivation levels. Booster sessions and/or continued treatment may be helpful for those exhibiting a low motivation trait.

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TABLE OF CONTENTS

LIST OF TABLES

Chapter I

INTRODUCTION

Obesity is an increasing concern for many in the United States, for health as well as social reasons. The usual method for losing weight is conceptually very simple -- one must reduce the number of calories consumed and increase the number used to produce an energy deficit. Unfortunately, many psychological, social, and physiological factors make weight reduction more complex.

Weight loss during formal programs has been possible for many (Zuti and Golding, 1976; Wilmore, Katch and Katch, 1970). Factors contributing to weight loss during this treatment period usually include a caloric restriction alone or in combination with behavioral modification techniques and/or an increase in physical activity. However, literature dealing with weight loss in obese subjects suggests that individuals, even if initially successful in modifying their body composition are less successful in permanently maintaining their desired body size (Stalonas, Katahn and Hall, 1974; Stunkard, 1979). Little is mentioned in the literature as to what happens after participation in a weight-loss program. Are there factors that make certain women more capable of maintaining their desirable weight?

Various factors have been investigated in an attempt to predict maintenance of weight loss following successful

weight reduction. Some factors which have been researched are; psychological attributes -- including locus of control (Dishman, et al., 1980), attitudes (Andrew and Parker, 1979), and self-motivation (Dishman and Ickes, 1981). Other areas include activity levels (Reiff, 1967; Stalonas, Johnson and Christ, 1978), etiologies of obesity such as eating habits, demographic data, obesity history, and medical complaints (Rimm, 1974; Hartz, et al., 1979).

With the low percentage of individuals able to keep weight off for extended periods of time, it is necessary to concentrate on determining if certain factors can be related to the success or failure of individuals' capability to maintain weight losses. This study limited its observations to four areas: 1) physical characteristics, 2) eating habits, 3) self-motivation level and 4) activity level.

Certain physical characteristics appear to aid in the success or failure of weight loss maintenance. Dubbert and Wilson (1984), found at a 30 month follow-up that individuals who had the highest percentage of body fat pre-treatment regained the most weight at follow-up. Research has shown contradictory results pertaining to rapid weight loss during treatment and its effect on long term weight loss maintenance (Dynlop and Lyon, 1931; Genuth, et al., 1974; Dubbert and Wilson, 1984; Adams, 1983).

Eating habits of an individual have been associated

with success or failure in weight maintenance. Fabry (1964) found that individuals who ate one or two meals a day tended to be more overweight than individuals who ate three or more meals per day. Hartz (1979) found that those individuals who had a strong appetite in the afternoon and evening and ate three or fewer meals a day tended to be less successful in maintaining their weight goals. Other eating habits which may contribute to weight change include binging and snacking patterns, adherence to behavior modification techniques, and meal skipping.

Research has indicated that a self-motivation trait, may be a determinant of adherence to exercise (Dishman and Ickes, 1981). Dishman and coworkers (1980) constructed and validated a Self-Motivation Inventory (SMI). In a study involving asymptomatic individuals with coronary heart disease (Dishman and Gettman, 1980), the SMI was administered in combination with other selected variables and was found to be a predictor of exercise adherence and independent of other motivational concepts such as approval motivation, achievement motivation, locus of control, ego strength, and exercise attitudes which were all unrelated to adherence. Stalonas (1978), found physical activity to be a more influential factor in weight loss one year after treatment than behavioral procedures.

Since obesity is such a complex problem with many

interacting factors which make it difficult to treat for extensive periods of time, it is imperative to try to find an association of factors that may contribute to the success of weight maintenance. Once the factors influencing the ability to lose weight are determined, it may be possible to treat obesity by specific emphasis on modifying these factors.

Research Problem

The major problem addressed in this investigation was to determine the incidence of weight change or maintenance in a follow-up of women who participated in nutrition and exercise weight loss programs at Virginia Polytechnic Institute and State University. An attempt was made to determine factors which may be associated with maintenance or changes in body weight, 6-12 months, post treatment. Factors examined included physical characteristics, eating habits, self-motivation level, and activity levels. This research will serve as a preliminary step in the development of a pre-screening tool which can identify subject characteristics which may predispose them to dropout or have minimal success. This information will aid in the treatment of obesity and maintenance of their desired weight loss goals.

Research Questions

From the initial research purpose, four major research

areas were determined. The research questions were used to aid in the development of the survey instrument. The survey attempted to determine the association between weight change post formal treatment and:

1. Physical Characteristics

    a. highest weight attained in adulthood
    b. lowest weight attained in adulthood
    c. weight before program
    d. percentage of body fat before the treatment program
    e. weight loss during program

2. Eating Habits

    a. frequency of meals
    b. snacking
    c. binging patterns
    d. time of strong appetite
    e. behavior modification techniques

3. Self-Motivation Level (SMI)

4. Activity Level

Significance of the Study

Weight loss has become a billion dollar industry for health as well as intense social pressure for thiness. There have been numerous weight treatment programs emerging throughout the United States, many of these programs use some form of near starvation to achieve rapid weight loss and most are successful in initially getting the weight off of individuals. However, this success appears to be short lived in most individuals -- with a return to their original weight or above in a relatively short period of time.

Maintenance of weight loss requires major life-style

changes. All aspects of the individual's life style, including eating habits, activity levels, and psychological factors, must be addressed. By determining factors that may contribute to weight maintenance, it is hoped that the knowledge gained can be used to help develop an instrument that will aid practitioners to gather useful information from their clients. This information will aid contribute to the treatment of obesity by specific emphasis on modification of these factors.

Delimitations

The following delimitations are imposed by the investigator in order to conduct the study using the available facilities, equipment, and subjects:

1. Factors researched were limited to four major areas: eating habits, self-motivation, physical characteristics, and physical activity levels.

2. Physical measurements were limited to body weight.

Limitations

The following limitations of the study are recognized:

1. Sampling was non-random due to the fact that the subjects were all participants in previous nutrition and exercise programs held at Virginia Polytechnic Institute, therefore results are applicable only to similar samples.

2. The sample size was limited to 19, due to subjects available from treatment programs.

3. Information gathered was based on the accuracy of the subjects self-reported answers to a questionnaire.

Basic Assumptions

The following assumptions were made:

1. IT was assumed that all subjects reported accurate information when answering the questionnaires.

Definitions

1. Activity Level Score: a score computed for each individual using a physical activity recall. Scores are reflective of energy expenditure during follow-up participation in physical activity. Computation was based on frequency, intensity, and duration of activity.

2. Binge Eating: the consumption of enormous quantities of food during a period of uncontrolled eating.

3. Gained Weight at follow-up: Subjects who gained 5 pounds or more in the time period between treatment termination and time of follow-up.

4. Maintenance/loss of weight: Subjects who maintained their weight loss gaining less than 5 pounds or continued losing weight in the time period between treatment termination and time of follow-up.

5. Self-Motivation Inventory (SMI): A scale developed to assess self-motivation, conceptualized as a behavioral tendency to persevere, independent of situational reinforcements.

Summary

The major objective of this study was to determine if certain factors including physical characteristics, eating habits, self-motivation, and activity levels were involved in promoting long term maintenance or continuation of weight loss. Due to the poor success rate in maintaining weight loss, it is necessary to ascertain information that may prove beneficial in the treatment of obesity for long-term management. This study was an attempt to provide information which could be used by practitioners in the treatment of obesity and the maintenance of weight loss goals.

Chapter II

REVIEW OF THE LITERATURE

Although many individuals are successful in losing weight during treatment programs--few are successful in long-term maintenance. Many investigators have reported adherence/attendance to treatment programs, but there is much less information regarding weight and exercise maintenance subsequent to the termination of treatment. Obesity is a very complex problem with many interacting factors which make it difficult to treat for extensive periods of time. Therefore, it is imperative to try to find association of factors that may contribute to the success of weight maintenance. Various factors were examined in this study to identify their pertinence in weight control. These factors were divided into four subgroups: 1) physical characteristics, 2) eating habits, 3) self-motivation level (SMI), and 4) activity level.

Physical Characteristics

The success in the treatment phase may affect weight maintenance. Dunlop and Lyon (1931) found that patients who lost weight most readily were the ones who tended to regain it most easily when treatment ended. In another study, patients who were put on a very-low-calorie diet (VLCD) showed very high rates of relapse (Genuth, et al., 1974). However, Dubbert and Wilson (1984) found long-term successes

lost slightly more weight during treatment than relapsers. In agreement with this is a study on follow-ups of twelve different weight loss programs that found the participants who lost the most weight during the programs tended to maintain weight loss over time (Adams, et al., 1983).

Initial body weight and percentage of body fat have been examined to determine a possible link with weight maintenance. Dubbert and Wilson (1984) reviewing individuals at a 30 month follow-up found that those individuals who had the highest percentage of body fat pretreatment regained the most weight at follow-up. However, initial weight failed to predict any long-term post treatment weight changes.

Eating Habits

Investigators have examined various eating habits in an attempt to link them with the success or failure of weight maintenance. Many factors examined have proven to be contradictory in their results. Fabry (1964) found that individuals who ate one or two meals a day tended to be more overweight than individuals who ate three or more meals per day. The classic studies on meal eating versus nibbling were conducted by Cohn (1965). One group of rats were permitted to eat freely while the other group were held to two feedings daily with the amount of food equaling their counterparts. At the end of the experiment the rats who

were restricted to intake twice daily, had nearly twice as much body fat as did the rats allowed to eat freely.

Hartz (1979) in a study that included 175 severely obese women who were followed 18 to 24 months after discharge from a hospital treatment program, found that factors significantly related to weight change were combination of time of strong appetite and number of meals eaten per day. They found that those individuals who had a strong appetite in the afternoon and evening and ate three or fewer meals a day tended to be less successful in maintaining their goals. However, Bortz (1966) found that weight loss of humans on a 600 kcal diet was constant regardless of the number of feedings.

Young, et al. (1971) studied moderately obese young men over a period of 14 weeks. This was divided into a baseline period followed by two periods of eating regimens of either one, three, or six meals per day. There were no significant differences in weight loss according to meal frequency, although persons on the one-meal-per-day pattern had higher serum cholesterol values.

The majority of weight loss programs involve some type of behavior modification techniques in an attempt to alter poor eating habits of the individual in order to make their weight loss attempts more successful. Behavior weight-control programs have repeatedly posted encouraging

treatment effects (Jeffery, Wing & Stunkard, 1978; Leon, 1976; Stunkard, 1975), and short-term maintenance of these effects (Mahoney, 1974). Long-term follow-up evaluations of behavior modification programs are becoming more common in the literature. Hall et al. (1974) found success in short-term weight losses of behavioral programs but this success was not maintained over time; other researchers have found similar results (Beneke, et al., 1979; Jeffrey, et al., 1978). However, data from Stuart (1967) provide an exception to these studies, finding an average weight loss of 4.5 kg for eight patients at 12 months post treatment.

The important issue concerning use of behavior modification may be adherence to these treatment strategies after treatment termination. Also, certain strategies may be more conducive to success in weight control than others. Stalonas, et al. (1984), found that during a follow-up period, adherence to program techniques as low. The average subject conscientiously used 6.3 of the available 11.94 program techniques at any time during follow-up. Data revealed that only two techniques, eating in appropriate place and eating just one portion during a meal, were used for over half the follow-up period.

Binge eating is a complex problem that often contributes to obesity and complicates standard weight reduction treatment (Stunkard, 1976). Binge eating has been

described as "ingesting large amounts of food within a short period of time with accompanying fears about not being able to stop eating and depressive moods (Gormally, 1982)." Binge eating, has been shown to present problems for overweight, normal weight, and underweight populations (Stunkard, 1976; Loro, 1981). However, this study was concerned with binge eating as a possible factor contributing to the success or failure to maintain weight losses. Binging appears to be an increasing problem among individuals with weight problems. A survey of pretreatment data from 280 patients at the Dietary Rehabilitation Clinic of Duke University Medical Center showed 28.6% of these patients reported binge eating regularly or at least two times per week. An additional 22.1% of all clients reported frequent binge eating or at least one binge episode per week (Loro, 1981).

One factor that appears to be a physiological cue for binge eating, is adhering to an overly strict and unrealistic diet (Wermuth, 1977). Overly strict dieting produces hunger, obsessions about eating, and feelings of extreme self-denial, deprivation and the consequent right to indulge (Mahoney & Mahoney, 1976). Extreme dieting, exercising, and weight reduction tend to result in greater binge eating (Loro, 1981). It may be necessary to screen for binge eaters before treatment to meet their unique

needs.

Self-Motivation Level (SMI)

Behavioral compliance or adherence is a fundamental problem in weight loss maintenance. Keeping off lost weight requires adherence to habitual behavior and lifestyle changes. Results from studies concerning compliance with medical treatment as well as exercise programs suggest that motivation is a crucial variable in the moderation of adherence (Ward, 1984). However, not all persons may have the self-motivation necessary to keep weight off for extended periods of time.

Research has indicated that a self-motivation trait, may be a determinant of adherence to exercise (Dishman & Ickes, 1981). Dishman and coworkers (1980) constructed and validated a Self-Motivation Inventory (SMI). Self-motivation is viewed in the research performed by Dishman as a "generalized, nonspecific tendency to persist in habitual behavior regardless of extrinsic reinforcement and is thus largely independent of situational influence" (Dishman, 1982). In a study involving patients with CHD or asymptomatic individuals (Dishman & Gettman, 1980) the SMI was administered in combination with other selected variables and was found to be a predictor of exercise adherence independent of other motivational concepts such as approval motivation, achievement motivation, locus of

control, ego strength, and exercise attitudes which were unrelated to exercise.

In a more recent study, Gale et al. (1984), examined factors which may be related to adherence of healthy men (n=33) and women (n=73) to a six-month exercise program. Their results showed self-motivation scores for early-dropout men were significantly lower, but the correlation between SMI and attendance for all subjects was only r=0.052.

Dishman (1981) advocates that while most research involving the SMI has been utilized with exercise, it may easily lend itself to testing in health settings other than exercise.

Activity Level

Various advantages to increasing energy expenditure through exercise include a possible rise in basal metabolism which would counteract the decrease in metabolic rate that occurs with dieting (Mayer, 1968). Bjorntorp (1976) suggests that exercise not only increases caloric expenditure and the metabolism of fat, it may also decrease appetite, and aid in cardiovascular endurance.

Numerous studies indicate that programs that incorporate exercise as well as reduced caloric intake produce better weight maintenance (Dahlkoetter, et al., 1979; Stalonas, et al., 1978; Wilmore, et al., 1970). One

such study as reported by Stalonas (1978) randomly divided subjects into four groups (all received a similar weight loss program; A) addition of exercise and contingency component; B) addition of just exercise; C) an addition of just a contingency component; and D) just the basic program). The exercise component consisted of increasing physical activity over a 10-week period from 150 to 400 kcal per day above their basal level. The contingency manipulation consisted of instruction in the use of self-reinforcement for successfully applying the strategies of the program. Subjects compiled lists of activities which were converted into points that could be exchanged for daily and/or weekly rewards. Subjects were compared after 10 weeks of treatment and at three months and one year follow-ups. Only those subjects exposed to the exercise treatment maintained their weight loss at the one year follow-up. Harris and Halbauer (1973) reported similar results in a study consisting of a controlled eating group and a controlled eating plus exercise group. No differences in body weight changes were found during treatment, however, the controlled eating plus exercise group lost significantly more weight at a seven month follow-up than the controlled eating group.

Katahn et al. (1982), studied forty-four massively obese persons (82.5% over desirable weight) in a 6-month

treatment program that combined instruction in nutrition, behavior modification and supervised exercise sessions held twice a week for an hour consisting of aerobic dance to elicit 70-85% of their max VO_2 for at least 30 min per session. Subjects lost an average of 28.1 lb during treatment. At follow-up (12-18 months post treatment), 39% of the group was rated as having become fully committed to an active lifestyle, and on the average, those subjects maintained all of the weight they had lost. The less active participants had regained over 40% of their treatment losses.

Conclusion

There is a vast history of unsuccessful attempts by many to maintain their weight loss achieved during formal treatment. Therefore, this study was an attempt to determine those components which may aid in continued weight loss or maintenance.

Chapter III

Journal Manuscript

FACTORS INVOLVED WITH SUCCESSFUL WEIGHT LOSS MAINTENANCE

Carol Sue Lynch, Janet Walberg,
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ABSTRACT

The research was performed to determine factors associated with weight loss maintenance. Factors examined included: a) physical characteristics, b) eating habits, c) self-motivation level and d) activity level. Subjects included 19 overweight females who had participated in a nutrition and exercise program held at Virginia Polytechnic Institute and State University. Two separate groups of subjects were contacted and interviewed. Group 1 (n=11) participants in a six week treatment program, consisting of a very low calorie (530 kcal) liquid diet, and a supervised exercise program corresponding to 60% VO_2max for 30-40 min., 3 times/week. Group 2 (n=8) consisted of an eight week treatment program, consisting of mild caloric restriction (1200-1500 kcal/day), and a supervised exercise program corresponding to 70% VO_2max for 30-40 min. Group 1 was 12 months post formal treatment and group 2 6 months.

A questionnaire was developed and administered to the subjects. The first three sections were multiple choice questions concentrating on eating habits, behavior modification techniques, and self-motivation level (SMI). The last section was an interview session ascertaining information on activity levels.

Of the factors examined, four were found to be prevalent for both groups: skipping breakfast and a strong

appetite in the evening showed higher average weight gains, preplanning meals and higher self-motivation levels produced a lower average weight gain. Group 1 showed lower average weight gains for those individuals who joined another program and ate 3 meals a day. Group 2 showed individuals who had higher activity levels had lower average weight gains.

Due to the low incidence of maintenance of weight loss, it appears necessary to emphasize maintenance strategies during treatment sessions. Also it appears necessary to individualize treatment for subjects due to the range of self-motivation levels. Booster sessions and/or continued treatment may be helpful for those exhibiting a low motivation trait.

Introduction

Obesity is an increasing concern for many in the United States for health as well as social reasons. Weight loss during formal programs is common (30,28), but success in keeping the weight off for an extended period of time is uncommon (15,19,25,26). Three factors contributing to weight loss during the treatment period usually include a certain degree of caloric modification techniques and/or an increase in physical activity. Colvin (5) suggests that it may be possible that the maintenance of weight loss is controlled in part by variables unrelated to those influencing the original regimen.

Eating habits of an individual in relation to success or failure of weight loss maintenance is an area that has been investigated. Factors such as number of meals eaten per day (4,13,16), time of strong appetite (16), adherence to behavior modification techniques (25), and episodes of binge eating (20,28), have been considered to affect weight loss maintenance.

Numerous studies indicate that programs that incorporate exercise as well as reduced caloric intake produce better weight loss maintenance (6,24,28). Research has also indicated that a self-motivation trait may be a determinant of adherence to exercise (9). Dishman and Gettman (8) found that the SMI (Self-motivation Inventory)

proved to be a predictor of exercise adherence, and advocate that the SMI may easily be adapted to other health settings such as adherence to obesity treatment.

Certain physical characteristics of individuals may also affect weight maintenance. Success in the treatment phase (10,14), initial body weight and percentage of body fat (10), all have been linked with success or failure in weight loss maintenance attempts.

There is a vast history of unsuccessful attempts to maintain weight loss achieved during formal treatment. Therefore, this study was undertaken to try to determine the components which may aid in continued success in weight loss or maintenance, after cessation of a formal program.

Methods

Subjects included 19 overweight females who had participated in a nutrition and exercise program held at Virginia Polytechnic Institute and State University. Two separate groups of subjects were contacted and interviewed. Group 1 (n=11) were participants involved in a six week treatment program consisting of a very low calorie (530 kcal) liquid diet in combination with nutrition education and instruction in behavior modification techniques. An exercise portion consisting of supervised jogging and brisk walking at an intensity corresponding to 60% VO_2max for 30-40 minutes was also incorporated into the treatment

program. Follow-up on group 1 was 12 months post treatment. Subject characteristics are found in Table 1. Percentage of body fat was assessed by skinfold measurements.

Group 2 (n=8) consisted of college-age females who participated in an eight week treatment program. The program incorporated a nutrition component of mild caloric restriction (1200 to 1500 kcal/day), with instruction in behavior modification techniques. An exercise session of 30-40 minutes consisting of supervised walk-jog, three times a week to elicit a 70% VO_2max heart rate response, and assessment of body fat by skinfold measurement. Follow-up on group 2 was 6 months post treatment. Subject characteristics are found in Table 1.

This study concentrated on four specific areas during the follow-up phase: 1) physical characteristics, 2) eating habits, 3) self-motivation level (SMI) and 4) activity level. Subjects were contacted and appointments made for them to individually participate in answering a questionnaire and brief interview.

The questionnaire was developed in accordance with the four areas of interest. The first three sections were multiple choice questions and the last section was conducted through a face-to-face interview session. Physical characteristics included questions on weight history, smoking, additional treatment programs, and physical or

emotional stressors that may have affected weight change. Questions pertaining to the subjects' eating habits included frequencies of meals and snacks, binging patterns, time of increased appetite, and frequency of use of behavior modification techniques during follow-up.

The third section was a modification of the self-motivation inventory (SMI) developed by Dishman and Ickes (9). The SMI is a self-report questionnaire developed to assess motivation. Modification consisted of one undirectional response being dropped ("neither characteristic nor uncharacteristic of me") to help responders make a decision in one direction or another. The forty-item scale consists of 19 positively keyed and 21 negatively keyed items with a possible response range of 40-160. Higher numerical scores on the SMI scale were indicative of a higher level of motivation.

The session ended with an interview to collect information of the subject's level of activity during the follow-up period. Activities that were factored into the individual's activity score were limited to aerobic type activities (i.e., walking, swimming, biking, etc.). An activity score was calculated using the following information:

1) Frequency: exercise sessions per week/month
2) Number of months of the year they participated

in that activity

3) Time involved in activity (i.e., minutes)

4) Intensity (i.e., distance covered/time)

Using MET values (2) for the various activities, an activity score was calculated for each activity using the following formula:

Activity Score = MET value X hrs/wk.

An overall score for each subject was then calculated by summing the scores for each exercise activity.

Descriptive statistics were generated on all data including means, standard deviations, and standard error of the mean. Subject's answers were averaged according to their weight change at follow-up. Subjects considered to have maintained weight losses ranged from those who continued to lose weight to those who gained up to 5 pounds. Subjects considered to have gained weight at follow-up were above 5.1 pounds of their post treatment weights.

Data were separated by groups. For each possible response the number of individuals that correlated with a particular response were totaled and an average weight change between end of program and follow-up was calculated.

The frequency of use of behavior modification techniques was computed as a percentage of subjects utilizing a particular technique and broken down into subjects who maintained/loss (< 5 lbs) and those subjects

who gained weight (≥ 5 lbs) at follow-up.

Results

Table 1 shows differences in group characteristics. Group 1 mean weight before the program was heavier than Group 2. Group 1 lost more weight during treatment and had a higher mean percentage of body fat at the beginning of the program. Group 1 tended to regain the most weight at follow-up with their mean weight change of +7.8 kg compared to group 2 who had a mean weight change of +2.0 kg. However, 12 months had elapsed between treatment termination and follow-up for this group and only half that time for group 2. The difference in time of follow-up and differences in treatments make it necessary to separate the data by groups.

INSERT TABLE 1 ABOUT HERE.

Physical Characteristics

The weight change of individuals during post treatment period was examined as a function of weight loss during the formal treatment program (Table 2). Group 1 showed a higher average weight gain at follow-up for individuals who lost the most weight during formal treatment program, however, group 2 did not replicate this finding.

Both groups showed a higher average weight gain for

those individuals who had a 30-40% body fat prior to treatment than those who had a lower (20-30% body fat), or higher (40% body fat and above) beginning percent fat.

The majority of subjects were not smokers, only one out of the total (n=19) smoked greater than a pack a day, and three others smoked less than a pack a day. Subjects in group 1 who joined another weight control program during follow-up period regained less weight at follow-up (6.9 kg) than those who did not (8.5 kg). Results showed a higher average weight gain for subjects who had reported achieving the lowest weights during their adulthood. This finding was more evident in group 1 with subjects achieving weights under 130 lb., gaining an average of 10.3 kg at follow-up and subjects who never achieved weights under 150 lb. in adulthood averaging less than a 2 kg weight gain at follow-up.

INSERT TABLE 2 ABOUT HERE.

Eating Habits

Average weight change was assessed for each answer choice on the eating habit questionnaire (Table 3). Most subjects (n=13) reported eating three meals per day. Group 1 showed a lower mean weight gain for those who ate three meals, compared to individuals who ate two or four meals per

day. The number of snacks an individual ate, however, did not appear to be relevant in the amount of weight change at follow-up. One subject who reported eating 4 snacks (most reported) gained 13.1 kg at follow-up. Evening was reported most frequently as the time likely to snack with group 1 showing a higher average weight gain (9.5 kg) for the evening snackers. The subject who lost 4.2 kg at follow-up reported snacking but did not have a particular time when snacking was most prevalent.

The majority of subjects in both groups reported binging "sometimes." The highest mean weight gain was evident in "sometimes" binging in group 1. Binging did not appear to predict weight change in group 2. Interestingly, the one individual who reported binging most of the time did not show a weight gain. The subject who regained the most weight during follow-up (17.5 kg) reported an average binging period of 1-2 weeks.

Time of strongest appetite showed higher average weight gains for individuals reporting strong appetites at dinner and evening. Breakfast was reported to be the meal which was skipped most often (n=10), and group 1 showed a higher average weight gain (10.0 kg) for those who were breakfast skippers.

INSERT TABLE 3 ABOUT HERE.

Behavior Modification Techniques

Table 4 is a breakdown of the frequency of use of behavior modification techniques post treatment. The table divides the subjects into those who maintained/loss (within 2.3 kg) and those who gained (greater than 2.3 kg) weight during the follow-up period. Not many of the 12 behavior modification techniques listed in the survey were used regularly during the follow-up period. A large percent of both groups reported "often" using the techniques, keep food out of sight and eat only one serving at a meal. Those techniques which had the highest percent reporting "rarely" used by both groups included, restricting number of meals recording food intake, eat in only one designated place, put utensil down between bites, and use of smaller plates. Eighty percent of the subjects who maintained weight reported preplanning meals often compared to twenty-nine percent who gained. Sixty-five percent of the gained group reported often throwing away food left on their plate compared to only twenty percent of the maintainers. Also, a higher percentage of gainers (64%) reported to "rarely" keep track of and limit kcal, than those who maintained (0%).

INSERT TABLE 4 ABOUT HERE.

SMI

Table 5 shows the frequency distribution of SMI scores among the total 19 subjects. The range of scores was from 83 to 135 with a mean of 111.1. Group 2 showed a higher mean SMI score (121.1) than Group 1 (103.8). Group 1 showed a consistent trend towards a higher average weight gain for those subjects who scored lower self-motivation scores (Table 6). Group 2 showed similar results with the exception of one subject. The subject who gained most weight at follow-up scored the lowest on the SMI scale.

INSERT TABLES 5 AND 6 ABOUT HERE.

Activity Level

Table 7 shows the frequency distribution of activity level scores among all the subjects. Scores ranged from 0 to 27.3, with the majority scoring under 10 (n=14). Group 1 and 2 had only two of their subjects scoring above 10. Those in group 1, unexpectedly had a higher average weight gain among those subjects with higher activity scores. (Table 8). However, group 2 had an opposite trend with the lower scores associated with higher average weight gains.

INSERT TABLES 7 AND 8 ABOUT HERE

Possible Factors effecting weight gain

Few subjects reported weight gain associated with illness, operations, medications, and diabetes. Other emotional stressors were reported frequently for both groups, and group 1 showed a higher average weight gain among those individuals associating this factor with weight gain. Over half of group 1 reported childbirth as a factor contributing to weight gain, however this factor did not appear to affect changes in weight at follow-up.

INSERT TABLE 9 ABOUT HERE.

Discussion

The results of this study were discouraging in that only 26% of all subjects were able to maintain weight losses or continue losing. Group 2 had a higher success rate (38%) compared to group 1 (18%). This could be attributed to fewer number of pounds lost for group 2 during treatment, and the shorter time period since treatment for group 2. Dynlop and Lyon's (12) findings, reported patients who lost most weight during treatment were the ones who tended to regain it most easily when treatment ended.

Some research (10) shows a higher regain during follow-up for those subjects with higher initial percentage body fat. The present study was unique in that those with a percentage of body fat between 30-40%, regained more than those of higher or lower percentages. This unique finding may have occurred since only 2 individuals in group 1 were between 30-40% body fat and one of them happened to be the highest gainer (17.5 kg). Dubbert and Wilson (10) found percent body fat to be the best single predictor of outcome of weight gain. Sjostrom (1980) found that individuals with a high percent body fat are more likely to have an increased number of fat cells, and the basal caloric-expenditure rate of fat tissue is lower than that of lean body tissue.

An important factor for those who succeeded in group 1 appeared to be joining another weight/exercise program. Adams (1), found joining additional programs to be a potentially important factor in maintaining weight loss over a period of one to three years. The participants who lost weight tended to maintain weight loss over time with more than one-third of them attending additional programs to help maintain their weight loss.

The present study showed most subjects who skipped breakfast and reported a strong appetite and snacking in the evening were less successful in maintaining their weight loss. Individuals who had a strong appetite in the evening

also tended to be the ones who skipped breakfast. This may suggest that these individuals ate a high concentration of their total caloric intake late in the day. This may have an adverse affect on weight loss, which may be due to a greater caloric consumption at this time or a metabolic deficiency from meal restriction. It may be beneficial if these women spread their food intake into smaller, more frequent meals. Obesity was found to be less in rats allowed to nibble freely throughout the day (3), and in persons eating more than three meals a day (11,16).

In recent years, it has been suggested that behavior modification techniques may be more effective in promoting weight loss maintenance than previously used methods (25). However, earlier research (18) along with the present study, show subjects continue using only a few of the techniques after treatment termination. Those used most often during follow-up period were keeping food out of sight and eating only one serving at meal. Other studies showed keeping food out of sight (18) and preplanning meals (1,18) popular techniques. The subjects in the present study who reported preplanning meals appeared to be more successful in maintaining their weight losses. It is interesting to note that one of the most successful techniques during treatment, keeping diet records, was not used often by any of the subjects.

Nilson (23) suggests that poor success rates in weight reduction and maintenance may be caused in part by subjects' lack of motivation. Research has indicated that a self-motivation trait can be measured in a valid and reliable manner, and is a significant determinant of exercise adherence (9). Ward (27), noted no differences between adherence and dropouts in self-motivation at any point of a 32 week exercise program involving 76 men and women. The present study suggests that the self-motivation trait may play a role in subjects' ability to maintain weight losses. Subjects showed a higher average weight gain when scoring lower in self-motivation. Self-motivation may be more important during maintenance periods than during treatments due to the lack of situational factors (i.e., program counselors, group support). It may be necessary for individuals scoring low on self-motivation to be scheduled for additional counseling sessions once treatment has ended or to join another program.

The most unexpected results of this study were that activity level scores of individuals in group 1 showed no consistent pattern of higher activity scores correlating with weight loss maintenance. Numerous studies have shown regular exercise enhancing the likelihood of weight maintenance after weight loss (6,19,21,22,25). Most of the subjects in both groups scored a low activity level score.

Only two subjects from each group scored above a 10. However, this result may be valuable in the support of exercise since the overall group also tended to gain weight at the follow-up assessment. Due to small subject numbers, one extreme score may give misleading results.

Comparing the most and least successful subject in this study, few factors appear substantially different. Both of these individuals scored low on the SMI and activity level. Both lost about the same weight during treatment, and joined another program during follow-up. The factors which differed were, the individual who gained most weight achieved a much lower weight in their adulthood (under 120 lb.) compared to the subject who continued weight loss (151-160 lb). The successful subject also ate more snacks, reported binging rarely, didn't skip meals, and experienced a strong appetite in the afternoon. Whereas, the unsuccessful subject, reported eating only one snack, binged sometimes - lasting one-two weeks, skipped breakfast, and reported a strong appetite in the evening.

The small number of subjects in this study make it difficult to predict factors that contribute to weight change. While conclusions regarding causality cannot be drawn from the present study, these results offer indirect support for past research in this area and can be used as a preliminary assessment of factors which may be more

influential in weight loss maintenance. Additional studies of factors that mitigate maintenance of weight loss are of extreme importance, since maintenance of weight loss appears more a problem than short-term weight loss. Many physical and psychological factors have been shown to influence maintenance of weight loss--the present study was able to access just a portion of them.

Those factors which appeared most prevalent for both groups in the present study were; individuals who skipped breakfast and reported a strong appetite in the evening showed a higher average weight gain at follow-up. Lower average weight gains appeared for those individuals reporting preplanning meals and scoring higher on the SMI. Group 1 also showed lower average weight gains for subjects who joined another exercise/nutrition program during the follow-up period and ate three meals a day. Group 2 showed lower average weight gains for individuals who had a higher activity level during the follow-up. The complexity of weight loss maintenance stands as a challenge to future research in this area. Once the factors influencing the ability to maintain weight loss are determined, it may be possible to treat obesity by specific emphasis on modifying these factors.

The knowledge gained from the present study suggest a need for more emphasis placed on maintenance strategies.

Suggestions include the possible development of an assessment tool to identify those most likely to relapse. This may be used to individualize counseling and treatment protocol. Longer treatment programs may be useful to help internalize habit and lifestyle changes. For individuals who have low motivation levels it may be necessary to incorporate booster sessions after the formal treatment session terminates. One final suggestion, more emphasis should be placed on maintenance strategies during the treatment session to prepare the individual to continue successful techniques after the program terminates when the support from the group and instructor are absent.

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TABLE 1

Group Characteristics

	Group 1	Group 2
Mean wt. before program	78.4 kg ± 2.6	74.9 kg ± 6.4
range	67.0 kg - 91.5 kg	59.1 kg - 118.4 kg
Wt. loss during program (mean)	7.7 kg ± 0.4	4.3 kg ± .5
range	6.0 kg - 11.0 kg	1.9 kg - 6.0 kg
Beg. % body fat (mean)	42.6 kg ± 2.1	33.2 kg ± 1.5
range	27.8 - 51.4	29.1 - 42.6
Wt. Change at follow-up (mean)	7.8 kg ± 1.4	2.0 kg ± 0.6
range	-4.2 kg - 17.5 kg	-1.1 kg - 4.5 kg
Time elapse during follow-up	12 months post treatment	6 months post treatment

Table 2

Physical Characteristics

	Group 1		Group 2	
	N	Ave. Wt. Gain	N	Ave. Wt. Gain
Wt. loss during program				
2.3 kg - less	0	0.0 kg ± 0.0	1	1.3 kg ± 0.0
2.4 - 4.5 kg	0	0.0 kg ± 0.0	3	3.5 kg ± 0.5
4.6 - 6.8 kg	3	5.0 kg ± 2.1	4	1.2 kg ± 0.9
6.9 - above	8	8.9 kg ± 2.3	0	0.0 kg ± 0.0
Beg. % fat				
20 - 30%	1	6.0 kg ± 0.0	2	2.2 kg ± 0.6
30 - 40%	2	13.6 kg ± 2.8	5	2.6 kg ± 0.6
40% - above	8	6.5 kg ± 2.1	1	-1.1 kg ± 0.0
Smoke				
> 1 pk/day	1	6.9 kg ± 0.0	0	0.0 kg ± 0.0
< 1 pk/day	2	8.0 kg ± 0.0	1	3.1 kg ± 0.0
No	8	7.8 kg ± 2.5	7	1.9 kg ± 0.7
Joined another Ex/Nutr program				
yes	5	6.9 kg ± 4.1	2	3.0 kg ± 0.0
no	6	8.5 kg ± 0.8	6	1.7 kg ± 0.8
Highest wt. attained				
130-150 lb.	1	9.6 kg ± 0.0	3	2.3 kg ± 0.4
151-170 lb.	2	7.5 kg ± 0.4	3	2.6 kg ± 1.1
171-190 lb.	4	11.0 kg ± 2.2	1	2.9 kg ± 0.0
191-more	4	4.2 kg ± 3.9	1	-1.1 kg ± 0.0
Lowest wt. attained				
130 lb. - under	4	10.3 kg ± 2.2	4	2.9 kg ± 0.1
131-150 lb.	5	8.1 kg ± 2.1	3	2.0 kg ± 1.1
151-170 lb.	2	1.9 kg ± 6.1	0	0.0 kg ± 0.0
171 - more	1	-1.1 kg ± 0.0	0	0.0 kg ± 0.0

Average weight gain between end of program and follow-up according to physical characteristics, and broken down into groups.

Table 3

Eating Habits

	Group 1 N	Group 1 Ave. Wt. Gain	Group 2 N	Group 2 Ave. Wt. Gain
# of meals				
2	3	7.6 kg ± 0.3	1	1.3 kg ± 0.0
3	7	6.4 kg ± 2.2	6	2.5 kg ± 0.7
4	1	17.5 kg ± 0.0	1	0.1 kg ± 0.0
# of snacks				
0	1	6.9 kg ± 0.0	0	0.0 kg ± 0.0
1	2	12.8 kg ± 3.4	4	2.2 kg ± 1.1
2	6	7.3 kg ± 1.5	2	1.5 kg ± 1.0
3	1	-4.2 kg ± 0.0	2	2.2 kg ± 0.6
4	1	13.1 kg ± 0.0	0	0.0 kg ± 0.0
Time most likely to snack				
morning	2	8.9 kg ± 0.6	0	0.0 kg ± 0.0
noon	0	0.0 kg ± 0.0	0	0.0 kg ± 0.0
afternoon	2	7.5 kg ± 0.4	3	2.3 kg ± 0.4
dinner	0	0.0 kg ± 0.0	1	3.1 kg ± 0.0
evening	6	9.5 kg ± 2.2	4	1.6 kg ± 1.1
none	1	-4.2 kg ± 0.0	0	0.0 kg ± 0.0
Binge				
always	0	0.0 kg ± 0.0	0	0.0 kg ± 0.0
most/time	1	0.0 kg ± 0.0	0	0.0 kg ± 0.0
sometimes	6	10.4 kg ± 1.4	4	1.2 kg ± 0.9
rarely	3	5.0 kg ± 5.1	3	3.4 kg ± 0.5
never	1	8.0 kg ± 0.0	1	1.3 kg ± 0.0
Ave. length of binge				
1 hr. - less	2	4.5 kg ± 8.7	2	2.9 kg ± 0.1
2 hrs. - 1 day	5	7.7 kg ± 0.6	5	1.9 kg ± 0.9
1-2 days	2	6.2 kg ± 4.4	0	0.0 kg ± 0.0
1-2 weeks	1	17.5 kg ± 0.0	0	0.0 kg ± 0.0
N/A	1	8.0 kg ± 0.0	1	1.3 kg ± 0.0
Time of strong appetite				
morning	2	8.8 kg ± 0.6	0	0.0 kg ± 0.0
noon	2	4.0 kg ± 2.9	0	0.0 kg ± 0.0
afternoon	1	-4.2 kg ± 0.0	2	2.0 kg ± 0.5
dinner	3	10.8 kg ± 1.7	5	2.5 kg ± 0.9
evening	3	10.5 kg ± 1.3	1	0.1 kg ± 0.0
Skipped meals				
breakfast	7	10.0 kg ± 1.3	3	2.8 kg ± 0.8
lunch	0	0.0 kg ± 0.0	3	1.6 kg ± 1.1
dinner	0	0.0 kg ± 0.0	0	0.0 kg ± 0.0
lunch/dinner	0	0.0 kg ± 0.0	1	0.1 kg ± 0.0
none	4	3.7 kg ± 3.8	1	3.1 kg ± 0.0

Average weight gain between end of program and follow-up according to eating habits, and broken down into groups.

Table 4

Behavior Modification Techniques: Frequency of Use

Technique	Frequency of Use often	sometimes	rarely
		% of subjects	
Keep track of & limit kcal			
maintained/loss	20.0	80.0	0.0
gained	0.0	36.0	64.0
Restrict # of meals			
maintained/loss	20.0	0.0	80.0
gained	21.0	14.0	65.0
Record food intake			
maintained/loss	0.0	40.0	60.0
gained	0.0	28.0	72.0
Eat only in designated place			
maintained/loss	20.0	40.0	40.0
gained	36.0	0.0	64.0
No other activity while eating			
maintained/loss	20.0	40.0	40.0
gained	28.0	29.0	43.0
Put down utensils between bites			
maintained/loss	20.0	40.0	40.0
gained	14.0	21.0	65.0
Sub. alternative activity for eating			
maintained/loss	0.0	60.0	40.0
gained	7.0	79.0	14.0
Preplan meals			
maintained/loss	80.0	0.0	20.0
gained	29.0	50.0	21.0
Using smaller plates			
maintained/loss	20.0	20.0	60.0
gained	21.0	21.0	58.0
Throw away leftovers			
maintained/loss	20.0	20.0	60.0
gained	65.0	7.0	28.0
Keep food out of sight			
maintained/loss	40.0	40.0	20.0
gained	72.0	21.0	7.0
Eat only one serving			
maintained/loss	60.0	40.0	0.0
gained	57.0	43.0	0.0

*percentage of subjects using different techniques during follow-up, broken down into subjects who maintained/loss or gained weight.

Table 5

Frequency Distribution

Distribution of Variable: SMI			
Interval	Frequency	Percent	Cumulative %
83.000 to 91.599	3	15.8	15.8
91.600 to 100.299	1	5.3	22.1
100.300 to 108.999	2	10.5	31.6
109.000 to 117.599	5	26.3	57.9
117.600 to 126.299	6	31.6	89.5
126.300 to 135.000	2	10.5	100.0
TOTAL	19	100.0	

Table 6

SMI Scores

Group 1
Range = 83 - 129
Mean = 103.8
S.D. = 13.8

Score	N	Average Wt. Gain
80 - 90	3	8.8 kg ± 5.5
91 - 100	1	8.0 kg ± 0.0
101 - 110	4	7.5 kg ± 2.3
111 - 120	2	7.5 kg ± 0.4
121 - 130	1	6.0 kg ± 0.0
131 - 140	0	0.0 kg ± 0.0

Group 2
Range = 112 - 135
Mean = 121.1
S.D. = 7.0

Score	N	Average Wt. Gain
80 - 90	0	0.0 kg ± 0.0
91 - 100	0	0.0 kg ± 0.0
101 - 110	0	0.0 kg ± 0.0
111 - 120	3	3.3 kg ± 0.5
121 - 130	4	0.9 kg ± 0.8
131 - 140	1	2.9 kg ± 0.0

Average weight gain between end of program and follow-up according to SMI scores, and broken down into groups.

Table 7

Frequency Distribution

Distribution of Variable: Activity Level			
Interval	Frequency	Percent	Cumulative %
0.000 to 4.499	7	36.8	36.8
4.500 to 9.099	7	36.8	73.7
9.100 to 13.599	1	5.3	78.9
13.600 to 18.199	1	5.3	84.2
18.200 to 22.699	0	0.0	84.2
22.700 to 27.300	3	15.8	100.0
TOTAL	19	100.0	

Table 8

Activity Levels

Group 1
Range = 2.1 - 27.3
Mean = 8.4
S.D. = 9.0

Score	N	Average Wt. Gain
0.0 - 5.0	5	6.9 kg ± 2.7
5.1 - 10.0	4	7.6 kg ± 3.2
10.1 - 20.0	0	0.0 kg ± 0.0
20.1 - 30.0	2	10.2 kg ± 1.6

Group 2
Range = 0.0 - 25.0
Mean = 8.9
S.D. = 7.3

Score	N	Average Wt. Gain
0.0 - 5.0	2	2.8 kg ± 0.0
5.1 - 10.0	4	2.3 kg ± 1.1
10.1 - 20.0	1	1.3 kg ± 0.0
20.1 - 30.0	1	0.1 kg ± 0.0

Average weight gain between end of program and follow-up according to activity level scores, and broken down into groups.

Table 9

Possible Factors Effecting Weight Gain

	Group 1 N	Group 1 Ave. Wt. Gain	Group 2 N	Group 2 Ave. Wt. Gain
Illness				
yes	1	7.9 kg ± 0.0	2	2.0 kg ± 0.5
no	10	7.7 kg ± 1.9	6	2.1 kg ± 0.8
Operation				
yes	1	9.6 kg ± 0.0	0	0.0 kg ± 0.0
no	10	7.6 kg ± 1.8	8	2.0 kg ± 0.6
Childbirth				
yes	6	7.5 kg ± 2.6	0	0.0 kg ± 0.0
no	5	8.1 kg ± 2.1	8	2.0 kg ± 0.6
Medications				
yes	2	13.6 kg ± 2.9	1	2.7 kg ± 0.0
no	9	6.5 kg ± 1.7	7	2.0 kg ± 0.7
Diabetes				
yes	1	7.9 kg ± 0.0	0	0.0 kg ± 0.0
no	10	7.7 kg ± 1.9	8	2.0 kg ± 0.6
Other Emotional Stressors				
yes	7	8.9 kg ± 1.9	4	1.9 kg ± 0.9
no	4	5.7 kg ± 3.2	4	2.2 kg ± 0.8

Average weight gain between end of program and follow-up according to possible factors which may have effected weight gain, and broken down into groups.

Chapter IV

SUMMARY

Obesity is still a major puzzle in medicine. Relief from obesity is theoretically attainable by every overweight person. Most obese individuals at one time or another have probably experienced significant weight losses, and are aware of the handicaps associated with obesity. Weight reduction by means of dietary restriction and behavioral treatment has become increasingly successful. However, researchers have been consistently unsuccessful in developing programs which result in sustained weight loss. Why is it so difficult to maintain reduced weight? It might not be unreasonable to consider that maintenance of weight loss is controlled in part by variables unrelated to those influencing the original weight loss regimen.

One thing is known for certain, maintenance of weight loss requires major changes in lifestyle, including eating habits, activity levels, and psychological factors. The purpose of this study was to evaluate the importance of a variety of factors in the ability to maintain weight loss. If certain factors are found to be associated with maintenance of weight loss, they can be used to help develop strategies for long-term treatment of obesity.

Subjects consisted of two different groups of individuals who participated in an exercise/nutrition

program held at Virginia Polytechnic Institute and State University. Subjects were contacted and asked to complete a questionnaire which consisted of questions dealing with eating habits, self-motivation levels and activity levels. One group was 12 months post treatment, the other group was 6 months post treatment. The specific objectives of this study were to determine: (a) weight change at follow-up, compared to their weight change at the end of treatment; (b) the effect of physical characteristics on weight change; (c) the effect of eating habits on weight change; (d) the effect of self-motivation on weight change; and (e) the effect of activity on weight change.

Those factors which appeared to influence the ability to maintain treatment weight losses were: (a) joining another weight/exercise program; (b) time of strong appetite; (c) skipping breakfast; (d) self-motivation level; and (e) lower weights attained in adulthood. A potentially important factor in maintaining weight loss in group 1 was the use of subsequent, additional weight loss-exercise programs. This is in agreement with other research which show it may be necessary for some individuals to try additional programs to maintain their weight loss. Reasons for this may be that without the social responsibility and constant support and reinforcement, individuals may decrease motivation and desire to continue in their efforts to

maintain or continue weight loss. If man-power was available, continued booster sessions would appear to have a beneficial role in continuing maintenance of weight loss.

The next factor relating to weight change was time of strong appetite and breakfast skipping. The relatively poor performance of women who had a strong appetite in the afternoon and evening and/or skipped breakfast suggests that they may consume a high concentration of their total calories late in the day. A number of reports with human subjects have suggested that weight reduction and the maintenance of weight loss is more effective if the individual consumes five to six small meals per day. Obesity was found to be less in rats allowed to nibble freely throughout the day than rats restricted in number of feedings. During sleep an individual's metabolism will slow down, consumption of breakfast will help raise metabolic levels to their normal level.

Self-motivation levels have been researched greatly in the area of exercise adherence, and have been shown to be a significant determinant of exercise adherence. However, the present study suggests this factor can be associated with success rates in weight maintenance. Subjects showed a higher average weight gain when scoring lower self-motivation (SMI) scores. Subjects scoring low on the SMI, when participating in an obesity treatment program, may be

indicative of a necessity for these individuals to be scheduled for additional sessions or counseling once treatment has ended.

Subjects who reported achieving lower adulthood weights tended to regain the most weight at follow-up. One possible explanation is individuals may have extremely restricted their dietary intake thus producing feelings of frustration and self-denial. When returning to normal eating they may have trouble regulating intake or feel they deserve to eat more due to their self-denial when dieting.

The result most unexpected in this study was the lack of correlation of activity level scores with the ability to maintain weight losses. The majority of subjects scored low on activity levels, which may have influenced the overall poor showing of subjects to maintain their weight loss (74% regained weight) at follow-up.

Although the small number of subjects in this study make it impossible to predict factors that contribute to weight change - this was an important step in the development of an assessment tool which could be used for obesity treatment. The more information which can be obtained on various factors which may be associated with long-term maintenance, the closer we may come to reaching some answers to the complexity of long-range obesity treatment.

The present study revealed certain factors may be more influential in contributing to the success or failure of weight loss maintenance. The factors which were associated with a higher average weight gain for both groups were skipping breakfast and a strong appetite in the evening. A lower average weight gain was noted for individuals who preplanned meals and scored higher on the SMI. Group ones' results suggested two other factors may contribute to the success of an individual to maintain their weight loss; joining another program and eating three meals a day. A higher activity level was a contributing factor to the success of individuals in group 2.

Although all subjects were successful during treatment, few continued these new habits and lifestyle changes and consequently regained a majority of their lost weight.

The present research suggests that those individuals who obtained the lowest weights in their adulthood were the ones most likely to regain the most weight at follow-up. This may be due to the individual incorporating severe dietary restrictions losing large amounts of weight, but feeling self-denial and depression. This may stimulate eating large quantities of food, once again regaining weight. It may be necessary to encourage individuals to diet with mild caloric restriction and emphasize positive reinforcement for their success.

The results of eating habits suggest that there is a need to restructure the times and scheduling of meals during each day. Breakfast should be encouraged and meals spread out over the day. Individuals may tend to skip breakfast and find themselves eating the majority of their calories in the evening which appears to have an adverse effect on the ability for continued weight loss or maintenance. Behavior modification techniques were rarely used once formal treatment ended. This may suggest individuals did not feel the need to continue using them after the program. It may be necessary to stress the importance of continuing these eating habit changes. Also, longer treatment sessions may aid the individual to internalize these behavior changes.

The self-motivation level of an individual also appears an important factor in the success or failure of weight loss maintenance. Individuals scoring low showed higher average weight gains. If the individuals have low self-motivation it would appear difficult for them to continue the necessary lifestyle changes once the program terminates. There is no longer the support and encouragement from the instructor or group. The individual may return to negative habits resulting in weight regain. Therefore, those individuals with low self-motivation may have to be dealt with on a long-term basis. Some type of contracting program may be necessary to help keep motivation levels up. The

contracting may include the necessity for them to weigh in once a month and/or continual counseling sessions to discuss problems and encourage continuance of maintenance strategies.

Although exercise did not appear beneficial for group 1, the result may have been due to one subject regaining a large amount of weight and having a high activity level. From previous research exercise appears to be beneficial for long-term maintenance of weight loss. Most of the subjects in the present study had low activity levels which may have influenced the overall low success rate for individuals to keep weight off. Finding an exercise program that is enjoyable for the individual and starting them at an intensity at which they feel comfortable may be key factors to keep individuals exercising. Also, a partner systen could contribute by helping to motivate each other and presenting a feeling of responsibility to the partner to continue exercise.

Since obesity is such a complex problem with many intervening factors, it is this author's opinion that one of the most important strategies is individualized treatment. The development of an instrument which would ascertain information about an individual's nutritional, psychological, physical and etiological factors could be an asset to aid in individualized treatment and focus in on

problem areas of each individual subject.

Recommendations for Further Study

This study leaves many questions unresolved about the factors which can be associated in weight loss maintenance. Additional studies concentrating on determining specifically what factors changed in subjects able to maintain weight losses and what factors enabled the subject to make these changes. This information may be necessary to treat obesity by specific emphasis on modifying these factors. The following recommendations for further study are made to supplement the results of this investigation:

1. Larger numbers of subjects are necessary to be able to look at factors which could be statistically related to weight loss maintenance.
2. Further study should be carried out on additional factors (i.e., social support) which may contribute to obesity management.
3. A longer follow-up period would be beneficial to determine factors associated with weight maintenance 2 or more years post treatment.

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APPENDIX A

METHODOLOGY

METHODOLOGY

Introduction

Assessment of the research questions brought forth in this investigation necessitated the development of a questionnaire. The questionnaire was administered to subjects who had participated previously in one of two nutrition and exercise treatment programs held at Virginia Polytechnic Institute and State University. Four areas of concern were addressed in the questionnaire: 1) Eating habits, 2) Activity levels, 3) Self-motivation levels (SMI), and 4) Physical characteristics.

Subjects

Participants had been involved in a previous nutrition and exercise program held at Virginia Polytechnic Institute and State University. Two separate groups of subjects were contacted and interviewed. A description of subjects is given in Table 1.

Group I (n=12) were participants in a program held during the fall, 1984. All subjects were female, ages were between 18 and 36 years, and were considered to be a generally healthy population. The six-week treatment period included the following: 1) a pre-treatment period during which time the subjects consumed a weight maintenance diet without exercise, 2) a four-week treatment period in which subjects consumed a very low calorie liquid diet (530

kcal/day) in combination with an exercise program. The exercise program consisted of a 30-40 minute supervised walk-job session, three times per week, which was to elicit a heart rate response of 60% VO_2max, 3) post-treatment period where each subject consumed a 1000 kcal diet in addition to exercise.

Group II was a program held in the spring, 1984. The twelve participants were all college-age females in good health. The eight week program consisted of an aerobic exercise and nutrition component. The aerobic exercise program consisted of 30-40 minute supervised sessions held three times per week. Participants engaged in walking or jogging to elicit a heart rate response of 70% of their VO_2max. The nutrition component consisted of mild caloric restriction (1200 - 1500 kcal/day) to result in a 1-2 pound weight loss per week.

Both groups had weekly meetings to discuss problems and provide nutrition informative lectures.

Survey Development

After reviewing the literature, it was necessary to define information desired and wright down possible questions to obtain this information. A rough draft was formed and disseminated among the author's research committee (3 professors; HPER division; Virginia Polytechnic Institute and State University), to gain feedback on the

instrument. Suggestions were made by the committee members and the survey was revised. Suggestions included the elimination of questions which were not pertinent to the research questions, and the reworking of certain questions to make them clearer and more concise.

Pilot interviews were then conducted among 10 participants from a population similar to that which was to be studied. Each participant was given instructions and asked to complete all questions. Participants were timed during the survey to estimate the amount of time which would best facilitate the interview session. Upon completion the researcher asked respondents what they thought of the questions asked, whether it was difficult to retrieve the information, and if they experienced any confusion from meaning of words or phrases employed. From the information ascertained upon pilot completion the instrument was revised. Some participants felt that certain questions which required memory recall were too difficult to remember. Also it was suggested that subjects may consider their pregnancy weights when asked for highest weight obtained in adulthood.

The committee agreed the instrument needed to be restricted and concentrated on specific areas. The areas decided on were 1) physical characteristics, 2) eating habits, 3) self-motivation (SMI) and 4) activity level. The

instrument was condensed and reviewed by committee along with an outside expert in the field of survey development (professor; Learning Resource Center, Virginia Polytechnic Institute and State University). Revisions were made which included a modification of the self-motivation inventory. The survey was now ready for distribution among subjects.

Self-Motivation Inventory (SMI)

A portion of the questionnaire presented was the SMI, which is a scale that was developed and validated by Dishman and Ickes (1981), to assess self-motivation. The forty item scale consists of 19 positively keyed and 21 negatively keyed items with a possible response range of 40 - 160 (Appendix B). The scale was construed so that a larger numerical value would be indicative of a higher self-motivation level. A modification of the self-motivation inventory was performed. The modification consisted of dropping a neutral middle response, ("neither characteristic nor uncharacteristic of me") to help force responders to make a decision in one direction or another. The seemingly innocuous middle neutral position, when counted, will sometimes lower or raise the average response level due to invalid responses.

Activity Level

The primary purpose of the activity level was to get an estimate of the subject's participation in physical exercise

subsequent to treatment termination.

Subjects were asked to recall the time they were engaged in various activities (Appendix B). The physical activity recall was a modification of the Reiff, Montoye (1967) questionnaire. Modifications included limiting activities to those which were aerobic in nature and the assignment of MET level (ACSM Guidelines) values to the specific activities when calculating the activity score. The subjects were interviewed face-to-face, to try to elicit a more accurate estimate of actual time spent in each activity.

After obtaining the information of subject's activities, calculations were performed to produce an activity level score.

The first step of the scoring system was to assign a work metabolic rate/basal metabolic rate (MET) to the various activities. It was necessary for certain activities to obtain the distance they covered during an exercise bout, to estimate a pace, which was necessary to determine a MET level for that activity. The MET values were obtained from the American College of Sports Medicine, Guidelines for Graded Exercise Testing and Exercise Prescription (1975).

An activity score was calculated for each activity using the following formula:

Activity Score = MET Value X hrs/wk

Hours/wk were calculated as follows:

If frequency = monthly

[(No. of mo. X min./mo.)/60]/52 = hrs/wk

If frequency = weekly:

[No. of mo. X ($_{d/wk}$ X min/d X 4)/60]/52 = hrs/wk.

An overall score for each subject was calculated by summing the activity scores for each activity. A sample calculation for an activity is provided in Table 10.

TABLE 10

Sample Calculation of an Activity Score

Subject: Jane Doe

Swimming: frequency = 2/month

No. of months = 3 mo/year

min/session = 30 min.

[(3 X 240)/60]/52 = .23 Hr/wk

[(No. of mo X min/mo)/60]/52 = Hr/wk

Score = 6 (MET Value) X .23 hr/wk = 1.38

Walking: frequency = 3/wk

No. of months = 12 mo/year

min/session = 30 min.

[12 X (3 X 30 X 4)/60]/52 = 1.38 Hr/wk

[No. of mo X ($_{d/wk}$ X min/d X 4)/60]/52 = Hr/wk

Score = 2.5* (MET Value) X 1.38 = 3.5

Total Activity Score: 1.38 + 3.5 = 4.9

* distance covered during exercise session is needed

Data Collection

Subject Contact

Subjects were contacted via the telephone and appointments were scheduled within a one-week timeframe to avoid any last minute attempts to shed extra pounds. Subjects were informed this was a follow-up and their help would provide us with valuable information for future programs. They were instructed to report to the VPI&SU War Memorial Gymnasium, Human Performance Laboratory at the scheduled time. To help relieve anxiety, subjects were informed they were to fill out a questionnaire and no other tests were to be performed (i.e., underwater weighing; stress test).

We were able to contact 11 of the subjects from Group 1 (n=12), and 8 of the subjects from Group II (n=12) (subjects who were unavailable, had relocated, or graduated). If subjects failed to show at appointment time, they were called immediately and times were rescheduled for as soon as possible.

Interview Session

Subjects were first asked to fill out an informed consent (Appendix C). Subject weights were obtained. Subjects were seated in a quiet room and instructions were given. It was emphasized questions should be answered as accurately and honestly as possible. Participants were

reassured that their names would not be associated with the answers.

An obscan sheet (Optical Scanner Processing Sheet) and a number 2 pencil were given to each subject along with the questionnaire. They were informed to fill in only one circle per question and to ask if they were unsure of any of the questions.

Subjects were informed to stop when reaching the activity level section. At this point they were asked if there were any questions on any material presented. The researcher then interviewed them on their participation of various activities, and tried to get an accurate estimate of time actually spent in participation. The following information was obtained:

1) Frequency: How often did they participate in the activity.
   a) once or twice/year
   b) monthly (i.e., 1 wk/month; twice a month)
   c) weekly
2) Number of months: number of months in the year they participated in that activity.
3) Minutes: Actual time involved in activity.
4) Distance covered: in activities which required this information for MET conversion.

Data Analysis

All answers were collected on optical scanner processing sheets (OBSCAN). All data was analyzed by groups. Descriptive statistics were performed including averages, standard errors of the mean, and item frequencies. Tables were constructed by averaging weight change at follow-up in contrast to weights at treatment termination. Total number of individuals who responded to a particular question were totaled and average weight changes computed.

The Behavior Modification frequency of use table gave results according to those who maintained loss (< 5 lb weight gain) and those who gained (> 5 lb weight gain) weight at follow-up. The percentage of maintainers/losers and gainers use of each of the listed techniques was given.

APPENDIX B

RAW DATA

SURVEY QUESTIONNAIRE

Subject	Wt. Change	SMI	A.L.	Wt. loss during Rx	Beg. % fat	smoke	joined prog.	Highest wt.	Lowest wt.
001	+6.9 kg	117	5.4	6.7 kg	49.4	> 1 pk.	no	161-170	151-160
002	+7.9 kg	110	27.03	9.0 kg	43.8	< 1 pk.	yes	201-up	161-170
003	-4.2 kg	90	2.7	8.2 kg	51.4	no	yes	201-up	151-160
004	+9.6 kg	109	3.0	7.2 kg	37.7	no	no	141-150	121-130
005	+6.0 kg	129	5.8	7.8 kg	27.8	no	no	171-180	121-130
006	+8.0 kg	93	2.5	7.3 kg	48.9	< 1 pk.	no	161-170	120-down
007	0.0 kg	105	5.7	6.3 kg	42.7	no	yes	201-up	141-150
008	+13.1 kg	87	2.1	11.0 kg	45.6	no	yes	201-up	131-140
009	+8.0 kg	118	3.8	6.0 kg	47.9	no	no	181-190	131-140
010	+12.4 kg	101	27.3	7.4 kg	40.8	no	no	171-180	131-140
011	+17.5 kg	83	6.8	7.8 kg	32.2	no	yes	181-190	121-under
012	-1.1 kg	122	9.3	6.0 kg	42.6	no	no	201-up	171-180
013	+2.8 kg	119	7.4	4.8 kg	32.2	no	no	141-150	121-130
014	+2.7 kg	112	0.0	2.7 kg	30.7	no	no	130-140	121-130
015	+4.5 kg	112	5.3	4.4 kg	34.0	no	no	151-160	141-150
016	+1.3 kg	121	15.1	1.9 kg	29.1	no	no	141-150	131-140
017	+0.1 kg	126	25.0	5.7 kg	33.1	no	no	151-160	131-140
018	+3.1 kg	122	5.4	3.4 kg	28.0	< 1 pk.	yes	151-160	121-130
019	+2.9 kg	135	3.8	5.7 kg	35.5	no	yes	181-190	121-130

	Behavior Modification Techniques											
Subject	18	19	20	21	22	23	24	25	26	27	28	29
001	S	M	R	M	R	M	M	M	N	R	M	R
002	S	M	R	R	M	M	S	S	S	R	M	R
003	S	R	S	S	S	M	R	M	R	R	S	S
004	S	S	R	N	M	M	S	S	R	A	M	S
005	R	N	S	M	S	M	S	R	M	M	M	S
006	N	R	N	N	M	M	N	S	S	S	M	S
007	S	R	S	R	M	M	S	M	S	N	S	R
008	R	N	S	N	S	M	R	S	S	A	S	S
009	N	S	N	M	R	S	S	N	N	A	S	R
010	N	R	N	N	N	S	S	R	R	N	R	S
011	R	N	R	R	M	A	S	S	R	A	M	S
012	A	R	N	S	M	S	S	M	N	M	A	R
013	R	R	R	R	M	R	S	M	M	M	M	R
014	N	N	N	N	S	R	S	S	M	A	M	R
015	S	N	S	R	R	S	S	M	N	M	M	R
016	S	M	N	M	S	R	R	N	M	S	R	S
017	S	N	R	N	N	S	S	M	N	N	A	N
018	R	N	N	M	S	A	S	S	M	A	S	N
019	S	A	S	M	M	M	S	M	N	N	M	R

A = always M = most of the time S = sometimes R = rarely N = never

Subject	Wt. Change	No. of meals	No. of snacks	Time of snack	Binge	How long	Time of strongest appetite	Meals Skipped
001	+6.9 kg	2	0	a.m.	sometimes	1 hr-less	dinner	breakfast
002	+7.9 kg	2	2	evening	sometimes	1 hr-less	evening	breakfast
003	-4.2 kg	3	3	n/a	rare	1 hr-less	afternoon	none
004	+9.6 kg	3	2	morning	sometimes	2 hr-1 day	morning	breakfast
005	+6.0 kg	3	2	evening	rarely	2 hr-1 day	evening	none
006	+8.0 kg	3	2	a.m.	sometimes	2 hr-1 day	noon	breakfast
007	0.0 kg	3	2	evening	most time	1-2 days	noon	none
008	+13.1 kg	3	4	evening	rare	1 hr-less	dinner	none
009	+8.0 kg	2	1	morning	never	n/a	morning	breakfast
010	+12.4 kg	3	2	evening	sometimes	1-2 days	dinner	breakfast
011	+17.5 kg	4	1	evening	sometimes	2 weeks-more	evening	breakfast
012	-1.1 kg	3	1	evening	sometimes	2 hr-1 day	dinner	lunch
013	+2.8 kg	3	1	a.m.	sometimes	2 hr-1 day	dinner	lunch
014	+2.7 kg	3	1	a.m.	rare	1 hr-less	afternoon	breakfast
015	+4.5 kg	3	1	evening	rare	2 hr-1 day	dinner	breakfast
016	+1.3 kg	2	3	a.n.	never	n/a	afternoon	breakfast
017	+0.1 kg	4	2	evening	sometimes	2 hr/1 day	evening	lunch/dinner
018	+3.1 kg	3	3	dinner	rare	1 hr-less	dinner	none
019	+2.9 kg	3	2	evening	sometimes	2 hr-1 day	dinner	lunch

Questionnaire Instructions

The following is a questionnaire designed to help evaluate various behaviors and activities you have participated in since the termination of the nutrition and exercise program. Questions are to be answered on the separate Opscan sheet with the pencil that will be provided to you. It is very important to answer every question. Please answer questions as accurately and honestly as possible, and fill in only one circle per question. This information will be kept confidential, and used to gather information which may prove helpful in future programs held at Virginia Tech.

Thanks for your time and effort!!!

Code No._____

Questionnaire

Name _____

Present Weight _____(lb.)_____(kg)

1. Highest weight you attained as an adult (18 or older -- excluding pregnancy)?

   1. 130-140 (or lower)
   2. 141-150
   3. 151-160
   4. 161-170
   5. 171-180
   6. 181-190
   7. 191-200
   8. 201-and over

2. Lowest weight you attained as an adult (18 or older)?

   1. 120 or under
   2. 121-130
   3. 131-140
   4. 141-150
   5. 151-160
   6. 161-170
   7. 171-180
   8. 181-and over

   *In the past, has weight change (gain or loss) accompanied any of the following? (questions 3-8)

3. Serious illness?

   1. yes
   2. no

4. Operation?

   1. yes
   2. no

5. Childbirth?

   1. yes
   2. no

6. Medications?

   1. yes
   2. no

7. Diabetes?

   1. yes
   2. no

8. Other emotional stressors (i.e. death in the family)?

   1. yes
   2. no

9. Do you currently smoke?

   1. less than one pack/day
   2. more than one pack/day
   3. no

10. Have you joined another weight/exercise program since treatment termination?

    1. yes
    2. no

11. How many meals do you eat daily? (excluding snacks)

    1. 1
    2. 2
    3. 3
    4. 4
    5. 5
    6. 6

12. How many snacks do you eat daily?

    1. 1
    2. 2
    3. 3
    4. 4
    5. 5 or more
    6. none

13. What time of day are you most likely to snack?

    1. morning (6 am-11 am)
    2. noon (11 am-1 pm)
    3. afternoon (1 pm-4:30 pm)
    4. dinner-time (4:30 pm-7:30 pm)
    5. evening (7:30 pm - and later)
    6. none of the above

14. Do you ever engage in binge (uncontrollable) eating?

    1. always
    2. most of the time
    3. sometimes
    4. rarely
    5. never

15. What is the average length of time the binge will last?

    1. 1 hr. or less
    2. 2 hrs. - 1 day
    3. 1 - 2 days
    4. 1 - 2 weeks
    5. 2 weeks or more
    6. N/A

16. Time your appetite appears the strongest?

    1. morning (6 am - 11 am)
    2. noon (11 am - 1 pm)
    3. afternoon (1 pm - 4:30 pm)
    4. dinner-time (4:30 pm - 7:30 pm)
    5. evening (7:30 pm - on)
    6. none of the above

17. On an average day which meal/meals would you be likely to skip?

    1. skip breakfast
    2. skip lunch
    3. skip dinner
    4. skip breakfast and lunch
    5. skip breakfast and dinner
    6. skip lunch and dinner
    7. none

*Which of the following procedures do you use in your daily eating habits since the program ended? Read each of the following, and write down the number of the alternative which best describes your eating habits. The alternatives are:

(1) Always
(2) Most of the time
(3) Sometimes
(4) Rarely
(5) Never

Please be sure to answer every item and try to be as honest and accurate as possible in your responses.

18. I keep track of and limit the number of calories I consume during the day.

19. I restrict the number of meals I eat during the day (less than 3).

20. I record the food I eat daily.

21. I eat only in one designated place.

22. I involve myself in other activities while eating (i.e. reading, watching T.V.).

23. I keep a utensil in hand throughout a meal.

24. I substitute alternate activity for snacking (i.e. exercise, reading, etc.).

25. I preplan my meals.

26. I'm using smaller plates, than before I entered the treatment program.

27. I throw away food left on my plate, after I'm through eating.

28. I keep food out of sight, that is tempting to me.

29. I eat seconds/thirds during a meal.

*Read each of the following statements and write the number of the alternative which best describes how characteristic the statement is when applied to you. The alternatives are:

(1) extremely uncharacteristic of me
(2) somewhat uncharacteristic of me
(3) somewhat characteristic of me
(4) extremely characteristic of me

Please be sure to answer every item and try to be as honest and accurate as possible in your responses. Your answers will be kept in the strictest confidence.

30. I'm not very good at committing myself to do things.

31. Whenever I get bored with projects I start, I drop them to do something else.

32. I can persevere at stressful tasks, even when they are physically painful.

33. If something gets to be too much of an effort to do, I'm likely to just forget it.

34. I'm really concerned about developing and maintaining self-discipline.

35. I'm good at keeping promises, especially the ones I make to myself.

36. I don't work any harder than I have to.

37. I seldom work to my full capacity.

38. I'm just not the goal-setting type.

39. When I take on a difficult job, I make a point of sticking with it until it's completed.

40. I'm willing to work for things I want as long as it's not a big hassle for me.

41. I have a lot of self-motivation.

42. I'm good at making decisions and standing by them.

43. I generally take the path of least resistance.

44. I get discouraged easily.

45. If I tell somebody I'll do something, you can depend on it being done.

46. I don't like to overextend myself.

47. I'm basically lazy.

48. I have a very hard-driving, aggressive personality.

49. I work harder than most of my friends.

50. I can persist in spite of pain or discomfort.

51. I like to set goals and work toward them.

52. Sometimes I push myself harder than I should.

53. I tend to be overly apathetic.

54. I seldom, if ever, let myself down.

55. I'm not very reliable.

56. I like to take on jobs that challenge me.

57. I change my mind about things quite easily.

58. I have a lot of willpower.

59. I'm not likely to put myself out if I don't have to.

60. Things just don't matter much to me.

61. I avoid stressful situations.

62. I often work to the point of exhaustion.

63. I don't impose much structure on my activities.

64. I never force myself to do things I don't feel like doing.

65. It takes a lot to get me going.

66. Whenever I reach a goal, I set a higher one.

67. I can persist in spite of failure.

68. I have a strong desire to achieve.

69. I don't have much self-discipline.

Instructions for Activity Levels

We are trying to estimate levels of activity for participants involved in the treatment program. We would like to ask you what activities you participated in since the program ended, how often, and the amount of time you actually participate in the activity. Please try and be as accurate as possible.

Frequency: How often do you participate in the activity?

1. once or twice/year
2. monthly (i.e. 1 week/month; twice a month)
3. weekly

No. of months: number of months in the year you participate in activity.

No. of days/week: complete only if you do activity weekly for a complete month or a complete year.

Minutes: Only record actual time involved in activity (i.e. if dancing, don't count time standing on the side watching or resting).

Intensity: Record one of the following numbers that correlate with how you feel during participation in activity:

1) light (no sweating or not tiring)
2) moderate (sweating or somewhat tiring)
3) vigorous (profuse sweating or tiring to exhaustion)

CODE No. _____

Exercise Activity Levels

1.	Dancing (includes aerobic dance	Frequency _____ No of months/year____ No of days/week_____	minutes _____ intensity _____ _____
2.	Bicycling	Frequency _____ No of months/year____ No of days/week _____	minutes _____ intensity _____ _____
3.	Swimming	Frequency _____ No of months/year____ No of days/week_____	minutes _____ intensity _____ _____
4.	Golfing (walking only)	Frequency _____ No of months/year____ No of days/week_____	minutes _____ intensity_____ _____
5.	Baseball or softball	Frequency _____ No of months/year____ No of days/week_____	minutes _____ intensity _____ _____
6.	Basketball	Frequency _____ No of months/year____ No of days/week _____	minutes _____ intensity_____ _____
7.	Soccer	Frequency _____ No of months/year____ No of days/week_____	minutes _____ intensity_____ _____
8.	Walking	Frequency _____ No of months/year____ No of days/week_____	minutes_____ intensity_____ _____
9.	Tennis	Frequency _____ No of months/year____ No of days/week_____	minutes_____ intensity_____ _____
10.	Running	Frequency _____ No of months/year____ No of days/week_____	minutes_____ intensity_____ _____

11. Hiking or mountain climbing	Frequency _____ No of months/year____ No of days/week_____	minutes _____ intensity_____ _____
12. Canoeing	Frequency _____ No of months/year____ No of days/week_____	minutes_____ intensity_____ _____
13. Racquetball	Frequency _____ No of months/year____ No of days/week_____	minutes_____ intensity_____ _____
14. Other	Frequency _____ No of months/year____ No of days/week_____	minutes _____ intensity_____ _____

APPENDIX C

INFORMED CONSENT

HUMAN PERFORMANCE LABORATORY

Division of Health, Physical Education and Recreation
Virginia Polytechnic Institute and State University

INFORMED CONSENT

I, _____, do hereby voluntarily agree and consent to participate in a testing program conducted by the personnel of the Human Performance Laboratory of the Division of Health, Physical Education and Recreation of Virginia Polytechnic Institute and State University.

Title of Study: Factors involved with successful weight loss maintenance.

The purposes of this experiment include:

1. To determine weight change of subjects involved in nutrition and exercise weight loss programs held at Virginia Tech.

2. Try to determine factors associated with maintenance or changes in body weight.

I voluntarily agree to participate in this testing program. It is my understanding that my participation will include:

Filling out a questionnaire asking question about the individual's dietary habits, activity level and perceived self-motivation. The subjects will be asked to fill out the questionnaire completely and accurately. Approximately 40 minutes will be needed to complete it. All answers will be kept in strict confidence. Also, the subject's weight will be ascertained.

I understand that participation in this experiment may produce certain discomforts and risks. These discomforts and risks include:

No apparent risks are involved.

Certain personal benefits may be expected from participation

in this experiment. These include:

A greater knowledge by the participant of certain factors which may aid in or hinder their weight goals.

Appropriate alternative procedures that might be advantageous to you include:

The subjects are not obligated to answer any questions that they feel uncomfortable answering or just prefer not to. However, emphasis is needed to let subjects know all answers will be kept in strict confidence.

I understand that any data of a personal nature will be held confidential and will be used for research purposes only. I also understand that these data may only be used when not identifiable with me.

I understand that I may abstain from participation in any part of the experiment or withdraw from the experiment should I feel the activities might be injurious to my health. The experimenter may also terminate my participation should he feel the activities might be injurious to my health.

I understand that it is my personal responsibility to advise the researchers of any preexisting medical problem that may affect my participation or of any medical problems that might arise in the course of this experiment and that no medical treatment or compensation is available if injury is suffered as a result of this research. A telephone is available which would be used to call the local hospital for emergency service.

I have read the above statements and have had the opportunity to ask questions. I understand that the researchers will, at any time, answer my inquiries concerning the procedures used in this experiment.

Scientific inquiry is indispensable to the advancement of knowledge. Your participation in this experiment provides the investigator the opportunity to conduct meaningful scientific observations designed to make significant educational contribution.

If you would like to receive the results of this investigation, please indicate this choice by marking in the appropriate space provided below. A copy will then be distributed to you as soon as the results are made available by the investigator. Thank you for making this important contribution.

_____ I request a copy of the results of this study.

Date _____ Time _____a.m./p.m.

Participant Signature _____

Witness _____
HPL Personnel

Project Director _____ Telephone _____

HPER Human Subjects Chairman ___Dr. Don Sebolt___
Telephone ___961-5104___

Dr. Charles Waring, Chairman, Institutional Review Board for Research Involving Human Subjects. Phone 961-5283.

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