THE EFFECTS OF STIMULUS CONTROL AND EXERCISE ON INTERNAL AND EXTERNAL OVERWEIGHT FEMALES

BY

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ABSTRACT

Forty-eight overweight females were randomly assigned into four groups: 1) stimulus control, 2) exercise, 3) stimulus control plus exercise, and 4) counting calories (control), to determine which treatment was most effective for weight and fat loss.

Locus of Control was assessed with Rotter's I-E and Saltzer's Weight Locus of Control scales. Weekly measures of food intake and energy expenditure were taken. The relation of program adherence to weight loss was also assessed.

Analyses of covariance showed that there was a significant effect of stimulus control procedures on weight and fat, whereas there was no effect of exercise. The weight loss was maintained six months after the end of the program in the groups that had received stimulus control treatment. Analyses of variance indicated that food intake decreased in the stimulus control group, whereas there was no significant effect of exercise on energy expenditure. Locus of Control orientation did not correlate with amount of weight loss. Program adherence did not correlate with amount of weight loss.

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INTRODUCTION

Obesity can best be defined in relation to the characteristics of the population under consideration (Katch and McArdle, 1977). There is no universally accepted criterion for obesity. Different norms and standards about "normal-weight" exist in different countries of the world. Obesity reflects very high quantitative deviations from the average weight and fat percentage of the population norms (Crisp, 1976). In general, a person who exceeds the normative weight by twenty percent or more is considered obese, while someone whose weight exceeds the norm by ten to nineteen percent is considered overweight (Sebrell, 1967).

Obese individuals in Western societies are devaluated and discriminated against in the school, working, and social environment (Karris, 1977; Benson et al., 1980; DeJong, 1980; Weiss, 1980; Worsley, 1981; Martinelli-Hall and Havasy, 1981; Harris, 1982; Harris, 1983). There are health risks such as diabetes, cardiovascular and renal diseases, and hypertension that are associated with obesity (Mayer, 1968). Obesity has been reported as one of the principal factors that accelerate aging (Ochsner, 1976). Weight loss has been associated with positive changes in clients' emotional and social life (Wilson, 1978).

Energy Intake and Expenditure

Obesity has been considered to be a result of a very high level of energy intake combined with a very low level of energy expenditure (Mayer et al., 1954; Mayer, 1955; Johnson, Mastropaolo, and Wharton, 1972; Katch and McArdle, 1977; Bellack, 1975; Epstein and Wing, 1980; Keesey, 1980). Apfelbaum, Bostsarron, and Lacatis (1971) who studied the effects of caloric restriction and excessive caloric intake on energy expenditure, found that the level of energy expenditure adapts depending on the increases or decreases in energy intake with the result of maintaining the body in a homeostatic level. This finding was consistent with Epstein and Wing (1980).

Weight loss would be a result of either: 1) an increase in energy expenditure, 2) a decrease in the amount of food intake, or 3) a decrease in the amount of food intake and an increase in energy expenditure (Mayer, 1968; Stuart, 1971; Katch and McArdle, 1977; Jeffery and Coates, 1978). However, research on obesity indicated that this line of reasoning might be too simplistic. Some studies have found that there is no direct relationship between overeating, physical activity, and obesity. J.Lincoln (1972) who studied the effects of caloric intake and physical activity upon obesity in middle-aged men, found that caloric intake did not increase with increasing obesity. He also reported that he did not find any direct

relationship between inactivity and obesity. He suggested that individual differences in activity levels were reflected in differences in caloric intake rather than in differences in weight. Maxfield and Konishi (1966) studied the patterns of food intake and physical activity in obese and nonobese women. They reported no significant differences for either caloric intake or energy expenditure between the two groups. Woo (1982) studied the effects of exercise on spontaneous caloric intake. She reported that a 19 as well as a 57-day period of exercise had no effect on the spontaneous caloric intake of obese women. Epstein and Wing (198Ø) reported that overweight individuals were found mostly to underexercise rather than to overeat. Obese individuals have been reported to use the elevators rather than the stairs more often, and to engage in fewer recreational, physical, and sexual activities than their normal- weight counterparts (Werner, 1976; Dean and Garabedian, 1979; Tevlin, 1979; Brownell and Stunkard, 198Ø).

M.B.Harris et al., (198Ø) studied some variables that affect success and retention of weight loss resulting from a long-term behavioral program for obese adolescent girls. Among the variables studied, nutritional intake and exercise, were included. It was found that those subjects who lost 1Ø pounds or more showed a decrease in caloric intake as opposed to those subjects who lost less than 1Ø

pounds. Amount of exercise did not differentiate successful from unsuccessful weight reducers.

It is of interest to note that exercise affects the level of food intake of lean and obese humans differentially. Durrant, Royston, and Wloch (1982) found that exercise (cyclilng) increased the level of food intake of their lean subjects, but decreased the level of food intake on the obese subjects. Both males and females were included in the above study.

Sex differences in weight loss

Gender has been reported to affect differentially the amount of weight loss. Harris (1969) reported that males lost significantly more weight than females who participated in a behavioral weight loss program. O'Neil et al. (1979), who studied the effects of sex in a behavioral weight loss program, found that male subjects lost significantly more weight than females did. Also, males were found to maintain the loss better than females. The differences could not be attributed to age, initial percent overweight, age of onset of obesity, socioeconomic factors, or self-reported activity level. The authors concluded that data on weight loss for males and females should be reported separately in order for comparisons to be made. Miller and Sims (1981) found that men were able to lose more weight than women who participated in a weight

loss program that included diet, nutrition, medical, and health education, behavior modification, and exercise. Although the mean percentage of weight loss was larger for females than for males, men lost more absolute weight than women.

Research on animal studies has also concluded that exercise affects the sexes differentially. Nikoletseas (1977) who exercised male and female rats on activity wheels found that although male rats did not increase their food intake as a result of exercise, female rats did. This sexual dimorphism was also found by Rolls and Row (1979). The early work of Mayer et al. (1954) has shown that low duration exercise (20-60 minutes) resulted in a decrease of the body weight of adult female rats. However, longer durations of exercise (1-6 hours) resulted in an increase in food intake with the weight remaining stable. With very long durations of exercise the animals entered a stage of exhaustion. Pitts and Bull (1977) who exercised male rats on treadmills, running 1.08 Km. per day , found that the food intake of the exercising group was significantly lower, than that of the sedentary controls.

Exercise and weight loss

The benefits of exercise on health in general, have been recognized by physicians (Cooper, 1968; Cooper, 1970). Exercise not only increases energy expenditure but also reduces the risk of certain cardiovascular diseases

and improves heart functioning. It has been reported that lack of exercise accelerates aging (Ochsner, 1976). Physical activity increases metabolic rate and controls food intake (Hoerr, 1984). Exercise is an effective way to lose fat per se (Moody, Kollias, and Baskirk, 1969; Johnson et al., 1972; Gwinup, 1975; Bjorntorp; 1976, Bjorntorp, 1978; Weltman, Matter, and Stamford, 198Ø). Low-calorie diets lead to weight loss but the loss is more of protein and water (Sharkey, 1979). Girandola (1976) who put college-age, normal weight women in either a low or high intensity exercise program found that there were no significant differences between the groups in body weight, but the low intensity group exhibited a significant decrease in percent body fat. This research is in agreement with that of other authors who suggested that loss of fat can be most efficiently achieved when exercise is of low intensity and long duration (Bjorntorp, 1976; Katch and McArdle, 1977; Sharkey, 1979). Physical workout has been reported to result in small weight loss with normal-weight women runners (Harris, 1981a). Harris (1981b) reported that normal-weight women runners were found to decrease their food intake after beginning to run. Exercise of low intensity (walking) has been found to increase metabolic rate in obese women (Bradfield, Curtis, and Margen, 1968). With obese individuals exercise has been associated with weight loss maintenance

or further loss after termination of a weight reduction program. Overweight children and adolescents who maintained their weight loss after treatment termination, were found to engage in more physical activity than either the regainers or the normal-weight group. It is important to note that no differences were found on the level of food intake between the regainers and those who maintained their weight loss (Cohen et al., 1981). In overweight adults exercise has been found among the factors related to weight maintenance (Stalonas, Johnson, and Christ, 1978; Gormally, Rardin, and Black, 1980; Gormally and Rardin, 1981; Miller and Sims, 1981; Graham et al., 1983), or to further loss after program termination (Harris and Hallbauer, 1973; Dahlkoetter, Callahan, and Linton, 1979).

Although exercise has been recognized as an important variable in some weight control studies (Stuart, 1971; LeBow, 1977; Wilson, 1978; Skovholt, Resnick, and Dewey, 1979; Harris et al., 1980), only a few studies have compared its relative efficacy to behavioral treatments. LeBow (1977) notes that eighty percent out of the 195 reviewed reports failed to teach overweight clients to increase their energy expenditure. Important variables to consider when investigating exercise include: duration, intensity, type of exercise, and food intake (Thompson et al., 1982). The studies that manipulated exercise

activity did not take into consideration several of the above variables, so comparisons are difficult to make. Harris and Hallbauer (1973) found that subjects assigned to an exercise plus behavior modification group lost more weight at a seven-month follow-up than either the behavior modification group or the attention-placebo control groups. Stalonas, Johnson, and Christ (1978) found that only those participants who were exposed to exercise and/or contingency management were able to maintain their weight loss after one year. Further interpretations could be made in the above studies if sex differences, amount of fat loss (if any), and intensity of exercise were reported. Dahlkoetter, Callahan, and Linton (1979), who used overweight women as subjects, reported that only the group assigned to the exercise plus eating habit change condition continued to lose weight eight weeks after treatment termination. The other three groups were: 1) exercise, 2) eating habit change, and 3) delayed treatment control. Measures of skin-fold thickness were taken, but none of the groups showed any significant change on fat loss. A significant decrease on girth measurements was found across all the treatment groups. The intensity of exercise was not reported.

Routine exercise activities refer to interventions in peoples' lifestyle that increase caloric expenditure (i.e. Learn to use the stairs rather than the elevator, etc.).

On the other hand, programmed activities involve exercise sessions where subjects engage in a specific activity for a certain period of time. A combination of routine and programmed activities is considered optimal for weight reduction programs (Thompson et al., 1982).

Adipose tissue

It has been demonstrated that body fat in humans can increase either by enlargement of the size of the fat cells in the body (hypertrophy) or by an increase in the number of fat cells (hyperplasia). It has been found that an increase in the number of fat cells occurs more rapidly during the early years of life in both man and animals, and is associated with early onset of obesity (Sjostrom, 1980). Bjorntorp (1978) found that individuals with hyperplastic obesity showed only minimal decreases in body fat at the termination of an exercise program. He concluded that hypertrophic subjects with moderate obesity are the most favorable candidates for exercise programs. This finding, although particularly useful for predictive purposes, needs further research since Gwinup (1975), who exercised obese women found, in contrast to Bjorntorp, that the three subjects who were obese for the longest period of time (therefore probably hyperplastic) lost as much weight and fat as the rest of the participants.

There are indications that exercise inhibits excess increases in the number of fat cells in the body during

infancy and adolescence, which are critical stages for fat cell number formulation (Hoerr, 1984).

The set-point theory

Although there is a large variation in body weight between individuals, research data show that within an individual body weight remains quite stable over time. A homeostatic model has been proposed according to which an individual's body weight is regulated by a set-point controller. The human body strives to maintain weight at a relatively stable level even though internal and external conditions may vary considerably. Accordingly, normal-weight individuals tend to remain normal weight, and obese individuals tend to remain obese since their body tends to defend a higher set-point. Both energy intake and expenditure are involved in body weight regulation (Keesey, 198Ø). It has been suggested that exercise is an effective and healthy way to lower the set-point (Hoerr, 1984).

Weight and fat measures

Although in extreme cases being highly overweight correlates with an excessive amount of adipose tissue (LeBow, 1977), two individuals equal in weight, height, age, and sex may differ in their fat distribution because of different activity levels. Weight is not an accurate measure of weight loss programs because it does not

reflect the effectiveness of body composition. Since obesity by definition involves an excess amount of body fat, measures of fat loss should be considered in obesity treatment studies. Calipers provide a proper instrument to measure skin-fold thickness (Franzini and Grimes, 1976; Wilson, 1978). This is still an indirect method of measuring body fat and it presupposes a correlation between total body fat and skinfold thickness. Training is a prerequisite in the successful use of calipers. Skin-fold techniques, when used properly, represent a practical and effective method for reliably assessing body fat (Grimes and Franzini, 1977; Seltzer and Mayer, 197Ø). Lohman et al. (1984), have suggested the use of triceps as one of the two most reliable sites for skin-fold measurements. Based on their work with obese individuals Seltzer and Mayer (197Ø) recommended the triceps skin-fold as not only the easiest site to measure, but also the most representative of total body fatness.

The externality hypothesis

Different theories of obesity have been proposed. Some have biological, and physiological dimensions, others concentrate on psychological and environmental factors that control overeating (Stunkard, 198Ø). Different types of treatment of obesity have been tested and compared to each other. Behavioral techniques constitute only one of the ways available to produce weight loss. The resulting

loss from behavioral methods is known to be moderate and poorly maintained over time (Jeffery and Coates, 1978; Harris et al., 1980). Behavioral techniques are based on the finding that environmental variables control overeating. There are indications that low-calorie diets are safe and effective for the first four weeks, for clients who are 30% to 100% overweight (McLean, 1981; Powers, 1982), but they have been found mainly ineffective with respect to long-term results (Howard, 1981). When combined with behavior modification, low-calorie diets were found to produce comparable amounts of weight loss to that of behavioral procedures, at one year follow-up (Wing, Epstein, and Shapira, 1982). Results from pharmacotherapy have shown that patients lose a significant amount of weight within a brief period of time. However, they regain the loss back after treatment is over. Pharmacotherapy has been reported as an effective alternative to subjects who did not initially respond to behavioral treatment (Craighead, 1984). When pharmacotherapy was compared to behaviorally treated groups it was found that behavioral treatment had better results after one year follow-up (Craighead et al., 1981; Brownell and Stunkard, 1981).

Stanley Schachter (1968, 1971) in a series of experiments has shown that obese people are more sensitive (as compared to normal-weight people) to external food-related cues, such as sight, smell, and taste of food

than to internal cues (physiological sensations of hunger). Further research has indicated that the externality theory had to become more refined to remain valid. Rodin (1980) for example, reported that there are individuals in all weight categories who are highly responsive to external food-related cues, but only some of them become overweight. She elaborated that research indicates a significant correlation between externality and weight gain. She concluded that high responsiveness to external food related cues is only one of the factors that lead to overeating and obesity. Obese individuals have been found to be more responsive to external food-related cues only when these cues are highly salient to them. Obese subjects have been reported to eat less than their normal-weight counterparts when the food-related cues are not prominent (Pliner, 1973; Ross, 1974). An obese person therefore is likely to eat more in the presence of salient food cues than when the cues are weak. The prominent presence of food serves as a cue for the obese that increases the probability that eating will occur again, since food is associated with eating.

When responses are differentially controlled by the presence or absence of certain stimuli (food-related in this case) behavior is considered to be under stimulus control (Craighead, Kazdin, and Mahoney, 1981). Some researchers have questioned Schachter's externality

hypothesis in studies with humans (Mahoney, 1975; Loro, Fisher, and Levenkron, 1979; Heretick, 1979; Conger et al., 1980; Meyers, Stunkard, and Milton, 1980), or animals (Colby, Misovich, and Kasouf, 1974), while others have found it valid (Pliner, 1973a; Pliner, 1973b; Ross, 1974; Johnson, 1974; Stutz, Warm, and Woods, 1974; Kozlowski and Schachter, 1975; Tom and Rucker, 1975; Pliner, 1976; Costanzo and Woody, 1979; Stevens, 1982). When stimulus control procedures are used overweight subjects are requested to reorganize their environment, to eat only in one and always the same room in the house, not to engage in any other behavior while eating, to use smaller dishes, so that small portions will appear larger, and to place food out of sight. Essentially, the aim of stimulus control procedures is to modify the eating response by manipulating the environmental cues that induce people to eat. The overweight individual becomes more aware of the actual amount of food that he/she consumes by concentrating on eating while eating. Also, the associations between food and every room in the house break down by asking the obese person to eat only at one room. Therefore, reduction of food intake is not the immediate goal of stimulus control procedures; this comes later on as a result of the manipulation of the environmental cues.

Stimulus control techniques have been applied in behavioral packages with results showing weight loss during

treatment (Stuart, 1971; Romanczyk, 1974; Chapman and Jeffrey, 1978; Katell et al., 1979; Coates and Thoresen, 1981) and at follow-up (McReynolds et al., 1976; Weiss, 1977a; Beneke et al., 1978; Beneke and Paulsen, 1979; Hautzinger, 1980; Carrol and Yates, 1981). M.B.Harris et al. (1980) investigated specific variables that correlate with successful weight reduction and maintenance in a behavioral program with obese adolescent girls. It was found that the subjects who lost more weight did not exercise significantly more than those who did not lose or lost less weight. However, a reduced number of places and situations to eat was related to increased weight loss. This finding suggests the effectiveness of stimulus control techniques. The subjects who lost more weight showed a significant decrease in their caloric intake, as compared to the non-losers.

Although stimulus control has been used extensively in comparison with other behavioral treatments and has yielded a favorable outcome, few studies have evaluated its efficacy when used as the only treatment procedure and have compared it to others. Given the contradictory results from studies testing the externality hypothesis, this comparison would be particularly useful. Treatment programs that involve a combination of procedures may produce cumulative or synergetic effects, however, for control purposes each procedure should be evaluated. This

will benefit obesity research in the long-run, since a single treatment procedure might prove as effective as a combination of treatments. To use a single procedure would be more parsimonious from a theoretical point of view and from a practical aspect it would save time and effort for both clients and clinicians. Besides, some procedures may prove more effective with certain individuals.

Mahoney (1976) has reported that weight loss programs are more successful during the summer season than during winter. This finding was not supported by M.B.Harris et al. (1980).

Locus of Control

The range of weight loss has been reported to vary considerably within weight loss programs (Harris and Bruner, 1971; Bellack, 1975). Assessing individual differences as related to successful weight loss would be of particular usefulness. Predictions could be made with respect to which candidates would respond to certain weight reduction programs. This in turn will stimulate further research in order to develop effective programs for those candidates who are currently "unsuccessful". Several attempts have been made to predict from subjects' characteristics (such as demographic variables, personal weight history, subjects' self-reinforcement style, and personality measures) their responsiveness to a weight reduction program (Weiss, 1977b). Of the personality

measures locus of control has been considered of special attention.

The concept of locus of control is based on social learning theory: certain predictions of an individual's behavior can be made based on his/her's expectations for internal or external control of reward (Rotter, 1966). In Rotter's I-E scale an individual who believes that events that happen are the result of one's own actions is said to have a belief in internal control of reward. Someone who believes that events are the result of chance, luck or fate, is said to have a belief in external control.

Some studies have found internally oriented subjects to be the most favorable candidates for weight control programs, since they achieve greater weight loss (Balch and Ross, 1975; Cohen and Alpert, 1978; Chapman and and Jeffrey,1978; Chambliss and Murray, 1979; Kincey, 1980; Goldney and Cameron, 1981; Kincey, 1981). In other studies externally oriented subjects appear to be at highest risk as treatment failures (Cohen and Alpert, 1978). Internals are expected to perform better in programs that involve self-motivation or self-reward, while externals perform better when there are externally controlled rewards (Saltzer, 1978). Hankins and Hopkins (1978) reported that internally oriented subjects were found to lose more weight if they were participating in an organized weight reduction program, while externally oriented individuals were found

more successful when they were not participating in any type of organized weight loss program. The authors did not specify what procedures the externally oriented individuals followed. Niemeier (1982), reported that being internal in locus of control did not differentiate successful from unsuccessful subjects who participated in a weight reduction program. Fisher (1983), found no significant relationship between scores on Rotter's I-E scale and success in a weight reduction program. Weiss (1977b), concluded that findings with respect to scores on the I-E scale and weight loss are still equivocal.

According to social learning theory behavior exhibited in a specific situation can best be predicted from situation-specific rather than generalized beliefs. That is, behavior as well as beliefs are situation specific. It would thus make more sense theoretically to use a specific locus of control scale developed for prediction of behaviors in weight reduction programs. Wallston et al. (1976) developed the Health Locus of Control scale, which is specifically designed to predict health related behavior. Saltzer (1982) developed the Weight Locus of Control (WLOC) scale, which is designed to measure perceived locus of control over one's body weight.

It has been recognized in studies on locus of control that the reward an individual would be getting by performing a given behavior is valued highly (Wallston et

al., 1976). The development of the Weight Locus of Control scale is based on the prediction that only individuals who value health and/or physical appearance highly would seriously consider losing weight. For them weight loss would be an important reward since it would result in an improvement in health and/or physical appearance. Internally controlled individuals would be more successful with self-control techniques for weight loss, since personal attitudes are important to them, while externals would perform better in programs that utilize social pressures because they value social norms highly (Saltzer, 1978). Consistent with social learning theory, it is expected that weight locus of control internals who value health and/or physical appearance highly would intend to, and actually will, lose more weight than the externals.

Program Adherence and Weight Loss

An important question that arises when reviewing studies on behavioral weight control programs is the extent to which weight loss is the result of specific behavioral changes which are the outcome of a behavioral program. Brownell and Stunkard (1978) reported that weight loss might be the result of some other variables to be defined, not of the behavioral changes prescribed in the weight reduction programs. Mahoney (1974), has pointed out that behavioral changes do not necessarily follow weight loss. Lansky (1981) reviewed the reports on which Brownell and

Stunkard (1978) based their comments and concluded that the studies that yielded negative findings suffer from methodological shortcomings; therefore any conclusions at the present time would be premature.

At present, findings are contradictory. Mahoney (1974) found the amount of weight loss to be significantly related to the degree of improvement of subjects' eating habits. Brownell et al. (1977) found that behavior changes were not correlated with weight loss during a 1Ø-week treatment program or at six-months follow-up. Stalonas, Johnson, and Christ (1978), who conducted a weight reduction program that included exercise and/or contingency management, found that although subjects engaged in the prescribed behaviors, only one out of ten behaviors was related to weight loss. This was between-meal uncontrolled eating. Graham et al. (1983) reported that in a five-year follow-up to a behavioral weight reduction program 58% of their clients appeared to adhere to at least three of the prescribed behavior changes and 35% to be physically active, on a self-report. Those clients who adhered to the behavioral changes and remained active were the ones who maintained their loss best.

It will remain for future research to answer the question with respect to program adherence and weight loss which undoubtedly is a critical one for behavioral research.

The present study: The present study was conducted in order to investigate the following: 1) the relative effectiveness of exercise versus stimulus control versus exercise plus stimulus control procedures on the weight, adipose tissue, and food intake of overweight females, 2) the differential responsiveness (if any) of subjects as evaluated by the I-E and by the WLOC scales, and 3) whether the desired outcome (weight loss) of the experimental procedures would be a result of the prescribed behavioral changes.

The following hypotheses have been generated:

1. The exercise plus stimulus control group would lose more weight than any other group.
2. The exercise group would lose more fat than the stimulus control group.
3. The internals of each group would perform better than the externals.
4. The weight-internals of each group would perform better than the weight-externals.
5. Weight loss would be correlated with participants' program adherence.

METHOD

SUBJECTS.

Advertisements were put on the radio and in local newspapers for recruitment. Candidates who responded were told about the length of the program, the refundable deposit, and the weekly meetings. Out of one hundred candidates, forty-eight women qualified to participate in this study. The mean age was 33 years, with a range between 2Ø and 47 years of age. Participants had to meet the following requirements: 1) Be between 18 and 47 years of age, 2) not having any health problems, 3) not taking any drugs, 4) not participating or planning to participate in another weight loss program, 5) not dieting, 6) not planning to get pregnant the following six months, 7) not having a history of metabolic problems, 8) be at least 15% overweight, according to the Metropolitan Life Insurance Company Height and Weight Tables (1983).

APPARATUS

1) A "Health O Meter" scale to measure weight, 2) a set of "John Bull" skin-fold calipers to measure body fat, and 3) a tape measure to assess body girth were used. Rotter's I-E Locus of Control and the Weight Locus of Control scales were used.

PROCEDURE

The present experimenter is of normal weight, had conducted a weight loss study in the past, and had received training in the special use of skin-fold calipers. The present study was conducted during the fall and winter seasons.

Preliminary information:

An introductory meeting was held for screening purposes. All candidates were requested to fill in a series of questions (see Appendix A). Then, candidates were weighed-in.

After the initial screening subjects were requested to give a deposit of $25.ØØ, which was refundable upon their completion of the program. Each subject was requested to sign a behavioral contract which specified the conditions under which the refund would be made, and the place where the deposit would be donated, if she would drop out of the program (see Appendix B). During this second meeting the Rotter's I-E and the Weight Locus of Control scales were administered. To avoid experimenter's bias the questionnaires were not scored until the end of the study. Subjects were told that they were going to be randomly assigned into four groups (see Figure A).

Phase I: The baseline phase lasted three weeks. During the first meeting the purpose of the baseline was explained to the subjects as a method to assess treatment outcome. Participants were told that they had been divided into four

groups and that each group would be assigned to different types of treatment.

Weekly meetings for each group were conducted separately. During meetings, which were conducted always at the same time of the day (after supper), the following measurements were taken: weight, chest and upper-arm girths, and triceps skin-folds. For reliability purposes skin-fold measurements on each subject were taken twice. Throughout the program individual meetings were arranged if a participant could not attend the regular sessions.

Subjects were told that for control purposes no further explanations would be given with respect to each group's specific nature of treatment. For the treatment phase, Groupl was assigned to stimulus control procedures, Group2 to an exercise program, Group3 to stimulus control techniques plus the exercise program that Group2 was assigned to, and Group4 (control) was requested to count the amount of calories consumed and burned. Subjects in all groups were counting calories consumed and burned, according to specified lists.

Phase II: This phase lasted one week. Its purpose was to ensure that participants fully understood their daily assignments. All subjects were requested to obtain a book that describes the caloric values of food (Kraus, 1981). Also, lists of energy expenditure for various types of activities were distributed to them (Katch and McArdle,

1977). Participants were asked to convert their daily food intake and daily exercise (if any), into calories consumed and burned respectively, on specifically designed sheets that were distributed to them (see Appendix C). From a pilot study it became apparent that subjects have found highly time consuming the time required to include every activity they have engaged in on the energy expenditure lists. For this reason, it was made explicit to all participants that activities such as eating, sleeping, sitting, typing, writing, reading, etc. should not be included on the list of energy expenditure. A number of participants became uncertain as to the instructions; therefore during the meeting the experimenter went over daily activity sheets of some of the participants to explain the assignements further.

Phase III: The treatment phase was initiated during the fifth week of the program. Handouts were distributed to each treatment group with the prescribed behaviors that each group was requested to follow. Each group was explained the rationale of the type of treatment it was given.

Stimulus Control Group: Participants in this group were given a handout which described in simplified terms how to minimize contact with food and contained suggestions for substitute behaviors. For example: they were requested to designate a room, table, and chair at their houses, and

working environments and to eat only there. They were also asked to eat their meals always at the same time, to have three meals a day only, with no snacking in-between, to concentrate on eating while they eat; to place all junk food out of sight and to store it in opaque containers; to use smaller dishes; to do their grocery shopping when they were not hungry. Finally, they were requested to preplan what they were going to eat when they were going out for dinner. Subjects in this group were asked to engage in alternative behaviors whenever they felt like eating and their meal time had passed (see Appendix D).

During the first meeting of phase III the logic behind the use of stimulus control procedures was discussed with the subjects of this group. Participants were encouraged to ask questions. It was explained to them that a weight loss of 1-2 pounds per week would be desirable. Subjects were requested not to skip any meals. Instead, to have three meals a day, at regular times with smaller portions of food. Participants were asked to read the handout on stimulus control every day, so that they would become familiar with the prescribed behaviors they were requested to follow. It was explained to the subjects that they could drink as much water, plain coffee, tea or diet pop in-between meals as they wanted. Subjects in this group were asked to fill in daily the checklist that was designed to "give them feedback on how well they follow

the prescribed behaviors" (see Appendix E). According to this checklist they were later evaluated with respect to program adherence.

Exercise Group: A handout was distributed to the subjects of this group that briefly described the benefits of exercise to health and to overweight people. This handout also suggested ways to increase energy expenditure by substituting non-exercise behaviors for routine activities that involve physical exercise (see Appendix F).

At the first meeting of phase III participants were requested to sign a consent form according to which they were taking full responsibility for any health problems that they might have had which would contraindicate their participation to the program (see Appendix G). Participants were asked to engage in routine as well as programmed activities. The programmed activities were aerobic in nature. Subjects were asked to engage in any type of aerobic exercise they liked (i.e. distance swimming, which was highly recommended, distance running, walking, skiing, skating, bicycling, roller-skating) for at least three times per week, as long as it was of enough intensity and duration to burn up 70 calories more than their baseline level for the first two weeks, and 100 calories over their baseline level for the third week of this phase and on. A gradual increase of 100 calories of energy expenditure every second week was initially

scheduled. However, participants commented right away that this was too high an activity level. Thus, from the third week of the treatment phase and on, the required energy expenditure per week remained at 270 calories more than each subject's baseline level. In their homework assignments participants were asked to write down daily, on specifically designed sheets, the type of exercise, the time spent on it, and the amount of calories they burned by performing it. Also, as part of their daily assignment each participant was requested to put the appropriate mark (1, 2 or 3) on her sheet according to whether she was adhering to the required amount of exercise o r not (see Appendix H). Participants were told that this point system would give them feedback with respect to how well they stick to the prescribed behaviors. Adherence referred to the amount of calories burned and the frequency of the subject's exercise activities as scheduled. Routine activities were also counted as part of the program. During the initial meeting of phase III participants were encouraged to ask questions with respect to the program, the benefits of exercise, and their homework assignments. It was emphasized that participants should be goal oriented, and try to exercise for a predetermined amount of time which would increase progressively.

Stimulus Control plus Exercise Group: During the first meeting of phase III the participants of this group were

given the handouts that subjects in the exercise and in the stimulus control groups were given (see Appendices I, J, K, L). They were asked to engage in the behaviors prescribed for both the exercise and the stimulus control groups, and were evaluated for program adherence according to the standards used for the stimulus control and exercise groups (see Appendices E, H).

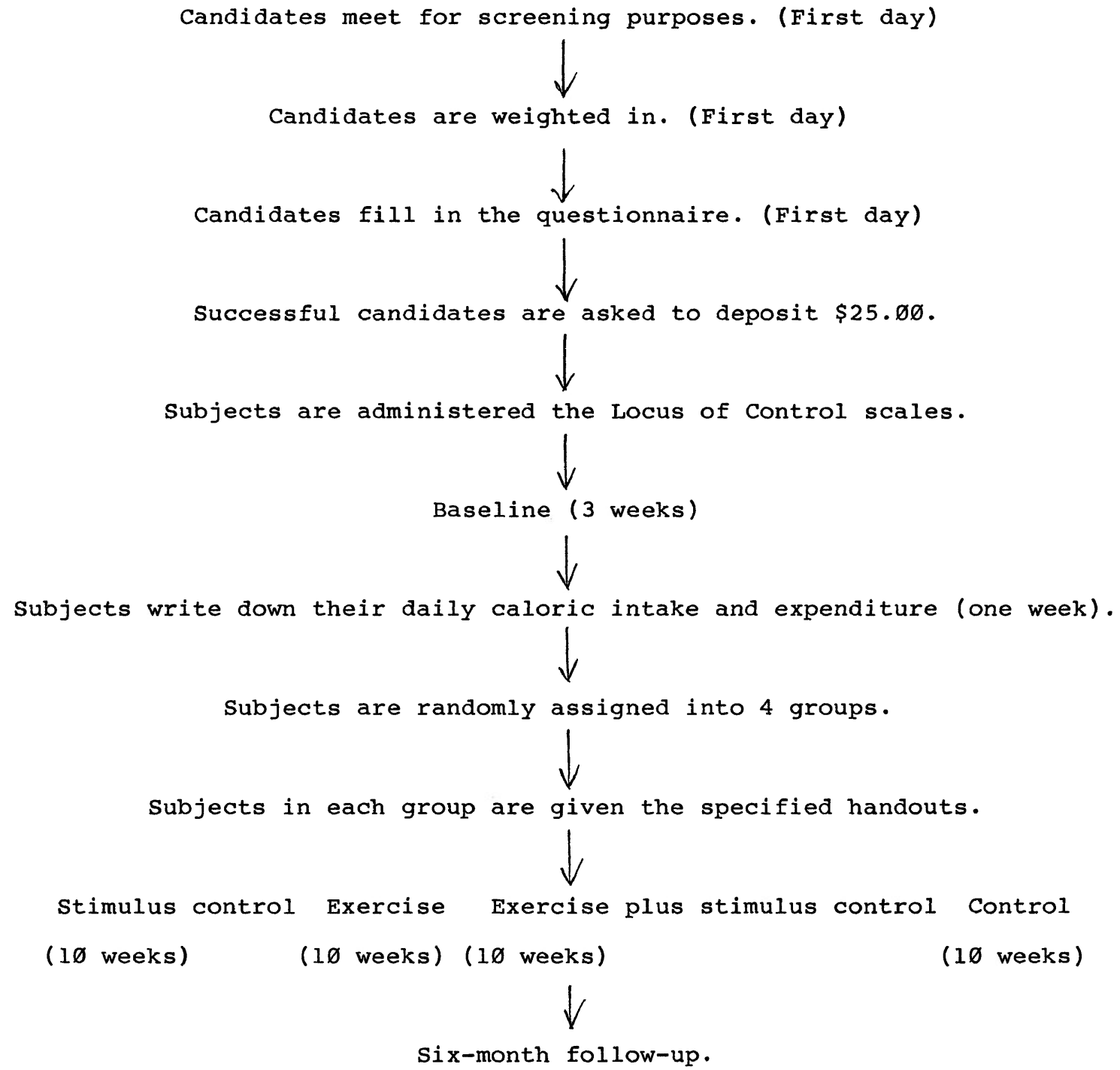
Control Group: Subjects in this group as well as those in the three experimental groups were asked to count their daily caloric intake and expenditure. Prepared sheets were distributed and participants were asked to fill them in daily (see Appendices M,N).

During the last meeting the different treatments that were used in each group were explained to all subjects. All participants were given the handouts that were distributed to the stimulus control plus exercise group at the beginning of the treatment phase. Subjects from the control group were told they could start following any type of treatment they would choose from those given, and that the experimenter would be available for feedback.

All participants were informed about a follow-up on weight measures that was going to be conducted six-months after the last meeting of the treatment phase. No contact was made with the subjects after the end of treatment and before follow-up.

FIGURE A

FLOWCHART OF EXPERIMENTAL PROCEDURES



RESULTS

Pretreatment Measures: One-way analyses of variance conducted on weight and body fat pretreatment measures revealed no differences among the groups before the beginning of the program. The weight means for each group are presented in Table I. Correlations among all the pretreatment measures are presented in Table II. Significant correlations were found between the different measures of obesity, indicating that the higher the weight, the higher the amount of body fat, and the larger the arm and under-the-chest area circumferences. Also, a significant correlation was found between the two measures of locus of control, suggesting that they measure common attributes.

Out of the 48 subjects who started in the program 8 dropped out during the course of the study: 4 subjects from the exercise group, 1 from the stimulus control group, 1 from the stimulus control plus exercise group, and 2 subjects from the control group (a 17% drop-out rate). The post-treatment analyses at the end of 14 weeks, as well as the six-month follow-up analysis were conducted on a total of 40 subjects. There were no missing data for these 40 subjects. The mean weight of all subjects before the beginning of the program was 184.57 pounds, with a range of 142.00-285.75 pounds.

Effects of treatment: Four indices were used to assess the

effects of the treatments: weight, triceps skin-fold, and measurements of the arm and chest circumference. The means for each group on weight and triceps are presented on Tables III and IV. Table 3. Two-way analyses of covariance were conducted on the post-treatment measures using the corresponding pretreatment measure as a covariate. For body weight there was a significant effect of stimulus control, $F(1,35)=20.14$, $p<.001$, but no effect of exercise, $F=.15$. There was no exercise by stimulus control interaction, $F=.32$. For body fat (triceps skin-fold), stimulus control was also significant, $F(1,35)=4.68$, $p<.05$ ($p=.037$), while exercise, $F=.92$, and the exercise by stimulus control interaction, $F=.13$, were not. The significant effect of stimulus control on weight and body fat indicates the greater weight and fat loss in the group receiving the stimulus control procedures. No significant differences were found for arm or chest measurements for exercise $F(1,35)=.26$ and $F(1,35)=.34$ respectively. However, the stimulus control effect approached significance, $F(1,35)=3.53$, $p=.069$ for arm circumference (see Appendix K); the value for chest measurement was nonsignificant: $F(1,35)=1.26$, $p=.27$.

The six-month follow-up on body weight was also analyzed by a two-way analysis of covariance using the pretreatment weight as the covariate. The difference between the stimulus control groups and the others was

still significant, $F=(1,35)= 4.23$, $p<.05$ ($p=.047$), indicating that the difference between these groups was maintained for this period. The effects of exercise, $F=.001$, and exercise by stimulus control interaction, $F=.24$, were again nonsignificant.

Two-way analyses of variance were calculated on average food intake and energy expenditure (Appendix L, Figures 2 and 3). The only significant factor was the effect of stimulus control on food intake, $F(1,36)=4.33$, $p<.05$, ($p=.045$), indicating less food consumption in the groups receiving the stimulus control treatment. It is important to note the nonsignificant effect of exercise on energy expenditure, $F=1.23$, indicating that the exercise groups did not report greater energy expenditure than the groups not given the exercise treatment.

Pearson's Product Moment Correlation was calculated to discover whether Locus of Control on Rotter's scale (LOC) correlated with weight loss. The median split was used for differential classification. A score of 9 or less indicated internality, whereas a score of 10 or more indicated externality. No significant correlation was found, $r=.27$, (D.F.=38). This suggests that the LOC scale did not predict weight loss. Correlational analysis was employed to assess the relation between weight loss and scores on Weight Locus of Control scale (WLOC). The median split was again used for differential

classification. A score below or equal to 4 suggested internality, whereas a score above 4 suggested externality. No significant relationship was found between locus of control on the WLOC scale and weight loss, r=-.Ø8, (D.F.=38). This suggests that the WLOC scale did not predict weight loss.

Pearson correlation calculated on scores on program adherence and weight change scores of the stimulus control group failed to show any significant relation, r=.19, (D.F.=9). With respect to the exercise group, correlational analysis employed on scores on exercise program adherence and weight change scores did not show any significant correlation, r=-.13, (D.F.=6). No significant relation was found on adherence scores on stimulus control procedures on the stimulus control plus exercise group, r=.43, or exercise adherence scores of the same group and weight change scores, r=.44, (D.F.=9). No significant correlation was found on amount of calories consumed and weight change scores of the control group, r=.16, (D.F.=8).

TABLE I

Pretreatment Measures between:		Weight		Triceps	
Group	n	x	S.D.	x	S.D.
Stimulus Control	11	182.68	33.28	25.84	4.23
Exercise	8	185.31	40.04	26.25	5.34
Stimulus Control plus Exercise	11	190.81	52.41	27.48	4.69
Control	10	183.00	26.77	25.75	5.09

TABLE II

Correlations among pretreatment means: Weight, Fat, Triceps, WTLOC, LOC.

	WEIGHT1	FAT1	ARM1	CHEST1	WTLOC	LOC
WEIGHT1						
FAT1	Ø.88**					
ARM1	Ø.84**	Ø.72*				
CHEST1	Ø.53*	Ø.59*	Ø.46			
WTLOC	Ø.Ø9	Ø.Ø7	-Ø.Ø4	Ø.27		
LOC	-Ø.Ø2	Ø.Ø4	Ø.Ø7	Ø.Ø4	Ø.33*	

D.F.=38

*p<.Ø5

*p<.Ø1

TABLE III

Average Weight (in pounds) Before, After Treatment and at a Six-Month Follow-up.

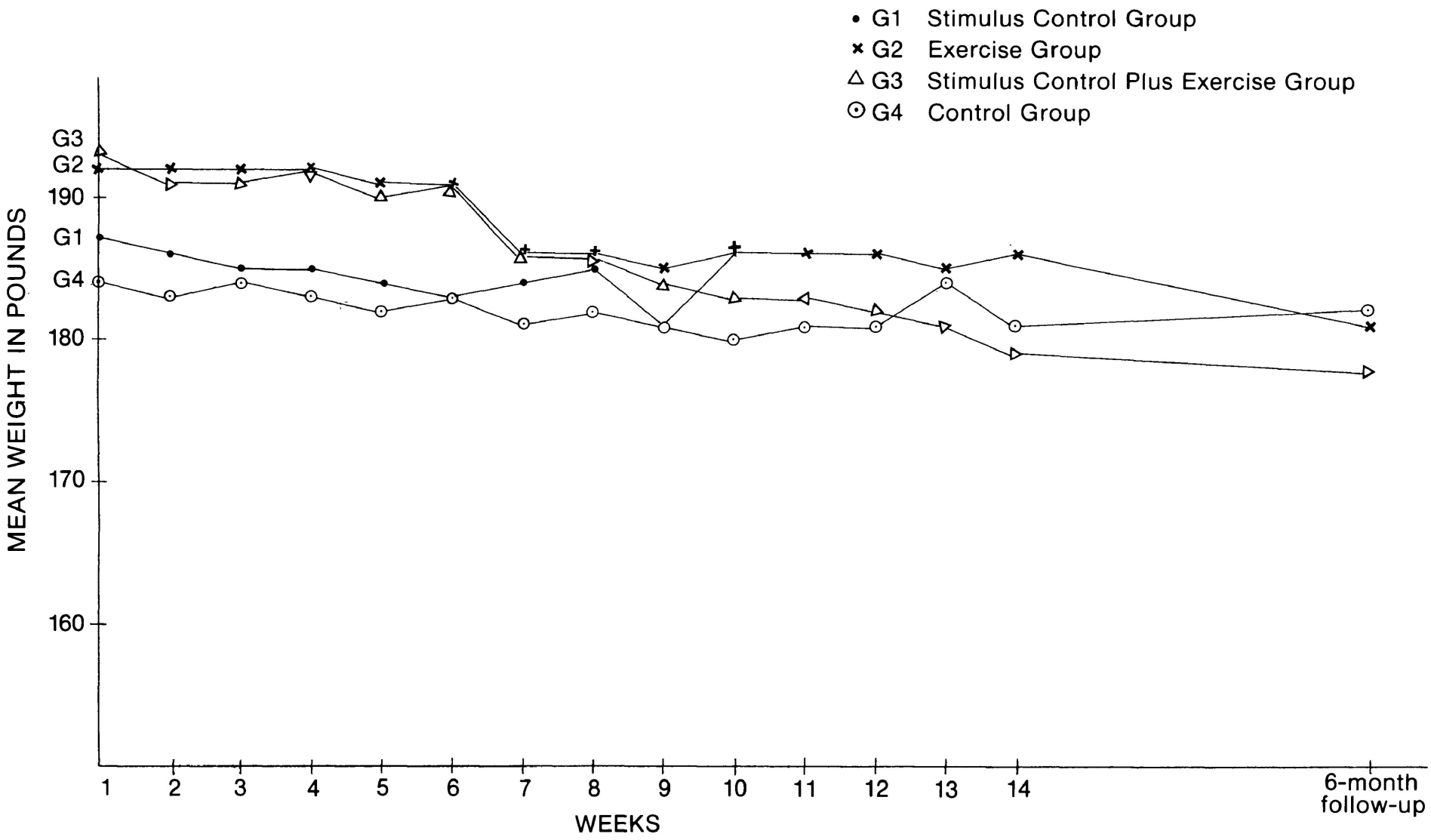
Group		Pre x	Post x	Follow-Up x
Stimulus Control	11	182.68	171.77	167.88
Exercise	8	185.31	186.Ø9	18Ø.56
Stimulus Control plus Exercise	11	19Ø.81	179.38	178.18
Control	1Ø	183.ØØ	181.45	181.17

TABLE IV

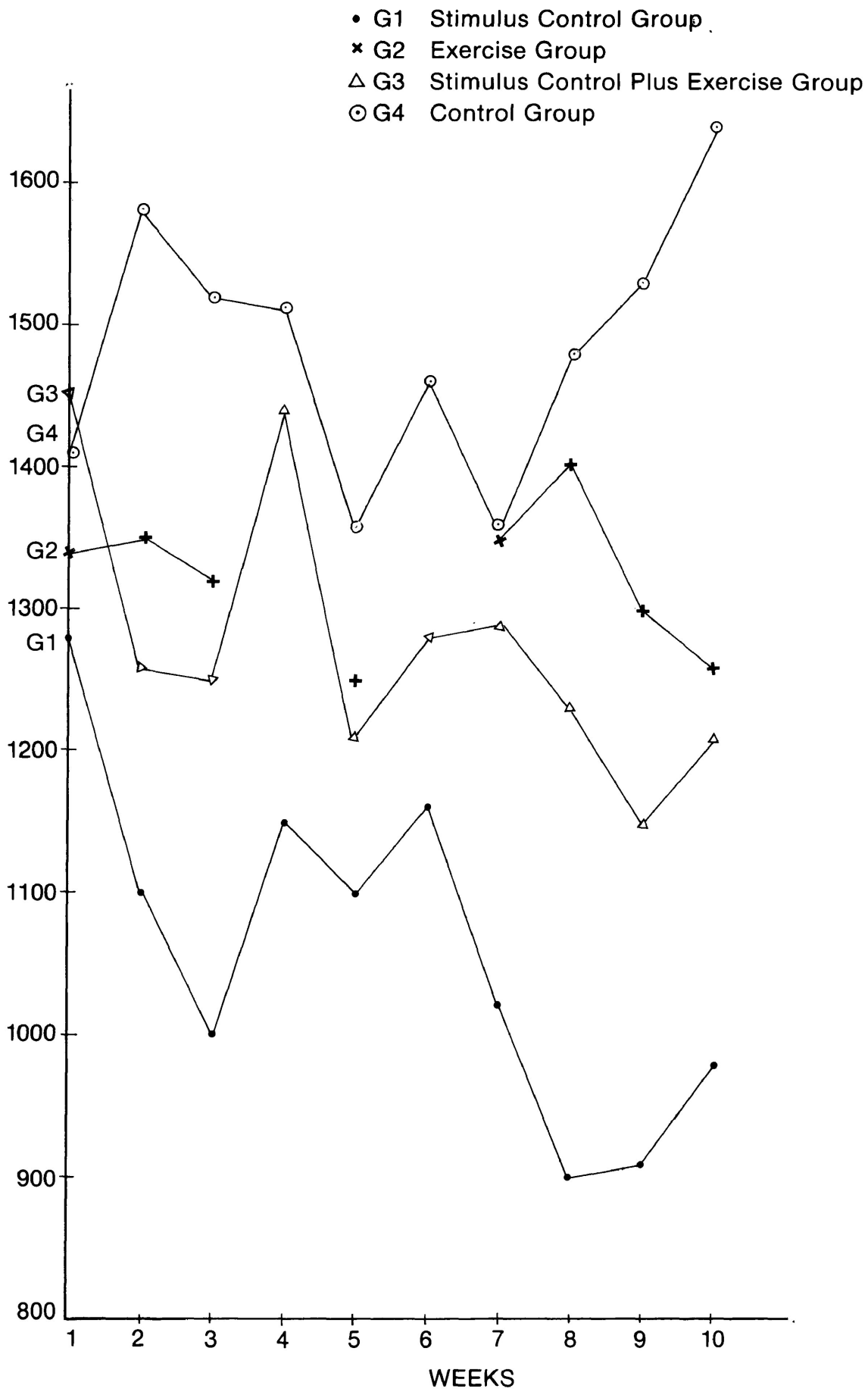
Average Measures of Triceps Skin-fold (in millimeters).

Group	x	Pre x	Post
Stimulus Control	11	25.84	24.96
Exercise	8	26.25	25.56
Stimulus Control plus Exercise	11	27.48	26.55
Control	1Ø	25.75	26.36

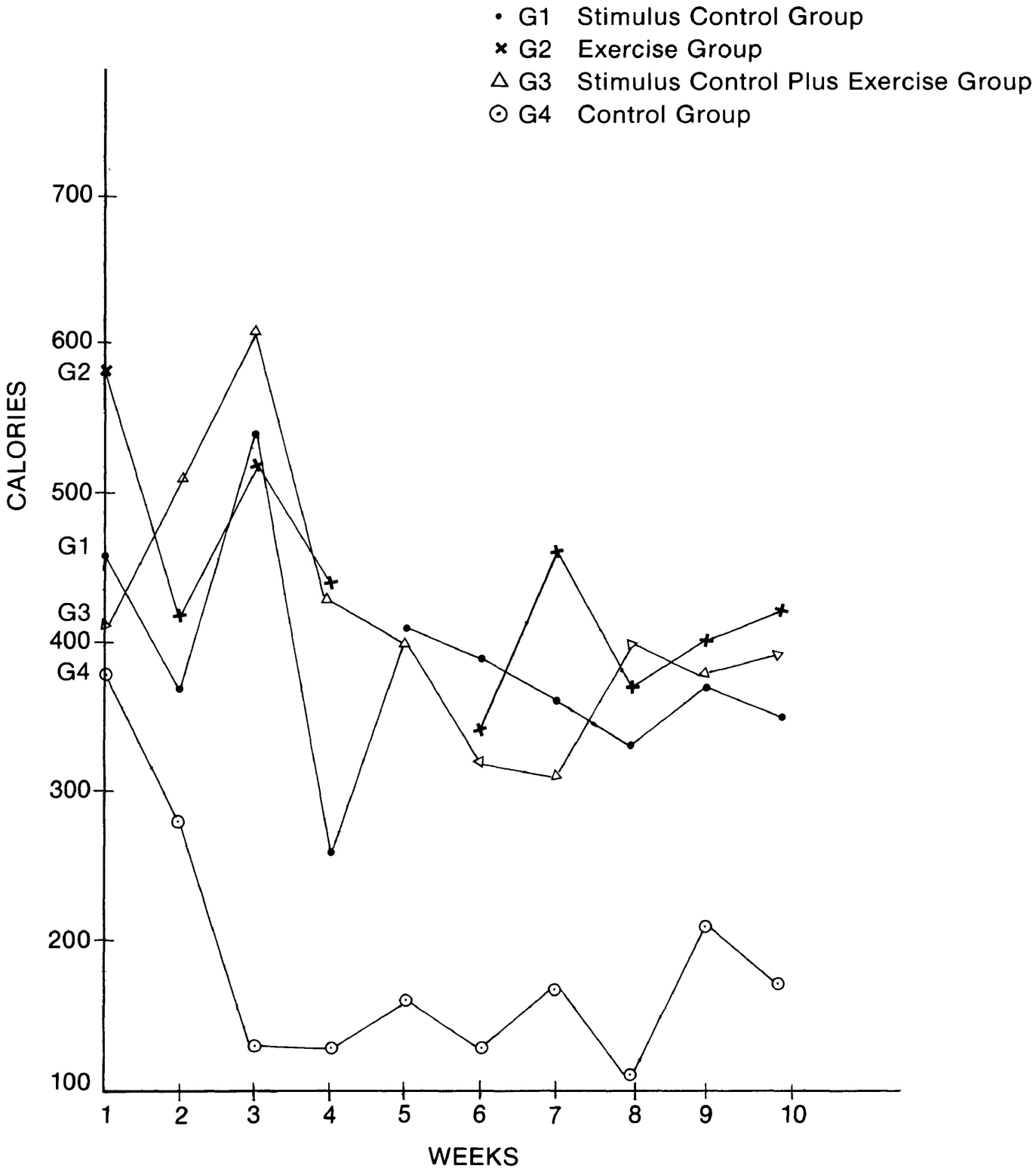
WEEKLY WEIGHT AVERAGES Figure 1



WEEKLY MEANS ON FOOD INTAKE Figure 2



WEEKLY MEANS ON ENERGY EXPENDITURE Figure 3



DISCUSSION

The present findings suggest that stimulus control procedures were an effective way to lose a moderate amount of weight and fat, while exercise was not. hile measures of weight and fat changed significantly for the stimulus control groups, there was no significant change for the exercise group. The fact that no interaction between stimulus control and exercise was found further supports the above interpretation. The exercise plus stimulus control group lost an average of 11.43 pounds. Out of the eleven participants who completed the program, eight of them (73%) lost more than 1Ø pounds during treatment phase. In the stimulus control group, out of the eleven participants who completed the program, seven (64%) lost more than 1Ø pounds during treatment. The stimulus control group lost an average of 1Ø.91 pounds, with a range of 3.5Ø pounds, with the exception of one subject who gained 5 pounds. The stimulus control plus exercise group lost an average of 11.43 pounds, ranging between 1.75 to 27.25 pounds, with the exception of one subject who gained .75 of a pound. The exercise and the control groups exhibited a minimum change on weight: a gain of .78 of a pound and a loss of 1.55 pounds on the average, respectively. The six-month follow-up revealed that the weight loss for the stimulus control groups was maintained. For the exercise group there were no effects

on weight loss.

Weight loss results from the present study were consistent with those in other weight loss studies that used behavioral techniques in a group format: The average weight loss experienced from the stimulus control groups was modest with large intersubject variability. It is important to note that while the amount of food consumption decreased for the groups receiving stimulus control treatment, there was no significant change for the exercise group on food intake. The lack of effectiveness of the exercise treatment might reflect a lack of accuracy of the self-report data. Subjects from both the exercise groups commented on having difficulty in following the prescribed amount of exercise, as was initially scheduled. Such factors as the weather conditions and time constraints were mentioned as reasons. Subjects from both the exercise groups did not actually adhere to the prescribed amount of exercise. After the first three weeks of the treatment phase the average level of energy expenditure for the exercise groups dropped quite dramatically. The fact that subjects from the exercise group gained an average of .78 of a pound can be better explained as a result of increased food intake, rather than increased energy expenditure resulting in fat loss and muscle gain.

Stimulus control procedures proved to be an efficient way to lose a moderate amount of weight without any excess

amount of emotional cost experienced by the participants. Most subjects reported they could generalize the prescribed behaviors to their house and working environments (except of one case of a journalist who had no specific time or place she was eating her meals). Also, the prescribed behaviors were simple to explain and to follow. In this study, exercise proved to be an ineffective way to lose weight. The exercise group had the highest drop-out rate (33%) of all the groups. Participants had difficulty in maintaining an increased amount of energy expenditure, reported a high frustration level, and did not lose any weight (or fat). Exercise intensity has been found to be associated with poor exercise adherence (Martin, Dubert, 1982). The above findings are consistent with those of other researchers in the area who reported that excessive body weight and fat are associated with dropping-out of an exercise program (Dishman, 1981; Martin, Dubert, 1982).

The hypothesis that subjects with an internal locus of control would lose more weight was not supported. No significant relationship was found between amount of weight loss and internality or externality on either Rotter's scale or the Weight Locus of Control scale. This finding supports the statement made by other authors that conclusions about locus of control and weight loss are still equivocal (Weiss, 1977; Goldnay and Cameron, 1981).

The contradictory findings could be a result of individual differences among subjects. Certain programs might be effective with certain individuals, specifically those who are internally oriented. An interesting finding is that most scores of the subjects who dropped-out of the program were considered to be in the external range according to the scales for locus of control employed. In Rotter's scale, six out of the eight subjects who dropped out were classified as externals. On the Weight Locus of Control scale, seven out of the eight drop-outs were classified as externals. While those external scores on Rotter's scale were not extremely high, all those on the Weight Locus of Control scale were very high. The higher the score the higher the indication of externality. This finding needs further research since the number of subjects who dropped out was insufficient for drawing conclusions. If the above finding is supported by future research, it would have major implications for obesity treatment research. Externally oriented individuals would be identified as being at higher risk for dropping out of weight loss programs. Specific types of programs would then be developed that would deal with those high risk subjects.

The fact that no relationship was found between weight loss and program adherence can be interpreted in three ways: 1) the measures of the prescribed behaviors may not truly reflect other important behavior changes which

occurred, 2) data on program adherence were on a self-report basis and they may not be accurate, and/or 3) weight loss might have been caused by factors irrelevant to those prescribed in the program (Brownell and Stunkard, 1978). The above possibilities remain open for future research to consider.

Consistent with other behavioral weight loss programs there were some successful and some unsuccessful weight reducers. No relationship was found between locus of control and amount of weight loss. Predictors for weight loss still remain puzzling. It is possible that specific programs are effective for specific individuals with certain: life style, attitudes towards weight loss, cognitive styles, self-concept, expectations, physiology, environmental reinforcers, etc. Those are factors that are open to future research.

During the follow-up participants were asked whether they were following the prescribed programs. Some of them reported they were following them, some others that they followed some type of diet, or that they joined some type of weight loss club, like Overeaters Anonymous. Still others reported they went back to their old eating habits. An important implication from the above reports is that the weight loss data gathered at a six-month follow-up could not be considered representative of the type of treatments employed during the program because of

the variability of weight loss procedures chosen by the participants. This problem makes follow-up data on weight loss difficult to interpret.

During the last meeting the experimenter asked all subjects for feedback about the extent to which the program met their exectations. Subjects from the stimulus control groups were mostly satisfied; subjects from the exercise and the control groups were mostly dissatisfied. Most subjects reported that by writing down the amount of energy intake and expenditure they became more aware of the fact that they were underexercising and overeating. The reported dissatisfaction from the control group suggests that self-monitoring of eating and exercise habits helps only to the extent of gaining some insight but is not sufficient for weight loss. Also, participants felt that the weekly meetings were worthwhile. Questions were clarified, the weight was checked, and this served as an incentive to follow the prescribed behaviors. These self-report data are consistent with the finding that frequent therapist contact promotes weight loss (Jeffery and Wing, 1979). Most participants expected some type of diet in order to lose weight. The experimenter went through a discussion during the beginning of the treatment phase in which it was explained that diets are one and not necessarily the best method to lose weight.

This author shares the viewpoint that in order for

weight loss to be maintained the individual would have to adjust to a new life style that would include new eating habits and an increased amount of exercise activity. Although this was emphasized in the present study, it became apparent that change of life style requires reeducation. Young, overweight individuals can learn to enjoy physical activity rather than avoiding it. Adults who have been used to a certain type of life style might be more resistant to change than children. Although knowledge about the nature of obesity increases with age it may be more valuable to educate people about obesity at all age levels (Harris and Smith, 1982). Pregnant women would be the group for whom reeducation should be emphasized, since they shape the eating habits of their babies at a critical age. This reeducation process which could start by health educators at the school settings would enhance prevention of obesity. M.B.Harris (1983) suggested that by educating students about obesity three goals could be achieved: 1) a better understanding of obesity, 2) a higher probability of preventing people from becoming obese, and 3) elimination of prejudice towards obese individuals.

Conclusion

The use of stimulus control procedures proved to be an effective way to lose a moderate amount of weight for overweight adult females. While stimulus control

procedures alone were effective for weight loss, exercise did not result in weight or fat loss. Locus of control scores, as measured by Rotter's and by the Weight Locus of Control scales, did not differentiate successful from unsuccessful weight reducers. However, most subjects who dropped out of the program were classified as externals in locus of control. The reason for the lack of relationship between program adherence and weight loss remains open for future research.

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LIST OF APPENDICES

APPENDIX A

PRELIMINARY QUESTIONNAIRE

Write: n.a., if a question is not applicable to you.

1. My name is_____

2. My phone number is_____

3. I am _____ years old.

4. My height is_____

5. According to the "Health O Meter" scale my weight is_____

6. I started gaining weight when I was_____ years old.

7. I have been overweight since early childhood_____

8. I have the following health problems:_____

9. I have a history of metabolic problems_____

10. I take the following drugs:_____

11. I am dieting, or plan to start dieting soon_____

12. For the last six months (or less) I exercise_____

a. every day b. twice per week c. once a week d. I do not exercise

13. I have participated in a weight loss program before

that ended _____months ago.

14. I have achieved a weight loss of _____lbs.

15. I have maintained the loss. Yes_____, No_____

16. I do not plan to participate in another weight loss program (other than the present) Yes_____, No_____

17. I plan to get pregnant within the following six months. Yes___, No____

APPENDIX B

BEHAVIORAL CONTRACT

Effective Dates: From_____to_____

We, the undersigned parties, agree to perform the following behaviors:

If I,_____ remain a faithful participant throughout the entire period of the study, THEN I will receive my $25.ØØ that I have willingly given to _____ as an indication of my commitment.

PENALTY:

If I do not fulfill the aforementioned requirements, I forfeit $25.ØØ to the Graduate Psychology Student Fund.

_____

Participant

_____

Experimenter

_____

Witness

APPENDIX C

DAILY CALORIC INTAKE SHEET

SP 2

Name:_____ Date:_____

Calories

Breakfast:

Lunch:

Dinner:

Daily total caloric intake:_____B_____

APPENDIX D

DAILY ACTIVITY SHEET

Type of exercise	Time spent	Calories burned

APPENDIX E

LIST of SUGGESTED STIMULUS CONTROL TECHNIQUES

It has been found in several studies that overweight people tend to eat more in the presence of food than in its absence. That is, they tend to be more sensitive than normal-weight people to such things as the sight, smell, and taste of food that to the feeling of hunger itself.

Try to eliminate contact with food when you are nothungry as much as possible. For example:

1) Eat only at a designated place in your house. That is, always in the same oom, while sitting on the same chair. Even when you feel really hungry you are not allowed to eat at a place other than the designated one. If you have to eat lunch or dinner somewhere else, for example at work, eat always at the same place there.

2) Eat your lunch and dinner always at the same time.

3) Do not engage in any other behavior while you eat: Do not watch TV while you eat, do not read or study, do not talk, do not listen to the radio. Instead of eating while watching TV, sew or write letters, or play cards.

4) Place all junk foBod out of sight: Do not store candy and/or fruit, or chips in dishes or bowls. Instead, put it in brown paper-bags and store it in cupboards. Food stored in the refrigerator should be stored in covered, non-transparent bowls. Any type of food should be stored

in the cupboards or the refrigerator in the kitchen only.

5) Use smaller dishes, so that you will get used to eat smaller amounts of food. Many people do not stop eating unless they see their dish empty.

6) Eliminate any extensive cooking or baking.

7) Do your grocery shopping only when you are not hungry (after you have eaten your meal).

8) Preplan: A day before you go out for dinner or at a party write down what do you plan to eat, figure out the caloric values of the food you re going to eat and stick to your plans. If you don't know what type of food will be served write down what you will not be allowed to eat. If you are going to bring something to the party prepare it when you don't feel hungry (after you have finished your meal).

9) When you feel tired go to sleep instead of eating.

1Ø)Instead of watching TV commercials read the newspaper.

11)When you feel bored or anxious play cards, do some painting or sewing instead of eating.

APPENDIX F

PROGRAM ADHERENCE FOR STIMULUS CONTROL GROUP

Date:_____ Days of the week

2 3 4 5 6 7

1. Daily Checklist

(if I read the checklist)

2. Recording my calories

3. Cue Elimination:

Designated eating place

Did not change place at table

Only eating when eating

Reduce visual cues(storage)

Junk food out of sight

4. Use smaller dishes

5.*Preplan: A day before going to a party plan how much you are going to eat

6.*Did grocery shopping after meal

POINTS:

Most of the time or yes=3

Sometimes=2

Not at all=1

TOTAL POINTS FOR THE WEEK_____

*Put n.a. if not applicable

APPENDIX G

List of Ways to Increase Activity

The benefits of exercise on health are many and have been well documented in many studies. By exercising you can lose fat per se, while with diets you lose mainly protein and water. To achieve maximum fat loss exercise should be of low intensity, long duration, and aerobic in nature. Aerobic exercises maximally benefit the cardiovascular system. Activities such as: distance swimming, jogging, bicycling, skiing, walking, skating, and rowing are considered aerobic in nature. Swimming is highly recommended as an exercise with minimal risks for injuries.

Lack of exercise accelerates aging. However, in order to have the desired effects exercise should be done on a regular basis. A good way to increase energy expenditure is to take advantage of every opportunity you are given:

1) When you feel bored or anxious do 10-20 repetitions of an exercise instead of eating. Or, go for swimming, or skiing.

2) Instead of watching TV commercials do 10-20 repetitions of an exercise and concentrate on what you are doing.

3) When you feel hungry but is not dinner time go for a walk instead of eating.

4) When you drive to work, park your car about half a mile

away and walk the rest of the distance.

5) Whenever you take the bus get off 7 or 10 stops earlier and walk for the rest of the way.

6) For short distances walk instead of taking a bus or a cab.

7) Wake up one or half an hour earlier and go for a walk, or cycling.

8) Always climb up and down the stairs instead of using the elevators.

9) Sweep or shovel the sidewalks in front of your house yourself.

10)Go for a walk with the dog -if you have any- every evening.

11)At your spare time get used to do: Gardening, mowing the lawn, wash the car.

APPENDIX H

Consent Form for the Exercise Participants

I the undersigned _____ declare that I am aware of any possible risks that might be involved through my participation in an exercise program conducted by Anastasia Stathatou, and I agree to take full responsibility, including medical advice for exercise and weight-loss programs.

_____

Participant

_____

Experimenter

_____

Witness

APPENDIX I

Program Adherence for the Exercise Groups

Fill in minutes of exercise and calories spent Date:_____

Mond.Cal.	Tues.Cal.	Wedn.Cal.	Thurs.Cal.	Fri.Cal.	Sat.Cal.	Sun.Cal.
Minutes	Min.	Min.	Min.	Min.	Min.	Min.

POINTS:

Most of the time or yes=3

Sometimes=2

Not at all or no=1

Total points for the week:_____

APPENDIX J

Program Adherence for the Control Group

	Days of the week					
	2	3	4	5	6	7
Recording my calories						

POINTS:

Most of the time or yes= 3

Sometimes= 2

Not at all or no= 1

Total points for the week_____

APPENDIX K

Summary Table: effects of stimulus control and exercise on arm circumference.

Source	Sum of Squares	D.F.	Mean Square	
Covariates				
Arm (before treat.)	622.95		622.95	240.88
Main effects				
Exercise	10.10		.67	.26
Stimulus control	9.12		9.12	3.53*
2-way interaction				
Ex/st.control	1.92		1.92	.74
Explained	634.98	4	158.74	61.38
Residual	90.51	35	2.58	

*p=.069

APPENDIX L

Mean Ranges on Caloric Intake During Treatment

Group	Min.	Max.
Stimuus Control	897.47	1389.40
Exercise	1046.66	2217.80
Stimulus Control plus Exercise	825.80	1583.10
Control	549.75	2195.65

Mean Ranges on Energy Expenditure During Treatment

Group	Min.	Max.
Stimulus Control	80.37	1183.70
Exercise	134.33	1259.28
Stimulus Control plus Exercise	78.66	842.09
Control	0.00	373.50