To the Graduate Council:

I am submitting herewith a dissertation written by Annell St. Charles entitled "An Interdisciplinary Model for the Treatment of Obesity in Young Girls." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Home Economics.

Daniel W. Hubbard, Major Professor

We have read this dissertation and recommend its acceptance:

Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

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AN INTERDISCIPLINARY MODEL FOR THE TREATMENT OF OBESITY IN YOUNG GIRLS

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Annell St. Charles

March 1981

DEDICATION

To the subjects and their families who participated in this study never losing faith, never giving up, and to my "soulmate" who always knew how to patch up the frayed edges of my confidence.

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ABSTRACT

The effectiveness of an interdisciplinary model in treating obesity in three young girls, ages 4 to 8, was studied over a 20-week period. Three subjects were selected from physician referrals and newspaper advertisement respondents. All of the subjects were clinically obese as indicated by weight and fatfold measures and had no apparent medical complications which would contraindicate treatment. Two of the subjects were white and one was of mixed racial background. One or both parents were obese in all subjects but none had obese siblings. The mother of each subject was the primary family member attending meetings.

Treatment effects were measured in terms of weight, height, fatfold, and behavioral changes. A single-case experimental design, utilizing a multiple baseline, across subjects format, was employed to demonstrate experimental control. The baseline phase of this design lasted 3, 4, and 5 weeks with Subjects 1, 2, and 3, respectively, while treatment occurred over 17, 16, and 15 weeks. The treatment package included the major components of dietary intervention, physical activity, and behavior therapy. Specific procedures were employed to implement each of the components.

All of the subjects demonstrated decreases in body weight in terms of pounds lost, a reduction in percent overweight, and a weight reduction index (RI). Subject 3 showed the greatest change followed by Subjects 1 and 2. All of the subjects maintained a linear pattern of growth during the study as indicated by changes in height.

Subject 1 demonstrated the greatest improvement in fatfold followed by Subjects 3 and 2. Differences in the order of response to fatfold and weight changes may be associated with (1) individual variations in activity level, (2) measurement error, or (3) an inadequate correlation between fatfold and obesity. All of the subjects showed an improvement in the degree of obesity as demonstrated by a weight-for-length index. The rank order of improvement paralleled that for weight change. All of the subjects modified inappropriate eating and exercise behaviors as indicated by reports of self-reported and observable change.

The results of this study have several implications for future childhood obesity treatment programs. The use of a single-case experimental design overcomes many of the limitations inherent in group comparison studies which include: (1) ethical issues, (2) problems in collecting a large enough group of subjects with appropriate characteristics, (3) a tendency to neglect reporting individual outcome results, and (4) less control over within-subject variability. The importance of maintaining adequate growth in children while attempting to treat their obesity emphasizes a reliance on clinical vs. statistical significance. Treatment models which allow long-term maintenance of treatment effects need to be identified. The components included in the treatment package need to be isolated to determine the critical elements. Finally, the model should be tested by other investigators, in different settings, on a variety of subjects, to identify the extent of generality. The single-case design may be utilized to accomplish this task either through a similar multiple baseline approach, or with larger groups of subjects.

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CHAPTER I

INTRODUCTION

The ability to store fat in early times was lifesaving for human populations whose survival depended on a fine balance between sustenance and starvation. The most successful survivors were those capable of storing the greatest amount of body fat during times of food abundance which in turn provided them with a reserve of energy in times of famine (1).

Today, excessive storage of body fat is not regarded as necessary for survival but may instead be considered maladaptive. The medical term for excessive body fat is obesity (2) Adult obesity has received great attention because of its association with increased risks of morbidity and mortality (3). Obesity in children has been more recently identified as a medical problem due not only to its correlation with adult onset diseases, but also because of unique psychosocial maladjustments which may develop in the obese child (4).

The presence of obesity in children may be accurately identified through the use of height-weight tables, fatfold thickness values, and visual assessment (5-7). Current findings with respect to fat cell development indicate that early intervention, ideally prior to the adolescent growth spurt, is essential to improve the prognosis for long-term weight control (8-10). Sexual differences in the expression of obesity occur due to disparities in the actual time of body fat deposition, the percentage of total body fat, and the perception of physical appearance (11-13).

Current methods for the treatment of obesity in children include dietary control, exercise, and/or behavior therapy. The use of dietary intervention alone as a treatment approach has resulted in a low rate of success (14). In contrast, when exercise has been used in combination with dietary intervention the success rate has increased (15-20). Most recently, the treatment package consisting of behavior therapy and dietary intervention has demonstrated the greatest success rate of all (21-32). Very few investigators have studied the effectiveness of a model combining dietary intervention, exercise, and behavior therapy in treating childhood obesity, although several studies have indicated the potential for success with this approach (33).

Although programs emphasizing a behavioral treatment of obesity have been highly successful in comparison with other approaches, their effectiveness has been diminished by the presence of certain problems (32,33). Many of those problems have been associated with the predominant use of a group-comparison experimental design (32). The single-case experimental design has been used successfully in a variety of treatment programs for behavior disorders (34), although it has received minimal use in obesity treatment (35,36).

In this study, an interdisciplinary model which combined the components of dietary intervention, physical activity, and behavior therapy was employed to treat obesity in young girls aged 4-8. A multiple baseline, single-case experimental design was used to analyze the effectiveness of the treatment package.

The objectives of this study were:

1. To increase the daily activity levels of the subjects.
2. To modify the inappropriate eating habits of the subjects.

3. To demonstrate a decrease in fatfold thickness of the subjects.
4. To decrease total body weight of the subjects in relation to height, or to stabilize the rate of weight gain in relation to height.
5. To maintain a linear growth pattern in all subjects.

The following assumptions were made:

1. None of the subjects would have endogenous causes of obesity considering known limitations of a pretreatment medical examination.
2. All subjects would be of at least average intelligence as demonstrated by the Stanford-Binet or Wechsler Intelligence Test.

The following hypothesis was formulated:

1. The successful utilization of the treatment package consisting of the components of dietary intervention, physical activity, and behavior therapy will result in weight loss, or a reduction of rate of weight gain in the subjects, and in a reduction in fatfold thickness values.

CHAPTER II

REVIEW OF LITERATURE

Identification and Prevalence of Obesity

Obesity is generally described as the condition of excessive body fat (2), and is reported to be the most common health problem in the United States today (8). Epidemiologists estimate that 40 to 80 million Americans are obese (37) and that the prevalence of obesity is increasing (38). The arbitrary definitions of obesity utilized in most studies, however, preclude an accurate reporting of its incidence.

Obesity can be classified as either adult-onset or juvenile-onset according to the age at which it first occurs (8). According to Guthrie (39), juvenile-onset obesity usually occurs before the child is 10 years old. Asher estimated that 44% of all cases of juvenile obesity begin during the first 3 years of life, 20% develop in the years between 3 and 5, 25% between the years of 6 and 8, and 15% between the years of 9 and 11 (40). By late childhood approximately 30% of all American children are reported to be obese (41).

Clinical diagnosis of juvenile-onset obesity is usually determined by the use of height-weight tables and fatfold thickness measurements. Various tables have been designed for the plotting of height-weight values of children. Some of the most useful of such tables are those provided by Ross Laboratories (42).

In children, weight is a function of age and, therefore, must be evaluated on an age-specific basis. Sex differences are also a factor and must be included in the design of height-weight tables.

The Ross growth curves are designed to allow for a plotting of height, weight, and weight-for-height values that are both age-specific and sex-specific. In addition, these charts demonstrate expected growth patterns at varying percentiles according to information provided by the National Center for Health Statistics (42).

Children whose weight-for-height values exceed the 95th percentile are considered to be obese (5). The basic problem of using these height-weight tables in predicting obesity is that such comparisons imply total body weight, not fatness. The relationship of body fat to lean body mass is a distinction central to the definition of obesity (43).

The use of fatfold calipers, which provide an estimate of total body subcutaneous fat, is a more acceptable method of determining obesity in children (44). Fatfold measures may be taken at various locations on the body. According to Seltzer and Mayer (45), a fatfold measure over the triceps muscle of the nondominant arm is the most representative of total body subcutaneous fat. Subcutaneous fat represents 40-50% of total body fat in children (39).

Fatfold thickness values are compared with average values reported for age and sex which have been categorized into percentiles (6). Fatfold measurements greater than the 95th percentile are usually considered diagnostic of obesity, especially when the weight-for-height value also exceeds the 95th percentile (46).

In addition to these standardized measures of childhood obesity, visual observation has been found to be a valid method of informally identifying juvenile obesity (7).

Immediate and Long Range Risk Factors

The health risks associated with obesity in the adult years are well documented. Adult obesity has been correlated with increased risks of coronary heart disease, hypertension, diabetes, gall bladder disease, cerebrovascular accidents, and arthritis (3).

Obese children may also suffer from physical and psychological maladjustments both as an immediate and as a delayed response to obesity (47,48). Obesity in children has been associated with hyperinsulinemia, depressed growth hormone release, carbohydrate intolerance, and hypertension (49-53).

The greatest danger associated with obesity in children is related to the duration of the condition and to its long-term health consequences (40). Heald and Hollander (54) reported that overweight infants tend to become overweight children and adolescents. According to Abraham and Nordsieck (55), approximately 86% of obese boys and 80% of obese girls remain obese as adults. However, a significant correlation between weight in children and weight as adults does not occur until after age 5 (2). Stunkard and Burt (56) have estimated that the odds against an obese adolescent becoming a normal weight adult are 28 to 1.

The tendency for obese children to remain obese as adults links childhood obesity with adult health problems (55). In a study of 4,829 Iowa school children, elevated weight and triceps fatfold values were

associated with an increase in coronary heart disease risk factors (57). In another study, women reported obese as teenagers were found to have an increased risk of developing uterine cancer (58).

The immediate consequences of obesity in children take the form of social and psychological stigmatism which may have a lasting effect on the child's emotional development (4). Obese children often receive hostility and rejection from peers (4), and experience body-image distortions (59,60), poor self-concepts, and disturbed personality characteristics (47,61). The obese child may also develop unsettling family relationships (4,62).

Prognosis for Treatment

The prognosis for treatment of adult-onset obesity is very poor (8). An even lower success rate has been reported for weight reduction of obese adults who were obese as children (9,10). Some authorities believe that obesity occurring during the first 6 months of life is almost totally intractable (8,40). The negative outlook for treatment in cases of juvenile-onset obesity has been partially attributed to current theories of fat-cell development.

Theories of Adipocyte Development

The accumulation of excess calories as fat is brought about either by the formation of new fat cells (hyperplasia), by the storage of fat in existing cells (hypertrophy), or by a combination of both (63,64). There are two critical periods of hyperplasia. The first period occurs during the first year of life, and the second occurs during the adolescent growth spurt (65,66).

The number of adipocytes which are formed during these critical periods of life represent the total accumulation a given individual will have throughout life (63,65). Most authorities believe that beyond adolescence no further increase in cell number may occur (8,67).

Hirsch and Knittle (65) have suggested that fat cells triple in size during the first six years of life and then remain at a plateau until the individual is approximately age 13. Sequential data on changes in fat cell size during the years after age 13 are not available (63) although adipose cell size in adulthood has been found to be significantly greater than at age 13 (65).

It has been hypothesized that the greatest incidence of hyperplastic adipose cell development may be found in those individuals with juvenile-onset obesity, suggesting that overnutrition during the time of adipoblast proliferation will lead to a permanent increase in both cell number and size (10,68). This information suggests that obesity occurring prior to the cessation of the adolescent growth spurt results in a proliferation of the number of adipocytes. If this hypothesis is correct, weight reduction attempted after this period of adipocyte hyperplasia would result in reduction of the size of the adipose cells without reducing the adipose cell number. Theoretically, there would be a limit to the weight reduction capacity of the juvenile-onset obese individual.

Obesity in Children

Historically, weight reduction programs have been developed with the obese adult in mind. Increased recognition of the relationship

of early onset obesity and later health problems, coupled with modern theories of fat-cell development, have prompted researchers to address the problem of obesity in children. Treatment programs for obese children have principally relied on dietary intervention, physical activity, and/or behavior therapy (14, 69).

Dietary Intervention

Dietary intervention of obesity may consist of calorie restriction, nutrition education, or both. The success of obesity treatment programs using dietary intervention alone is very poor. Coates and Thoresen (14) presented a review of several studies which used a dietary approach alone and concluded that while dietary intervention may show short-term results it is ineffective in long-term weight management.

Dietary intervention of obesity in children is further complicated by the need to reduce body fat without impairing the normal growth and development processes (2). Some reports indicate that the maintenance of a constant body weight with an increasing ratio of lean body mass (LBM) to body fat with normal linear growth is the desired result (2). An acceptable daily diet for weight reduction in a pre-adolescent should include a minimum of 1200 kilocalories with an adequate amount of protein (59).

Physical Activity

Several investigators have reported increased success in treating obesity with programs combining an exercise regime with dietary management (15-20). Exercise has been shown to result in a greater loss of adipose tissue and a smaller decrease in lean body mass than occurs with dieting alone (70).

The observed decrease in adipose tissue was the result of a decrease in the size of the adipose cells while the total number of cells was unaffected (63). In both humans and rats, dietary manipulation does not appear to affect adipose cell number (63). At least one study, however, has demonstrated that exercise begun early in life retarded the development of fat cell multiplication during the growth period (71). These findings suggest that while regular exercise begun early in life may reduce the number of fat cells, exercise and weight reduction later in life will result only in a reduction in cell size (63).

Additional benefits of exercise to the obese individual have been proposed. Exercise has been demonstrated to regulate food intake (72, 73), increase adipocyte response to insulin (74), improve glucose tolerance (75), increase physiological efficiency of work and improve cardiovascular conditioning (70), and enhance self-concept (70,76).

While it is clear that a program combining exercise with dietary restriction will be of greater benefit to obesity reduction than dietary intervention alone, the question still remains as to what type of exercise is appropriate and of what duration and intensity it should be. In general, there are two ways in which exercise may be incorporated into everyday life (70). The first involves the use of nonmeasurable changes in daily occupational and routine activities. The second way concerns participation in some form of regular recreational activity or sport.

In the absence of clear-cut information on the exact type and amount of exercise which will optimally benefit a given obese individual, it is best to focus on prescribing a form of activity which will be suitable for an individual and which has a high probability of long-term

compliance (75). In conclusion, although dietary management and exercise have been used with some degree of success in obesity treatment, a major problem with their use has been in maintaining long-term weight reduction.

Behavior Therapy

The most successful obesity treatment programs to date have added behavior change strategies to the components of dietary intervention and physical activity (33). Behavioral approaches to obesity treatment rely on the principles of social learning theory (14). According to this theory, many behaviors are learned and maintained through an interaction between the individual and the natural environment (77). Eating and exercise behaviors are responsible for establishing and maintaining the obese condition, therefore, a successful treatment approach must include strategies to alter behavior patterns of food intake and energy expenditure. This can be accomplished by modifying specific variables in the individual's natural environment (14,78).

Behavioral Treatment of Obesity

Stated simply, the behavioral treatment of obesity relies on four principles (63,79):

1. A description of the behavior to be modified.
2. The development of techniques to modify and control the inappropriate behavior.
3. The substitution of alternative, acceptable behaviors to replace the inappropriate behavior.

4. The provision of prompt reinforcement or reward for appropriate behavior.

The application of these principles to obesity treatment programs for adults has been used with varying degrees of success for many years (79,80). Studies utilizing behavioral techniques for the control of childhood obesity have been slower to develop (21-31,81). The results of those studies have indicated that a treatment approach combining the behavioral techniques of self-monitoring, stimulus control, and positive reinforcement has the greatest chance of success in a clinical setting.

Self-Monitoring

Self-monitoring involves instructing the subject to observe and record key factors related to obesity, such as body weight, food intake, physical activity, and caloric consumption (33,82,83). The records are usually kept on a daily basis and may include the environmental and emotional circumstances affecting the monitored behavior (33,83).

Self-monitoring is useful in assessing individual problem behavior patterns and in providing feedback to the subject about treatment progress (83). More importantly, the very act of self-monitoring has been found to have an initial reactive effect of producing behavior change (83,84). Over a longer period, additional behavioral procedures are necessary to sustain therapeutic gains (82,84).

Stimulus Control

Stimulus control, also called environmental management, relies on the principle that obese individuals are highly responsive to external

cues for food intake (83). Once these cues have been identified, they can be controlled or eliminated from the immediate environment. This reduces the likelihood of stimulating inappropriate food intake (33).

Some examples of this procedure include limiting the accessibility of high-calorie foods, removing food from all places in the house except the kitchen, eating each meal at the same place, removing excess food from the table, and slowing the rate of eating (82,83). This procedure has been found to be particularly valuable in programs for children since it encourages the establishment of desirable eating habits essential for long-term weight control (33).

Positive Reinforcement

Positive reinforcement assumes that a behavior producing favorable consequences will increase in frequency (83). For the obese individual, the positive consequence of inappropriate eating habits is immediate (i.e., pleasure in the taste of the food). To change this behavior it is necessary to set up a substitute system of highly favorable immediate rewards for appropriate eating behavior (83).

Behavioral obesity treatment programs of children use two types of rewards: social rewards (e.g., praise, approval), and tangible rewards (e.g., money, toys, activities). The social rewards usually occur informally and spontaneously as the program professionals, family members, and friends observe behavior change. Individuals may also be trained in the systematic use of social rewards (82,83).

Tangible rewards are generally distributed under a formal system, such as a contingency contract or other forms of written agreements (33,83). In the contingency contract, a specified reward

is earned or forfeited contingent upon whether or not the subject makes an agreed upon behavior change (82). The effectiveness of this procedure appears to be directly related to the promptness with which the reward is given (33).

Family Involvement

The role of the family in the treatment of obese children is an unresolved issue. While several studies have demonstrated weight loss in children whose parents were involved in the program (25-30), only one study investigated the effectiveness of the involvement specifically (31). Even without conclusive evidence in this area, it is generally felt that the involvement of family members in obesity treatment programs for children is desirable (14,33).

Family members can take an active role in providing immediate reinforcement for desired behavior changes. In addition, the family can be taught to model appropriate behaviors. Finally, since the child's opportunities for food intake and exercise are largely under parental control it is imperative to assure their cooperation in planning the child's program (14,33).

Obesity usually follows a family line. In the family of an obese child one or more members may also be obese (85). Several investigators have suggested that this is a product of social learning rather than a genetic phenomenon (85-88). This learning is a result of interpersonal interactions between the child and the family (85). An obesity treatment program emphasizing a strong behavioral approach might change this interaction so that it will support the learning of appropriate eating and exercise behaviors.

Current Treatment Outlook

A review of current treatment approaches to childhood obesity was published by Coates and Thoresen (14). Several recommendations for improved treatment success were listed which show considerable merit:

1. Discontinuing the use of treatment approaches already proven to be unsuccessful.
2. Continuing to treat subjects in some systematic way during a follow-up period.
3. Widening the perspective of variables considered important in influencing eating and activity patterns.
4. Involving family members directly in treatment.
5. Using strategies to support appropriate eating and exercise habits outside of regular treatment sessions.

Foreyt (89) has suggested that a treatment package combining behavior modification, nutrition education, and physical activity would have the greatest probability for success. Cohen and co-workers (90) also reported a high degree of long-term weight loss maintenance in children using a combination of self-regulatory practices and physical activity.

These recommendations were the basis for the treatment approach utilized in the present study.

CHAPTER III

METHODS OF RESEARCH

Subjects

Subject Selection Procedure

Subjects were recruited for the study in two ways. First, all local pediatricians listed in the Knoxville telephone directory were contacted by a call from the principal investigator. A brief description of the study was given and the pediatrician was asked to make referrals of potential subjects. Second, an advertisement for the study was printed in the University daily newspaper, The Daily Beacon, inviting calls from persons having information about potential subjects (Appendix A).

Physician referrals or respondents to the advertisement were told the project objectives over the telephone and invited to attend an introductory meeting to learn more about the study. They were informed that attending the meeting would not commit them to participating in the project.

Introductory meeting. The introductory meeting and all subsequent meetings were held in the College of Home Economics under the supervision of the Project Director (PD) and the Principal Investigator (PI). During the introductory meeting, the project was explained to potential participants according to guidelines established by the University Human Subjects Committee (Appendix B). Copies of the consent form (Appendix C)

and contract form (Appendix D) were distributed for investigation and the potential participants were given an opportunity to ask questions.

Information cards (Appendix E) were completed on all potential participants who expressed a desire to participate in the study. Parents were informed that it was their responsibility to secure a physician's examination of their child. They were advised that a letter would be mailed to each designated physician within the following week to inform them of the purpose of the examination. It was explained that physician approval must be received before the subject selection procedure could continue.

Physician contact. Each designated physician was sent a packet of information containing the following items:

1. A letter stating the purpose of the examination (Appendix F).
2. A journal article describing the physician's role in identifying the cause of the obesity (10).
3. An abstract of the project (Appendix G).
4. A physician approval form (Appendix H).

Evaluation meeting. As each physician approval form was received by the PI the potential participants were contacted to attend a second meeting to further evaluate their appropriateness for inclusion in the study. During that meeting, the child's height, weight, and fatfold measures were taken by the PD. The weight-for-height percentiles were determined by a plot of the value on a Ross Laboratories growth chart (Appendix I). The percentile of the fatfold values was determined by comparison with standards given by the Ten-State Nutrition Survey (Appendix J).

All potential subjects whose fatfold and weight-for-height values were above the 95th percentile were asked to verbally state their desire to participate in the program. The parents of potential subjects meeting the above criteria were asked to sign a consent form with the PI. A second evaluation meeting was set with all potential participants who had thus far met the conditions for inclusion in the program.

Second evaluation meeting. All potential subjects attending a second evaluation meeting were given either the Stanford-Binet or Weschler Intelligence Test depending on their age. Height, weight, and fatfold measures were also taken on each child by the PD at this and each subsequent meeting. All potential subjects who were determined to be of at least average intelligence and who had met all previous criteria were accepted as subjects for the study.

Subject Characteristics

A total of 11 responses were received for potential participants: 8 from physician referrals, and 3 from the newspaper advertisement. Of the original 11, 1 withdrew because of a transportation problem, 5 withdrew due to the child's lack of interest, and 2 were eliminated because of advanced age (> 13). Two additional physician referrals were received late in the study and were, therefore, not included.

Three girls, 4 to 8 years old, were selected as program participants. Relevant characteristics of the subjects are summarized in Table 1. All subjects shared certain characteristics: (1) they were all clinically obese as indicated by weight and fatfold measures; (2) all expressed a desire to lose weight; (3) none had obese siblings, but one or both parents were obese; and (4) the mother of each subject was the primary family member attending meetings.

Table 1

Subject Characteristics

Variables	Subject 1	Subject 2	Subject 3
Age	8 years	4 years	4 years
Initial weight (%tile)	62 kg (95+)	32 kg (95+)	29 kg (95+)
Initial height (%tile)	141.5 cm (95+)	117 cm (95+)	108.2 cm (75-90)
Initial fatfold (%tile)	42 mm (95+)	23 mm (95+)	26 mm (95+)
Race	white mother; black father	white	white
Weight status of family members (according to mother)	Normal wt. mother; obese father; normal wt. younger male sibling	Obese mother; obese father; normal wt. older male sibling	Obese mother; obese father
Birth weight (%tile)	7 lbs 15 oz. (90)	6 lbs 12 oz (25-50)	8 lbs 15 oz (95+)
Birth length (%tile)	21 in (95+)	21 in (95+)	21.5 in (95+)
Family member(s) attending meetings	Mother, younger brother, occasionally "stepfather"	Mother, older brother	Mother, grandmother

Table 1 (continued)

Variables	Subject 1	Subject 2	Subject 3
Family marital situation	Mother unmarried living with father of younger sibling	Intact family	Parents divorced; subject living with mother
Age of appearance of overweight (according to mother)	Birth	Age 3 years	Age 3 years
Main reason for obesity (according to mother)	Eats the wrong foods	Snacking	Eats the wrong foods
Intelligence test results	(WISC-R) Verbal 101 Perfor. 84 Full 91	(S-B) CA 4-9 MA 5-9 IQ 122	(S-B) CA 4-5 MA 4-9 IQ 107

Some differences among the three subjects existed: (1) subjects 2 and 3 were approximately 4 years old while subject 1 was 8 years old; (2) subjects 2 and 3 were white while subject 1 was of a mixed racial background (white mother, black father); (3) subjects 2 and 3 were of above average intelligence according to test scores, while subject 1 received an average score; (4) subjects 2 and 3 were reportedly overweight since age 3, while subject 1 was reported to have been overweight since birth (however, this was not supported by birth weight and length values); (5) subjects 1 and 3 were living in disrupted family situations, while subject 2 lived in an intact family; and (6) the mothers of subjects 1 and 3 reported "eats the wrong foods" as the main reason for obesity, while the main reason given for subject 2 was "snacking."

Contract meeting. Following acceptance into the program, each program participant attended a meeting to sign a contract with the PI and to arrange for payment of the monetary deposit. A Nutrition Questionnaire and Diet History Form (Appendix K) was also completed at this time. The contract and monetary deposit were later omitted from the study because of the tendency for participants to withdraw as a result of the expressed hardship of making the deposit.

Measures

The subjects were weighed on a 350 pound capacity standard model fulcrum scale (Continental Scale Corp., Chicago, IL) which had been calibrated for accuracy during the study by a professional scale service. Measurements were rounded to the nearest quarter pound. Heights were measured to the nearest millimeter using a wall-mounted height calibrator

and headboard. Triceps fatfold measures were taken using a Lange Skinfold Caliper (Cambridge Scientific Instruments) which was calibrated against a standardization gauge included in the kit prior to each measurement. Values were rounded to the nearest half millimeter. All measures were made in triplicate and the average value was used. Measurement procedures followed guidelines issued by the Tennessee Department of Public Health (84).

Formulas

Body weight was analyzed in terms of pounds lost, reduction in percent overweight, weight reduction index (RI), and a weight-for-length index according to the recommendations of Hall and Hall (85), Jeffrey (86), Coates (36), and Durant and Linder (87).

Pounds lost. Pounds lost refers to changes in body weight from the final baseline measure.

Reduction in percent overweight. Percent overweight was determined using formula 1.

$$\frac{\text{Actual weight} - \text{50th percentile weight}}{\text{50th percentile weight}} \times 100. \qquad (1)$$

The 50th percentile weights were taken from a Ross Laboratories growth curve (42) for a child of the same age and sex. Reduction in percent overweight was calculated by subtracting each week's percent overweight from the percent overweight at the final baseline meeting.

Reduction index. Feinstein's (88) weight reduction index (RI) was calculated using formula 2.

$$RI = \frac{Wl}{Ws} \times \frac{Wi}{Wt} \times 100 \qquad (2)$$

or

$$RI = \frac{\text{Pounds lost}}{\text{Surplus weight}} \times \frac{\text{Final baseline weight}}{\text{50th percentile weight}} \times 100.$$

Surplus weight refers to the difference between the actual weight and the 50th percentile weight.

Weight-for-length index. The weight-for-length index is a ratio of a child's actual weight over the actual height to the expected weight over the expected height. The expected weight and height are the 50th percentile standards for age and sex from the growth charts (42). Formula 3 was used in computing these results.

$$WLI = \frac{A}{B} \times 100 \qquad (3)$$

where

$$A = \frac{\text{Actual weight (kg)}}{\text{actual height (cm)}}$$

$$B = \frac{\text{50th percentile expected weight (kg) for age}}{\text{50th percentile expected height (cm) for age}}.$$

Behavioral Changes

Behavioral changes of the individual subjects were determined nonquantitatively from information provided by participant self-report and investigator observations. Sources of self-reported behavior change included: 1) the initial nutrition questionnaire and diet history form; 2) daily food intake and activity records; and 3) participant verbalizations.

Experimental Design

A single-case experimental design utilizing a multiple baseline, across subjects format was employed in the study (34). The design consisted of two phases: 1) baseline (A), and 2) treatment (B). The baseline phase varied in length from one subject to the next. Treatment was then applied in sequence to subjects. Experimental control was established by observing the trend of a plot of dependent measures of weight and fatfold over time from A phase to B, and across subjects.

Procedure

Baseline

The baseline phase for Subjects 1, 2, and 3 lasted 3, 4, and 5 weeks, respectively. This phase consisted of weekly measures of height, weight, and fatfold taken during the subject screening process and before any active treatment was initiated. Subjects were instructed not to attempt to alter their eating and exercise habits during this phase. Baseline measures were continued until a reasonably stable pattern of dependent values was apparent, based on examples of stability provided by Hersen and Barlow (34).

Treatment

The treatment phase consisted of the introduction of a multicomponent treatment package to the subjects during individual meetings. Initially, the meetings were held weekly, and then less frequently as treatment results became apparent. Treatment lasted 17, 16, and 15 weeks for Subjects 1, 2, and 3, respectively. The treatment

package included the major components of dietary intervention, physical activity, and behavior therapy. Specific techniques were utilized to implement each of those components. The interaction of the major components and their techniques is demonstrated in Figure 1.

The diagram presents behavior therapy as the most critical component of the treatment package in recognition of the fact that it encompasses the other two major components. The behavioral techniques of environmental management, self-monitoring and reinforcement were carried out by employing the techniques of dietary intervention and physical activity. Self-monitoring was implemented through the use of daily food intake and activity records (Appendixes L and M). The food intake forms provided information about the type and amounts of food consumed and the social or environmental factors contributing to the intake. Activities listed on the daily activity records were assigned a point value according to their ranking as heavy, moderate or light exercise. The rankings were determined by a calculation of the approximate number of calories expended per minute with each activity (63). The information gathered from those forms was used to determine appropriate ways in which the environment could be managed in order to stimulate change. A plan of reinforcement for desired change was then described on a separate form (Appendix N) using the information provided by the daily records.

The daily records also provided an indication of what specific nutrition or activity educational information was needed by a given individual. Educational information was furnished through the use of audio-visual materials, handouts, individual meetings, and modeling.

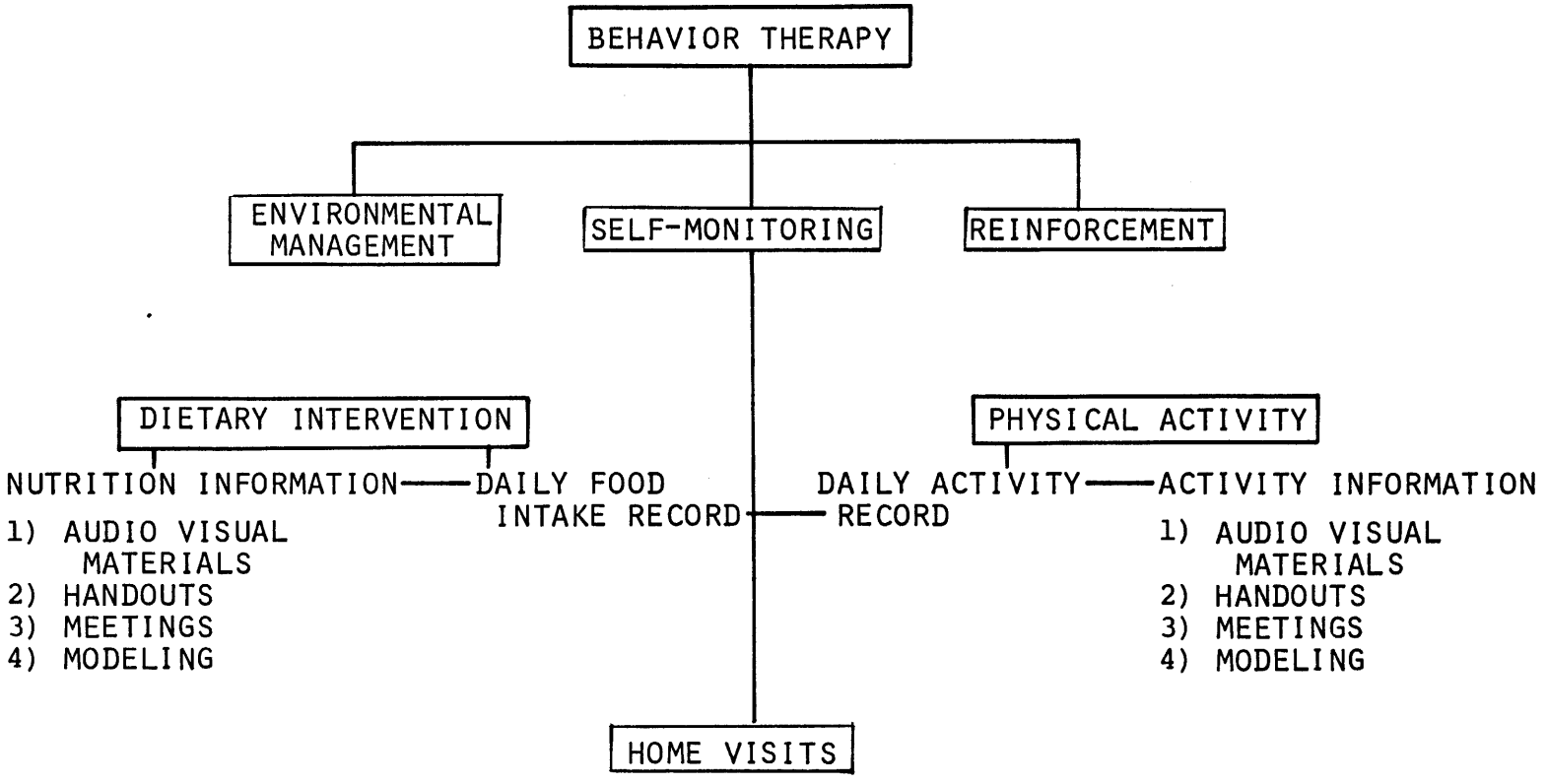


Figure 1. Treatment Package.

The technique of home visits is listed separately from any one major treatment component because, as the diagram indicates, it is an extension of all of the components.

Treatment sessions. The general format of a treatment session involved the following: 1) subject and mother arrived at the meeting site at the scheduled time and were greeted by the PD and PI; 2) the subject and PD went to the measuring room to complete height, weight, and fatfold measures; 3) at the same time, the parent and PI met in an office to discuss the information collected on the daily food intake and activity forms and other pertinent information about the child's progress; 4) when the measures were completed, the PD and subject joined the PI and parent; 5) at that time the results of the measuring session were discussed in relation to the information provided on the daily records; 6) the PI then aided the parent and subject in setting a goal for the following week and selecting a reward for meeting the goal; 7) parent and child were finally provided some form of educational information either separately or together.

The treatment sessions lasted from 20 to 45 minutes. Frequently, other family members would attend the sessions in which case they were involved in the activities to the extent judged appropriate by the PI. The specific format of the individual treatment sessions is outlined in Table 2. Appendix O presents a more detailed explanation of each activity. The numbers beside the activities refer to their location in the appendix. Numbers including the letter a indicate that the activity was for the subject only, while numbers with the letter b involved the parent only. Numbers without letters included both parent and subject.

Table 2

Description of Individual Treatment Sessions

Week	Activities		
	Subject 1	Subject 2	Subject 3
1	"The Snacking Mouse" (1)	"The Snacking Mouse" (1)	"The Snacking Mouse" (1)
2	Food groups game (2a) Food fads quiz (2b)	Food groups game (2a) Food fads quiz (2b)	No meeting
3	"Nutritional Needs of Your Body" (3)	"Nutritional Needs of Your Body" (3)	No meeting
4	"How to Diet Sensibly" (4)	"How to Diet Sensibly" (4)	Food groups game (2a) Food fads quiz (2b)
5	No meeting	No meeting	"Nutritional Needs of Your Body" (3)
6	No meeting	"Fun with Good Foods" (5a); "Shaping Up for the Long Run" (5b)	No meeting
7	"Fun with Good Foods (5a); "Shaping Up for the Long Run" (5b)	"The Physiology of Exercise" (6a); Walk (6b)	No meeting
8	"The Physiology of Exercise" (6a); Walk (6b)	No meeting	"How to Diet Sensibly" (4); Home visit
9	No meeting	"Your Exercise Program" (7)	No meeting

Table 2 (continued)

Week	Activities		
	Subject 1	Subject 2	Subject 3
10	"Your Exercise Program" (7)	No meeting	"Fun with Good Foods" (5a); "Shaping Up for the Long Run" (5b); Home visit
11	No meeting	Home visit (8)	No meeting
12	Home visit (8)	Modeling (9)	"The Physiology of Exercise" (6a); Walk (6b); "Your Exercise Program" (7); Home visit
13	Modeling (9)	No meeting	No meeting
14	No meeting	"Fast Food Calories" (10)	"Fast Food Calories" (10) Home visit
15	"Fast Food Calories" (10)	No meeting	Modeling (9); Certificates (11) Begin follow-up
16	No meeting	Check-in meeting; Certificates (11) Begin follow-up	
17	Check-in meeting Certificates (11) Begin follow-up		

The introduction of the activities was consistent across subjects with the exception of home visits. During the 7th treatment week, Subject 3 expressed a need to withdraw from the study because of the financial burden of travel to the meeting site. To avoid losing this subject, the PD and PI elected to complete the treatment program by making regular home visits.

Additional Program Features

Physician progress report. A progress report (Appendix R) was mailed to the designated physician of each subject once a month during the treatment phase. This report included a comparison of initial and current values for height, weight, and fatfold, as well as general comments about the subject's progress in the study.

Evaluation form. A program evaluation form (Appendix S) was sent to each parent participant upon completion of the active treatment phase of the project. The evaluation form provided a vehicle for participant reaction, and aided the PI in planning an individualized approach to subject follow-up.

Follow-up. At the final meeting of the treatment phase, participants were advised that the subject's progress would continue to be followed by the PD and PI for at least one year. They were informed that the methods of follow-up would include telephone contact, use of home scales and a weight chart, and booster sessions. They were reassured that every effort would be made to aid the subject in continuing and maintaining treatment success. They were also encouraged to make use of the techniques and procedures learned during the project to work with their child at home.

CHAPTER IV

RESULTS

Dependent Measures

Body Weight Changes

Figures 2, 3, and 4 demonstrate weight changes of each subject by weeks. Weeks when no meeting was held are indicated by a broken line. These figures illustrate that each of the subjects responded favorably to the treatment program in terms of pounds lost, reduction in percent overweight, and a weight reduction index.

Subjects 1, 2, and 3 lost 4.75, 1.75, and 5.50 pounds after 17, 16, and 15 weeks of treatment, respectively. When weight loss was presented in terms of reduction in percent overweight, Subject 1 showed a reduction of 9%, Subject 2, 5%, and Subject 3, 16%. The weight reduction index indicated that Subject 1 received a score of 14.80, Subject 2, 10.15, and Subject 3, 40.19.

General observations. Some general observations may be made about weight change of each subject during the study. All of the subjects showed an increase in body weight during the baseline period, followed by an immediate decrease when treatment was initiated. The decrease occurred consistently for 4 weeks in Subjects 1 and 2, and for 5 weeks in Subject 3. Subjects 1 and 3 did not attend meetings for the next two weeks and Subject 2 failed to attend for 1 week. An increase in weight was observed in all subjects following this time off. The increased weight exceeded the final baseline measure in Subject 2 and

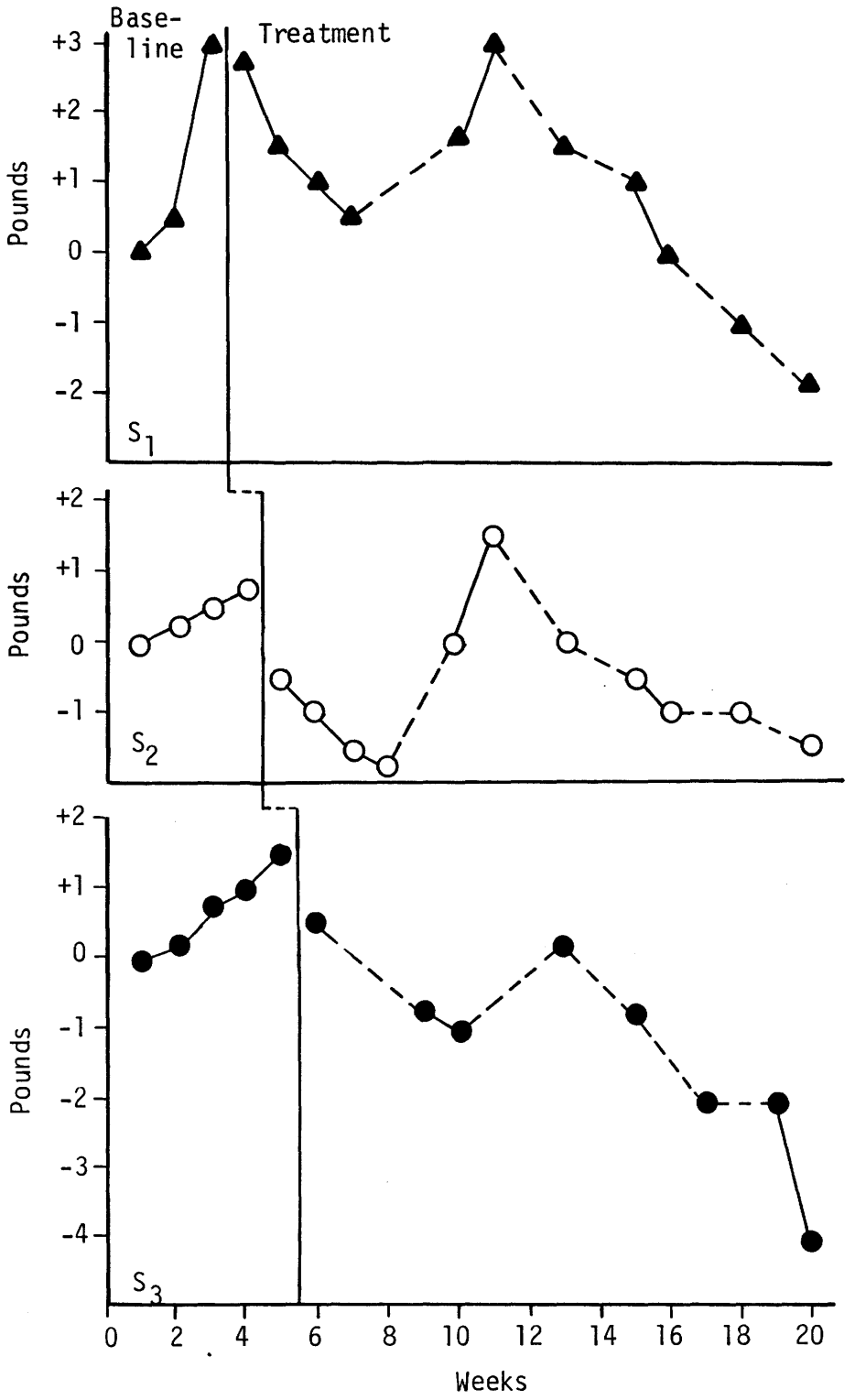


Figure 2. Pounds Lost Across Subjects. Dotted Lines Indicate Sessions Missed.

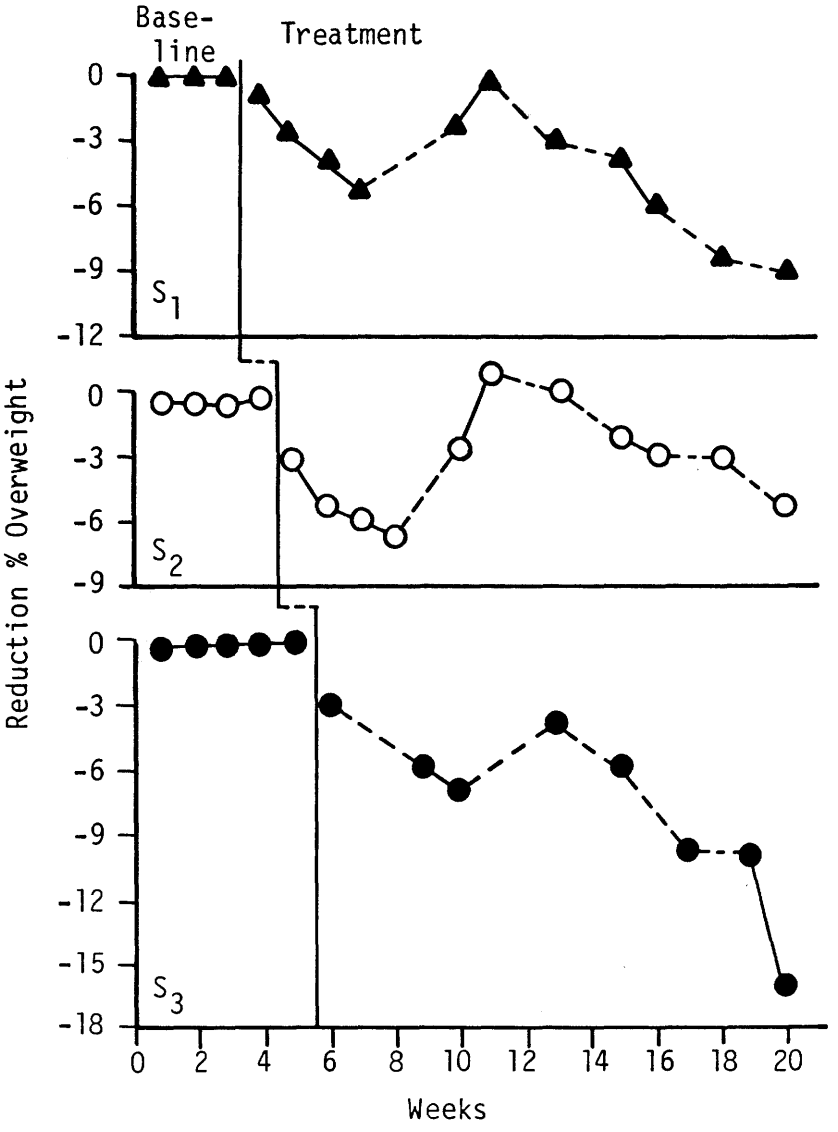


Figure 3. Reduction in Percent Overweight Across Subjects. Dotted Lines Indicate Sessions Missed.

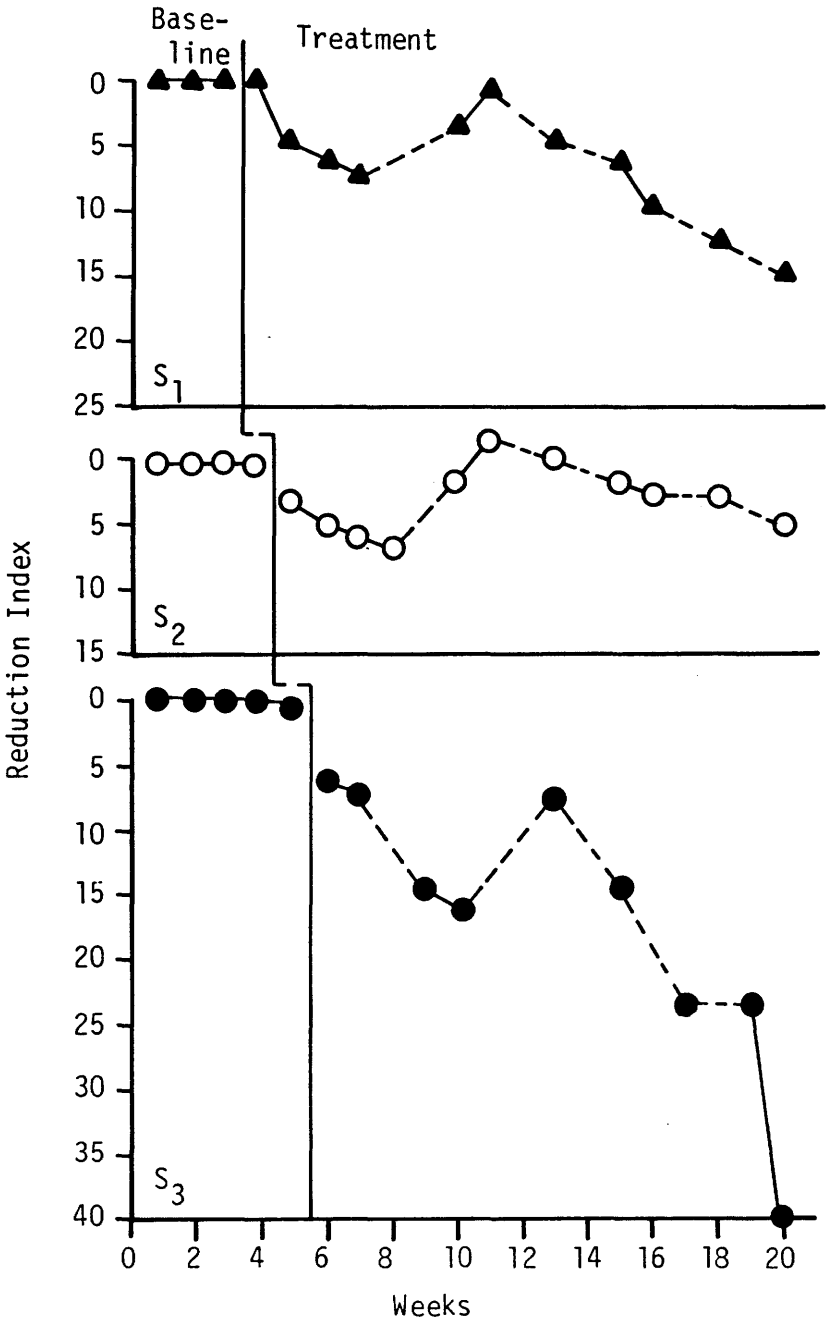


Figure 4. Reduction Index Scores Across Subjects. Dotted Lines Indicate Sessions Missed.

paralleled that value in Subject 1. The increase exceeded the initial value in all subjects.

Figure 2 shows the weight decrease in each subject from baseline to treatment. It also demonstrates that weight loss occurred in treated subjects while weight continued to increase in subjects still in baseline. It was reported previously that Subjects 1 and 3 failed to attend meetings for 2 weeks early in the study and that Subject 2 did not attend a meeting for one week during this same time period. These absences were followed by a weight increase in each subject. In contrast, when time off from meetings occurred as a part of the treatment process, weight loss continued in each subject.

The weight changes demonstrated by Figures 3 and 4 indicate that early in treatment Subjects 2 and 3 reversed their patterns of response from that observed in Figure 2. By the end of treatment, however, their rank order of response paralleled Figure 2.

Fatfold Changes

Weekly fatfold changes by subjects are presented in Figure 5. The results demonstrate that a slight increase in fatfold occurred during baseline in all subjects, followed by a return to the initial value during the first week of treatment. Subject 1 continued to show a decrease throughout treatment with periods of plateau occurring from weeks 6-7, 10-11, 15-16, and 18-20. Subject 2 exhibited a more sporadic pattern of change including a plateau from weeks 5-7 and 13-15, a decline between weeks 7-10 and 15-20, and an increase from weeks 10-13. Subject 3 showed a fairly steady decline in values with one period of plateau occurring from weeks 9-13.

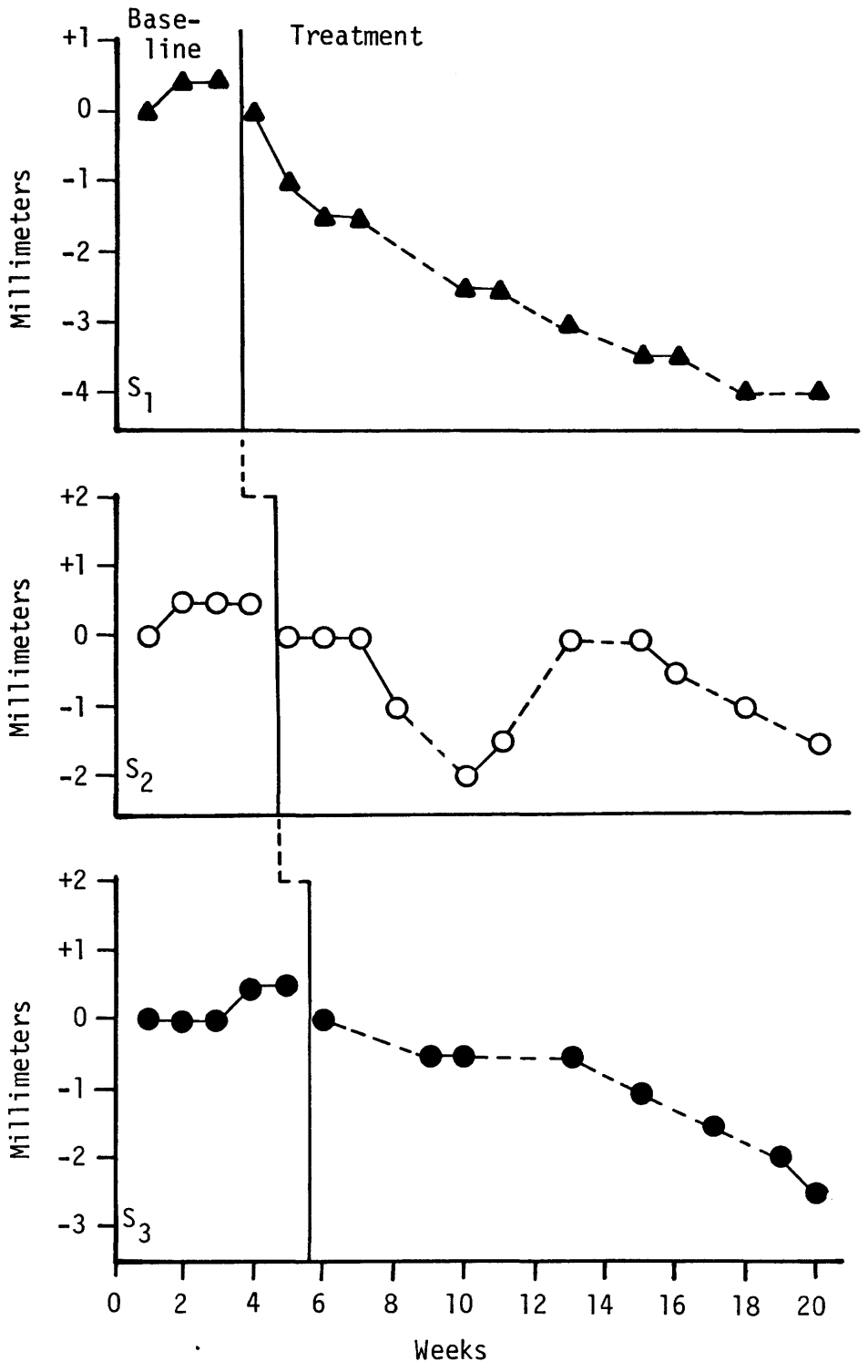


Figure 5. Fatfold Changes Across Subjects. Dotted Lines Indicate Sessions Missed.

When fatfold changes were compared with weight changes for each subject (Figure 6) additional observations can be made. With Subject 1 the changes appear unrelated to each other beyond week 7 when the weight was observed to increase without a parallel increase in fatfold. In addition, the fatfold changes were much more pronounced than the weight changes in this subject.

In Subject 2 the results were more closely related. Fatfold is shown to increase following an increase in weight. By the end of treatment the two measures demonstrated an equivalent change. The results from Subject 3 follow the most similar pattern throughout treatment, although at the end of treatment weight change showed a greater decline than fatfold. When the subjects were ranked in order of total loss in fatfold, Subject 1 appeared to have the greatest response to treatment (4.5 mm), followed by Subjects 3 (3 mm) and 2 (2.5 mm). This order of response differed from the ranking previously reported for weight change although Subject 2 continued to have the least response.

Height Changes

Figure 7 presents the changes in height for each subject during the study. Subject 1 increased in height 1.3 cm, Subject 2, 1 cm, and Subject 3, .9 cm. All subjects maintained a pattern of linear growth throughout the study. The graph indicates that changes in height were unaffected by treatment.

Weight-for-length index. The results of calculating the weight-for-length index are presented in Figure 8. Durant and Linder (87) have reported that children scoring between 90 and 109 are considered in the normal range; scores of 89 or below are classified

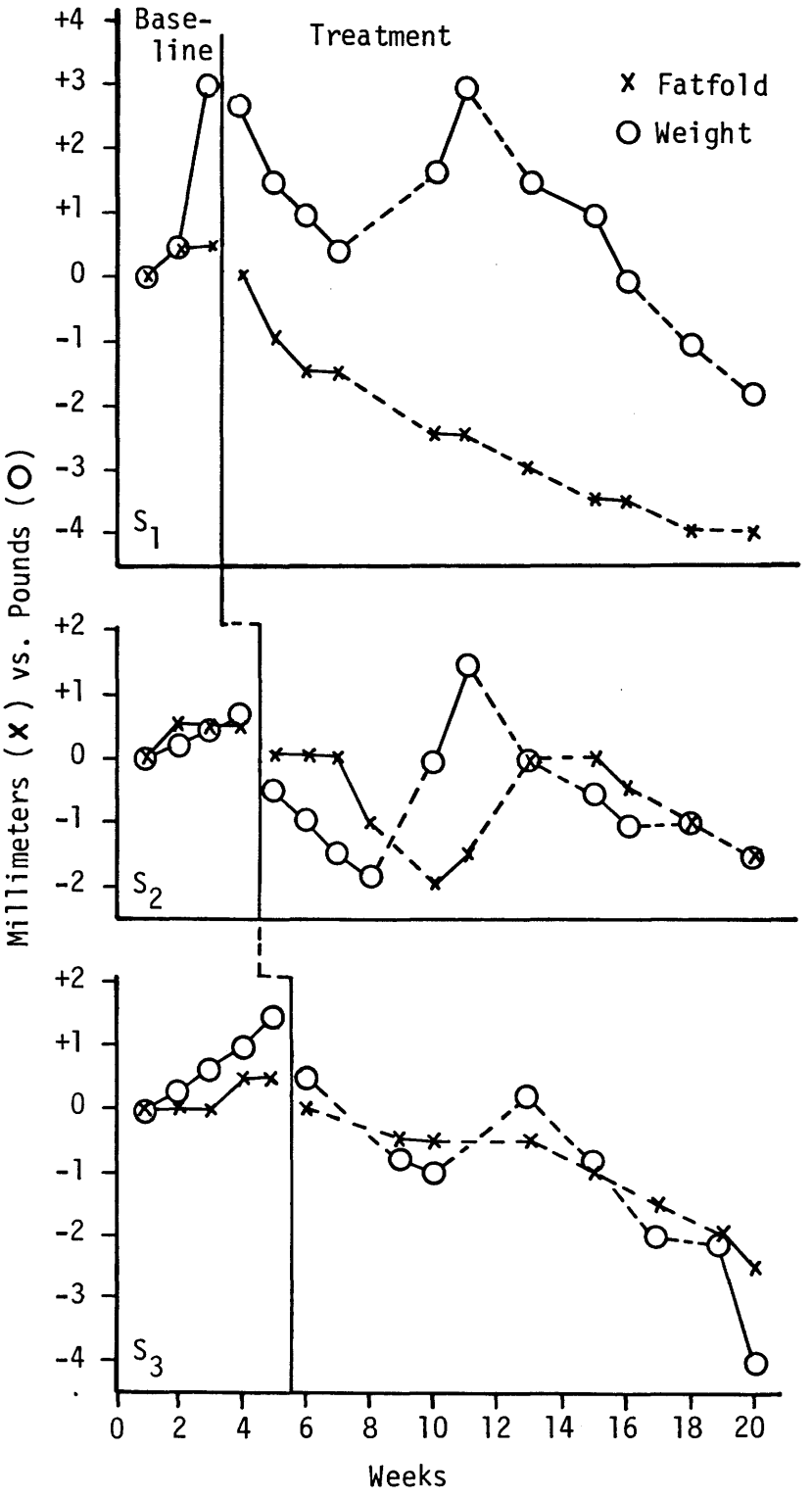


Figure 6. Fatfold vs. Weight Changes Across Subjects. Dotted Lines Indicate Sessions Missed.

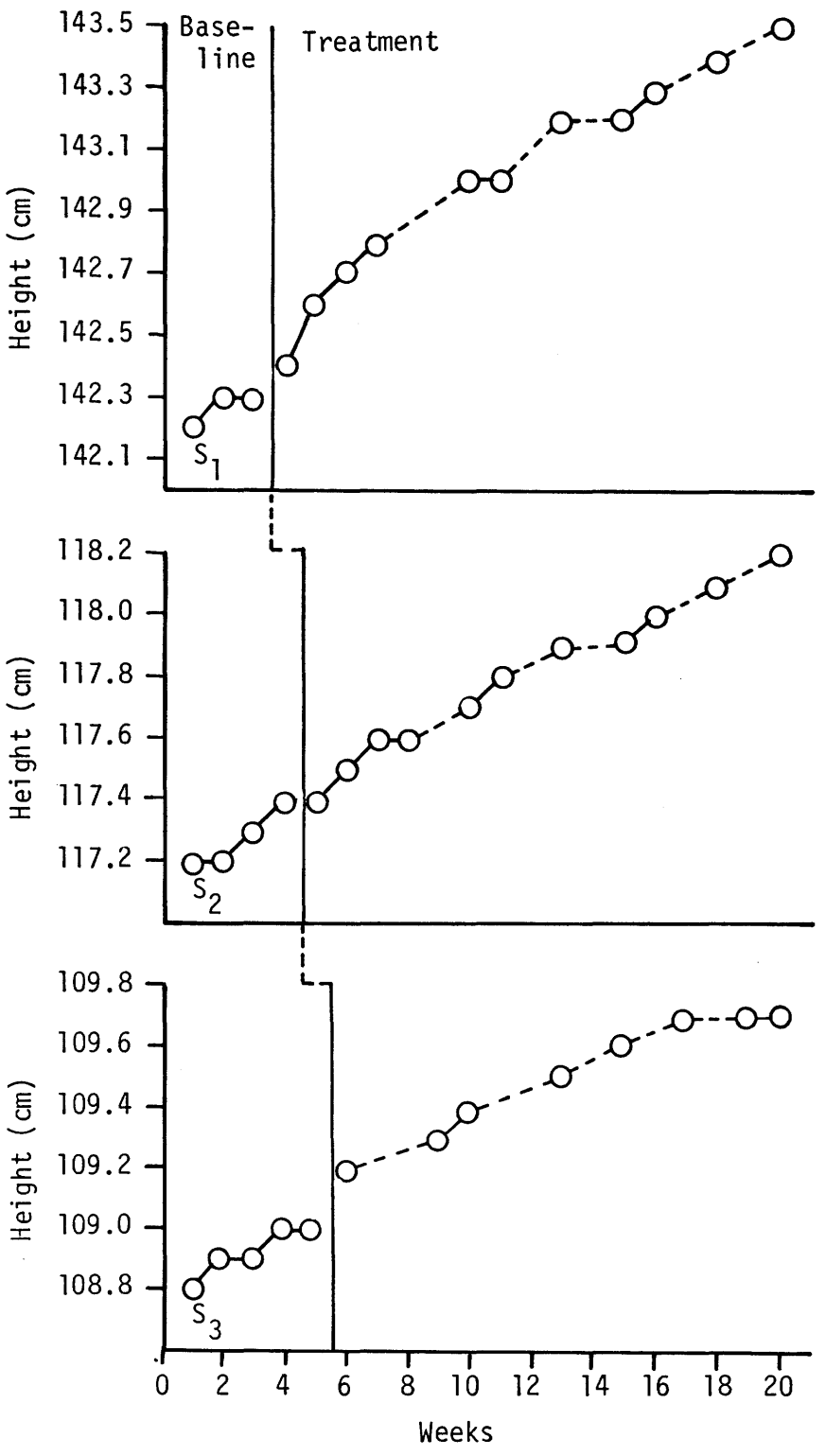


Figure 7. Height Changes Across Subjects. Dotted Lines Indicate Sessions Missed.

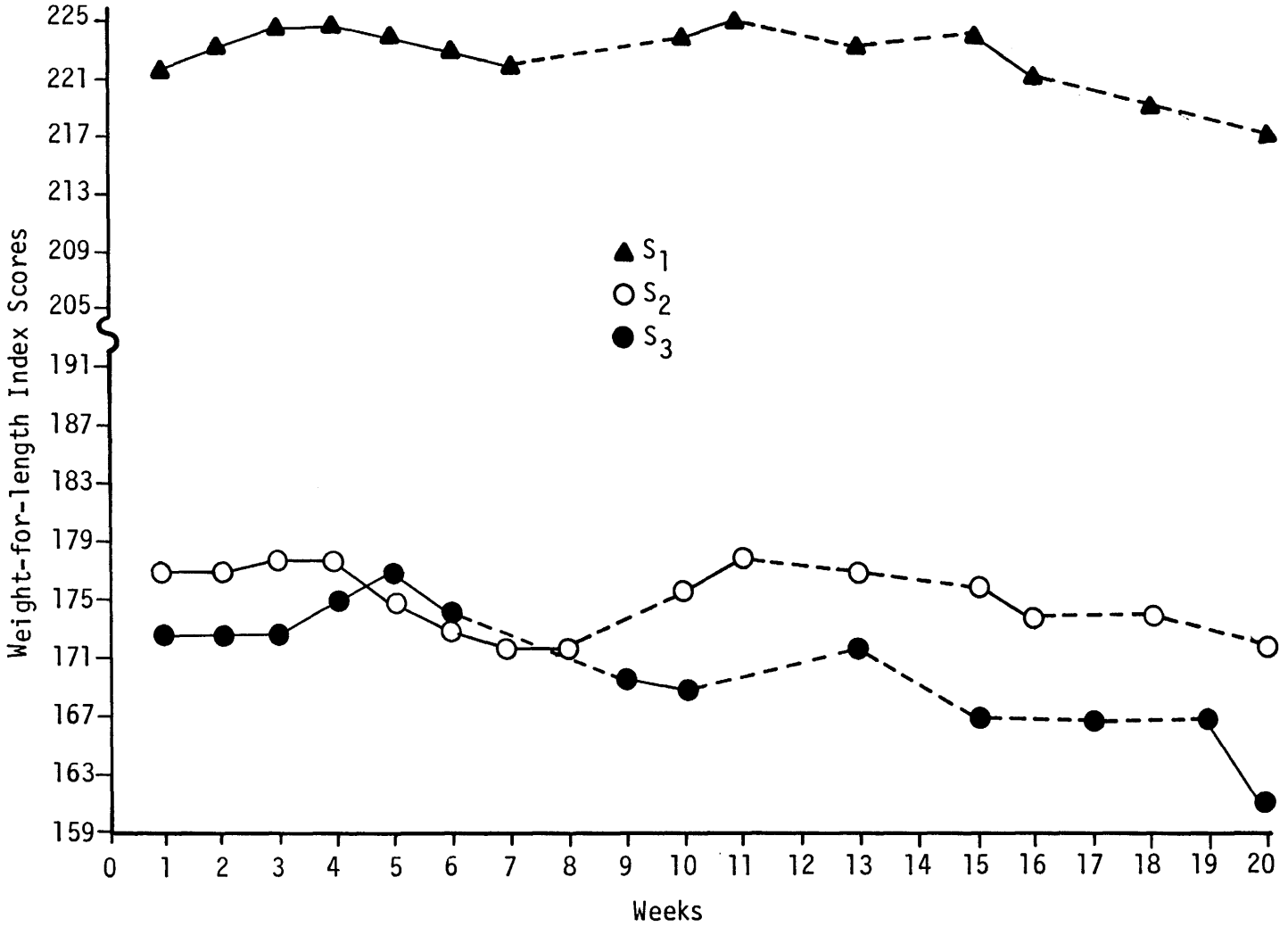


Figure 8. Weight-for-length Index by Subjects. Dotted Lines Indicate Sessions Missed.

thin or underweight; scores of 110 to 119 indicate overweight. Children scoring 120 or above are considered obese.

All 3 subjects of this project scored above 120 on the weight-for-length index throughout the study. Using the above classification system, these subjects were obese at the beginning of the study and remained obese throughout. Figure 8 indicates that Subject 1 was considerably more obese than the other two subjects. The scores for Subjects 2 and 3 demonstrated a closer relationship but Subject 3 received a lower score both at the beginning and the end of the project. All of the subjects decreased their index score during the study. The index score of Subject 1 declined 9 points, Subject 2, 4 points, and Subject 3, 16 points.

Summary of Results from Dependent Measures

The overall results from the dependent measures indicate that all of the subjects responded favorably to treatment with respect to changes in weight and fatfold. Table 3 ranks the subjects according to their order of response to each of those measures with the first ranked subject showing the greatest response. The table demonstrates that Subject 3 showed the most favorable response in terms of weight change measures, while Subject 1 responded with the greatest decrease in fatfold.

Behavioral Changes

Sources of information on changes in eating and exercise behaviors of the individual subjects included both self-reported changes and investigator observations.

Table 3

Rank Order Responses to Dependent Measures

Rank Order	Decrease in Fatfold Measures	Reduction in Percent Overweight	Reduction Index	Total Pounds Lost	Weight-for-Length Index
1	Subject 1	Subject 3	Subject 3	Subject 3	Subject 3
2	Subject 3	Subject 1	Subject 1	Subject 1	Subject 1
3	Subject 2	Subject 2	Subject 2	Subject 2	Subject 2

Self-Report

Nutrition questionnaire and diet history form. Table 4 presents a summary of the behavioral changes reported by the parents on the nutrition questionnaire and diet history form. Subject 1 reportedly was very active. Her usual daily activities were dancing to music indoors, swimming, bicycling, skating, and playing kickball outdoors. The mother stated that the subject commonly ate only two meals daily, with a snack before dinner. Breakfast was the meal most often skipped. Her favorite snacks were peanut butter and crackers, grilled cheese sandwiches, and cereal. The subject usually had second helpings of meat at dinner, and lunch was usually eaten away from home at a recreation center.

The mother felt that the subject's biggest eating problem was consumption of the wrong foods ("she likes a lot of junk"). Meals were customarily eaten at the dining room table. Snacks were consumed while walking around. A 24-hour food intake recall revealed a diet which contained fewer servings than recommended by the Daily Food Guide for the milk, vegetable and fruit groups and consisted of approximately 1700 kilocalories consumed in two meals and a snack.

The usual daily activities of Subject 2 included playing games indoors, and bicycling, swimming, and playing games with other children outdoors. She typically consumed 3 meals a day and snacked continuously throughout the day. Her favorite snacks included ice cream, fruit, carrots, cucumbers and milk. Her mother felt that her biggest problem was snacking and eating too fast. Meals and snacks were eaten at several different locations including the kitchen table, the den in

Table 4

A Summary of Eating and Exercise Behaviors as Revealed By the Nutrition Questionnaire and Diet History Form

Subject	Usual Daily Activities	Number of Meals (M) Snacks (S)	Favorite Snacks	Biggest Eating Problem	Food Groups	24-Hour Recall	
						Kilocalories	Meals (M) Snacks (S)
S1	Dancing Swimming Bicycling Skating Kickball	2 (M) 1 (S)	Peanut butter; Crackers; Gr. cheese; Cereal	Wrong foods	Mi-3 Pro-4 F/V-0 Gr-5 Oth-1	1700	2 (M) 1 (S)
S2	Games Bicycling Swimming	3 (M) 3+ (S)	Ice cream Fruit Carrots Cukes Milk	Snacks; Eats too fast	Mi-1 1/2 Pro-2 F/V-2 Gr-7 Oth-3	1700	3 (M) 2 (S)
S3	Dancing Tricycling Walking Swinging	2 (M) 1 (S)	Peanut butter; Crackers; Cookies; Cokes; Kool-Aid; Bread	Snacks	Mi-1/2 Pro-2 F/V-2 Gr-4 Oth-2	900	2 (M) 1 (S)

front of the television set, and while walking around indoors or playing with other children outdoors. Subject 2 had fewer servings of all food groups, except grains, than recommended by the Daily Food Guide. She consumed approximately 1700 kilocalories a day.

Subject 3 usually engaged in dancing to music indoors, and tricycling, walking, and swinging outdoors. She ate either 2 or 3 meals daily with breakfast being the meal most often skipped, and frequently had an afternoon snack. Her favorite snacks were peanut butter and crackers, cookies, Cokes, Kool-Aid, and bread, and snacking was considered to be her biggest eating problem. Lunch was usually eaten away from home at either the grandmother's or babysitter's house. Meals at home were eaten at the kitchen table. A 24-hour recall revealed that her diet did not meet the recommendations of the Daily Food Guide for any food group and consisted of approximately 900 kilocalories consumed in 2 meals and a snack.

Daily food intake and activity records. The food intake and activity records provided a daily report of inappropriate behaviors for each subject and indicated whether targeted behaviors had been successfully modified. A summary of the behavior changes of each subject is listed in Table 5. All of the subjects were rewarded for appropriate behavioral changes. The table indicates specific eating behaviors which were targeted for change. The targeted activity behavior for all of the subjects was to increase the amount of daily activity points earned. Figure 9 illustrates the changes in activity points earned by the subjects for the first 10 weeks of the study. The use of the daily records was gradually faded from the treatment program after that time. The

Table 5

Summary of Weekly Target Behaviors, Goals, and Rewards

Treatment Week	Subject 1				Subject 2				Subject 3			
	Behavior Targeted	Goal Set	Reward Given		Behavior Targeted	Goal Set	Reward Given		Behavior Targeted	Goal Set	Reward Given	
			Yes	No			Yes	No			Yes	No
1	H. cal. snacks	Low cal. snacks	X		H. cal. snacks	Low cal. snacks	X		H. cal. snacks	Low cal. snacks	X	
2	Eats at several locations	Only at dining room table	X		Eats at several locations	Only at dining room table	X		NM	NM	NM	NM
3	Eats fast	Slow the rate of eating	X		Eats fast	Slow the rate of eating	X		NM	NM	NM	NM
4	More than one help-at meals	1 serving only	X		Eats fast	Slow the rate of eating	X		Low activity points	Increase activity points	NM	
5	NM	NM	NM	NM	NM	NM	NM	NM	Low activity points	Increase activity points	X	
6	NM	NM	NM	NM	High calorie dessert with dinner	Fruit with dinner	X		NM	NM	NM	NM

Table 5 (continued)

Treatment Week	Subject 1				Subject 2				Subject 3			
	Behavior Targeted	Goal Set	Reward Given		Behavior Targeted	Goal Set	Reward Given		Behavior Targeted	Goal Set	Reward Given	
			Yes	No			Yes	No			Yes	No
7	H. cal. school lunches	Low cal. school lunches from home	X		H. cal. school lunches	Omit bread and dessert	X		NM	NM	NM	NM
8	Low activity points	Increase activity points	X		NM	NM	NM		Night Snacking	No snacks after dinner	X	
9	NM	NM	NM	NM	Low activity points	Increase activity points	X		NM	NM	NM	NM
10	Low activity points	Increase activity points	X		NM	NM	NM		Low activity points	Increase activity points	X	

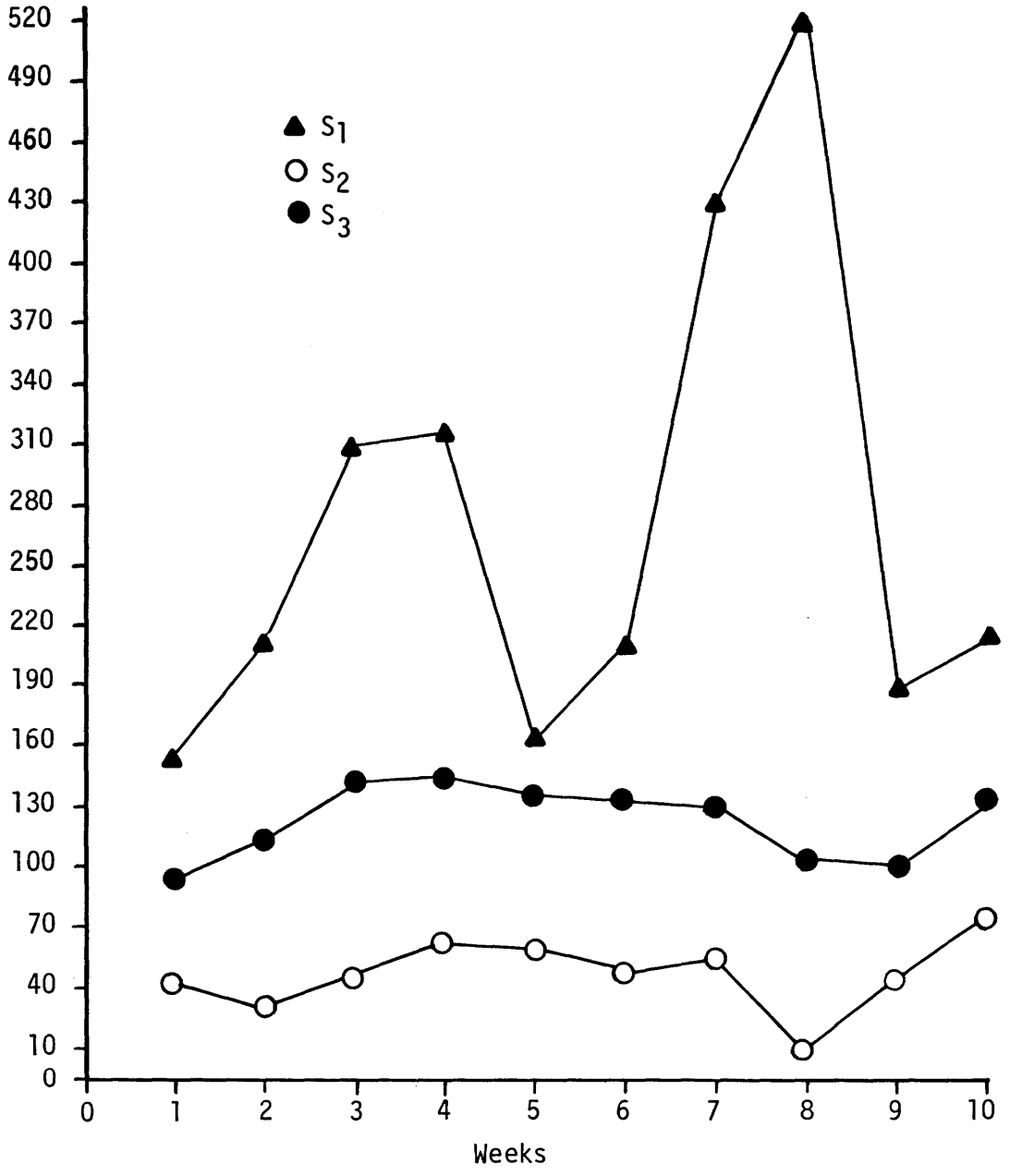


Figure 9. Activity Points Earned by Subjects.

results demonstrate that Subject 1 maintained the highest activity level throughout the study, followed by Subjects 3 and 2. Subject 1 shows the greatest variability in activity points ranging from 155 to 520 points, while the range of points for Subject 2 was the least variable (97-147). Subject 3 demonstrated a range of 10 to 81 points.

Participant verbalizations. Each of the parents was asked to state what they felt had been the most important behavior change in their child which would contribute to long-term obesity control. The parent of Subject 1 reported that slowing the rate of eating and paying more attention to what is eaten were the critical behavior changes. Making more appropriate food selections and taking smaller servings were listed by the parent of Subject 2. Subject 3's parent designated choosing low calorie snacks and eating less in general as important behavior changes.

When the subjects were asked what they believed had contributed most to their success in treatment, Subject 1 stated that she had reduced her intake of food and was making better food choices. Subject 2 felt that her decreased snacking and increased activity had benefited her the most. Subject 3 reported that reducing her intake had helped control her obesity.

Observations. The observations of behavior change made by the investigator during this study were nonquantitative, subjective impressions subject to the limits of human insight. These observations have been included in the appendix (Appendix T) of this report in a modified case history format.

Summary of Behavioral Changes

The principal target behaviors for the subjects in this study were excess food intake and low levels of physical activity. There were also secondary target behaviors which were identified specifically for each individual subject. Table 6 provides a summary of the behavioral changes which were both reported and observed to have occurred during this study.

Table 6

Summary of Behavioral Changes

Principal Target Behavior	Specific Target Behaviors	Antecedent Events	Maintaining Stimuli	Substitute Behaviors	Antecedent Events	Maintaining Stimuli
			Subject 1			
Excess food intake	High calorie snacks	Visit to grandmother (store)	Pleasant taste	Low calorie snacks	Money used at store saved	Money used to buy toy, etc.
		Snacks available at home	Thought of as a treat		H. calorie snacks not available	Change in choice of snacks rewarded
	Eating several locations	Television show	Enjoys show	Eat only at dining table	Told may lose TV privilege;	Allowed to watch show;
		Playing with friends	time with friends		Not allowed to play while eating	Change in eating location rewarded
	Eats too rapidly	Anxious to play	Goes out to play	Slow rate of eating	Told play contingent on slow eating	Allowed to go out to play
	More than one serving at meal	Eats rapidly	Goes out to play	One serving only	Slows rate of eating	Rewarded for taking one serving only

Table 6 (continued)

Principal Target Behavior	Specific Target Behaviors	Antecedent Events	Maintaining Stimuli	Substitute Behaviors	Antecedent Events	Maintaining Stimuli
			Subject 1 (continued)			
	High calorie school lunches	Given money for school lunch	Buys lunch at school	Low calorie lunch from home	Lunch made at home	School lunch money used for reward
Low activity level	Erratic activity habits	Weather change prohibited	Mother states too cold to exercise outside	Stable activity habits	Bicycle repaired; Gym class started	Rewarded for increased activity points
			Subject 2			
Low activity level	Erratic activity habits	Exercise influenced by playmates	Play activities inconsistent	Stable activity habits	Family agreed to walks with subject; Jump-rope purchased	Rewarded for increased activity points
Excess food intake	High calorie snacks	Brother takes high cal. snack	Eats snack with brother	Low calorie snacks	Told would be rewarded for low cal. snack choices	Receives reward
	Eats at several locations	Brother takes food to play or watch tv	Plays or watches tv with brother	Eats at dining table only	All family members eat only at table	Rewarded for eating only at table

Table 6 (continued)

Principal Target Behavior	Specific Target Behaviors	Antecedent Events	Maintaining Stimuli	Substitute Behaviors	Antecedent Events	Maintaining Stimuli
			Subject 2 (continued)			
	Eats too rapidly	Allowed more than one serving	Has more than one serving	Slow rate of eating	Told one serving only and reward for slower eating	Rewarded for slower eating
	High cal. dessert at dinner	Father requests dessert at dinner	Eats dessert with father	Low cal. dessert at dinner	Father agrees to low cal. dessert	Rewarded for low calorie dessert
	High cal. school lunch	Given high calorie lunch	Rewarded by taste of lunch	Lower cal. school lunch	School kitchen personnel instructed to omit bread and dessert	Rewarded for eating low calorie lunch
			Subject 3			
Excess food intake	High calorie snacks	Spends days with grand-mother	Grandmother gives high calorie snacks	Low calorie snacks	Grandmother instructed in appropriate snacks	Rewarded by grandmother for low snack choices
	Night snacking	Requests night snack	Given night snack by mother	No snacks after dinner	Mother instructed not to give night snacks	Rewarded for requesting water instead of night snack

Table 6 (continued)

Principal Target Behavior	Specific Target Behaviors	Antecedent Events	Maintaining Stimuli	Substitute Behaviors	Antecedent Events	Maintaining Stimuli
			Subject 3 (continued)			
Low activity level	Erratic activity habits	Exercise subject to parent cooperation	Parent does not wish to exercise	Stable activity habits	Mother buys exercise record	Rewarded for exercising to record

CHAPTER V

DISCUSSION

Treatment Implications

Body Weight Changes

The results of the various measures of body weight changes demonstrated that all of the subjects responded favorably to treatment. The controlling effects of the introduction of treatment can be inferred from the observed weight loss in a treated subject while weight continued to increase in untreated subjects. The use of a multiple baseline design allows us to observe this effect sequentially in the 3 subjects which increases our confidence in the efficacy of the procedure (34). The relative brevity (1 week) of the elapsed time period between the three baselines in this study decreases the strength of these conclusions. However, a reversal of the weight loss trend in each of the subjects following a period of unapproved time away from meeting demonstrates that experimental control had been responsible for weight loss prior to that time.

The total pounds lost by each subject were small in comparison to reports from studies treating obese adults (77,80,89). However, if the weight loss trend observed prior to the unapproved time off had continued throughout the treatment period, the small losses might have been considerably larger. Powers (91) has pointed out that in evaluating programs to treat obese children weight loss per se may not be necessary for treatment to be judged effective since even small losses may impede normal growth. She suggests that either very minor weight losses or a

decline in the rate of weight gain may be considered clinically significant in treating young children. The results of height changes for each subject demonstrated that a linear growth pattern was maintained. It is reasonable to conclude that the amount of weight change which occurred in response to treatment did not interfere with the normal growth and development of the subjects. Mayer (73) has reported that presenting weight changes strictly in terms of pounds lost favors the most severely overweight subject because individuals with more weight to lose will show weight loss more rapidly. Additional measures of weight change have been suggested to increase confidence in the results (35,85-87).

Presenting the results in terms of a reduction in the percent overweight has the advantage of incorporating an individual's expected weight for height, sex, and age. In this study the 50th percentile weight represented the expected weight. Use of the reduction index has the additional advantage of considering the surplus weight (current weight-50th percentile weight) when computing weight loss. The use of the 50th percentile values in these two formulas is subject to question since all of the children were observed to be above the 50th percentile in height. This implies that the child should be underweight for height which creates an unrealistic, and likely frustrating, weight goal expectation. Substituting the same weight percentile values in these formulas as the child's height percentile value might present a more accurate picture of weight change. The use of a weight-for-length index has been recommended as a more reliable and accurate measure of relative body weight in children. The cumulative weight change results presented in this study showed no change in the rank order of subject response regardless of which measure was used.

Fatfold Changes

All of the subjects were noted to decrease fatfold during the study. An interesting observation, however, was that the rank order of response to fatfold change differed from the order reported for weight change.

There are several possible explanations for the pattern of fatfold changes observed in this study. These changes will be discussed in terms of: 1) variability in subject response, 2) sources of measurement error, and 3) usefulness of fatfold measures.

Variability in subject response. Several investigators have reported that changes in body composition reflected by fatfold measures are more likely due to increases in energy expenditure from physical activity than to decreases in energy intake from calorie restriction alone (19,63,70,76,91). Regular exercise without a change in calorie intake has been shown to cause a decrease in fat tissue even without weight loss, whereas, weight loss due to decreased calorie intake alone has not resulted in a reduction in total body fat (63,91).

In this study, subject response reflected by fatfold changes may be related to exercise habits. Although the study was not designed to measure energy expenditure from physical activity directly, an appraisal of exercise habits was made from the information provided by the daily activity records. A comparison of the rank order of subject response to fatfold changes and average weekly activity points supported the proposed association between amount of regular activity and fatfold changes.

Sources of measurement error. Measurement of triceps fatfold thickness is subject to a number of random technical errors which may reduce the reliability and validity of these values (5). The most common sources of error have been outlined by Powers (91). These

include: 1) use of the wrong arm (should be nondominant), 2) incorrect measurement of the midarm point, 3) examiner not comfortable, 4) incorrect placement of the caliper point, 5) reading done too early or too late (should be 2 or 3 seconds), and 6) caliper pinch not maintained or handle not fully released.

Every effort was made to control against error in fatfold measurements taken in this study. However, considering the extensive possibility of random error, there is a chance that the results were affected by one or more of the sources of error mentioned above.

Usefulness of fatfold measures. Of the various measures of fatness used in obesity research fatfold thickness is generally considered to be both accurate and practical (6,45,46). However, this method is still not widely accepted for use by clinicians. One reason for this discrepancy is the lack of complete standards for specific age, sex, and race which diminishes the usefulness of such measures. Furthermore, when fatfold measures have been compared to other direct measures of body fatness they have been shown to be only 61 to 88% accurate (92). In this study, the rank order of response to fatfold changes did not parallel the results of the weight-for-length index. Since the index reported an obesity score for each of the subjects, we would expect these two measures to compare. The lack of comparison may indicate the inaccuracy of the fatfold measures.

Research Implications

Previous studies utilizing a behavioral approach to treat obesity have indicated that optimal success may be achieved by constructing a treatment package consisting of nutrition education,

physical activity, and the behavioral procedures of self-monitoring, environmental management, and positive reinforcement. The present study has demonstrated that this treatment package is successful in short-term obesity control in young girls. Treatment resulted in weight loss, reduction in fatfold, increased activity levels, and modification of inappropriate eating habits.

Experimental Design

Previous approaches to the behavioral treatment of obesity have been criticized for their overreliance on the group comparison experimental design. The limitations of that design include: 1) ethical issues of withholding treatment from a control group, 2) practical problems in collecting a large enough sample of homogenous subjects, 3) a tendency to neglect reporting individual outcome by averaging group results, 4) difficulty in generalizing from the group to the individual, and 5) recognition of intersubject variability while lacking control over within-subject variability (34).

The single-case experimental design used in this study had the advantage of overcoming many of the limitations of the group comparison design. The absence of control subjects removes the ethical objection of withholding treatment. The small sample size requirement facilitates the collection of subjects. The absence of group averages allows a report of individual outcome. Flexibility of the single-case design allows alterations of the treatment procedure in order to identify within-subject variability. Finally, determining sources of variability and replicating the experiment on several subjects, allows a determination of generality of findings across the subjects which increases the ability of establishing subject generality (34).

The main limitation to using a single-case design is also related to generalizability. In this study, the successful replication of the treatment procedures across the three subjects allows us to infer that this experiment has general application to subjects with similar characteristics. The recognized dissimilarities of these three subjects broadens the potential for generalizability. The shortcoming of this approach is that even though generality has been established across subjects the experiment has not determined if the same results would occur in different settings (setting generality) or with different investigators (therapist generality).

Clinical vs. Statistical Significance

Establishing the relative value of clinical vs. statistical significance is a critical issue in behavioral research. The behavioral researcher is primarily concerned with producing clinically or socially relevant changes. The statistical researcher relies on a comparison of group averages which may obscure individual response to treatment. The main criticism of the statistical approach is that it may either under- or overestimate clincial effectiveness (34).

The present trend in behavioral research is away from the use of statistics. Coates (36), however, has provided an example of how statistics may be used effectively to give strength to the results of the behavioral treatment of obesity using a single-case design.

This study did not measure the presence or absence of statistical significance. In view of the relatively small changes in the physiological parameters, it is doubtful if the use of statistics would have provided an accurate picture of the clinical and social effectiveness

of the research. As stated previously, when treating obesity in children it is essential to balance treatment of the obese condition with prevention of growth stunting. The major significance of the present study lies in the area of social effect. The reported changes in eating and exercise habits, coupled with observable improvement in self-esteem, demonstrate that socially relevant change has occurred. In addition, evaluation forms completed by the participants at the end of the study indicated that they were highly satisfied with the results of the program and felt positive about their potential for continued obesity control.

Future Directions

Maintenance of treatment effects. Early reports on the behavioral treatment of obesity indicated that weight losses achieved by behavioral measures were more stable than those achieved by other means. More recently it appears that maintenance of weight loss following behavioral treatment is no better than by other treatment techniques (32, 93). Concern has been expressed over the potentially hazardous effects of cyclically losing and then regaining weight. Some research has indicated that moderate, stable obesity may be less of a health risk than an erratic pattern of weight loss and gain (48).

The best methods of maintaining weight loss are yet to be identified. Current recommendations stress the need for reporting follow-up data on obesity treatment studies for at least one year in an effort to isolate successful methods of maintaining treatment effects (32,91). Using these recommendations, the subjects involved in this study will be followed for a minimum of one year.

Isolation of effective treatment components. The effective combination of treatment components described in this study provide a model which may be employed to treat obesity in similar subjects. However, since the study was designed to test a treatment package it is uncertain whether all of the individual components are necessary to achieve success. Preliminary information provided by the program evaluation forms indicate that the meetings and daily records were considered by the participants to be the most important treatment components. A next step in investigating this treatment model would be to design a study which would isolate the critical elements of the package. Additional directions for this research could include testing the treatment package on different types of subjects, both individually and in groups.

Standardized behavioral measures. Previous research on the behavioral treatment of obesity has been criticized for indirectly measuring behavior changes by inference from weight loss and fatfold measures. The lack of standardized methods of measuring behavioral change in obesity research has forced most investigators to rely on measures of physiological change. In the present study, an attempt was made to report behavioral changes. The lack of a quantitative method for reporting behavioral data is regarded by the investigator as a principal limitation of the study. In a recent report, Coates (36) proposed a research strategy for directly measuring behavior changes related to obesity. His proposal may assist future investigators in studying the behavioral treatment of obesity.

In Conclusion

The initial objectives of this study were to: 1) increase the daily activity levels of the subjects; 2) modify the inappropriate eating habits; 3) decrease fatfold thickness; 4) decrease total body weight or stabilize the rate of weight gain; and 5) maintain a linear growth pattern. It was hypothesized that the successful application of treatment components from nutrition, physical activity, and behavior modification would result in fulfillment of these objectives. Success in achieving these objectives can be interpreted as supporting the hypothesis.

CHAPTER VI

SUMMARY

This study was designed to test the effectiveness of an interdisciplinary model for treating obesity in young girls. The model combined educational techniques from the disciplines of nutrition and physical activity with the behavioral procedures of stimulus control, self-monitoring, and positive reinforcement. It was hypothesized that the effective implementation of this model would result in: 1) a decrease in body weight or in the rate of weight gain; 2) a decrease in fatfold measures; 3) a modification of inappropriate eating behaviors; and 4) an increase in daily activity levels.

Subjects

Subjects were recruited from local pediatricians and by a newspaper advertisement. Potential subjects were screened by a medical examination and a series of interviews designed to determine the lack of complicating medical conditions, the presence of obesity, a commitment to obesity reduction, and a willingness of the family to participate. Three girls, 4 to 8 years old, were selected as program participants. Subject 1 was 8 years of age, 62 kg and 141.5 cm. She was of mixed racial background with an obese father, normal weight mother, and a normal weight younger male sibling. Subject 2 was 4 years of age, 32 kg and 117 cm. Both her parents were obese but her older male sibling was normal weight. Subject 3 was 4 years of age, 29 kg

and 108.2 cm. Her mother and father were obese. She had no siblings and was living with her mother.

Design

A single-case experimental design was used. Experimental control was established by utilizing multiple baseline observations across the subjects of dependent physiological measures of weight and fatfold changes. The design included baseline and treatment phases. The baselines varied in length from one subject to the next. Treatment lasted 17, 16, and 15 weeks for Subjects 1, 2, and 3, respectively.

Treatment Procedure

A multicomponent treatment package was introduced to the subjects during weekly meetings. Height, weight, and fatfold measures were taken at each meeting. A discussion of treatment plan occurred between the PI, subject, and parent, followed by the presentation of an educational activity. Treatment sessions lasted from 20 to 45 minutes and were frequently attended by other family members. A variety of techniques were employed to teach skills in: proper food choices, exercise, and modification of food intake. One or more visits were made to the home of each subject during treatment. Treatment was designed to discourage reliance on the investigator and to encourage cooperative responsibility between the subject and family. Evaluation forms were completed by the participants at the end of treatment and a one-year follow-up was planned.

Results

All subjects demonstrated a positive response to treatment. Subject 1 lost 4.75 pounds, showed a 9% reduction in overweight, and received a weight reduction index (RI) score of 14.80. Subject 2 lost 1.75 pounds, reduced overweight by 5%, and received an RI score of 10.15. Subject 3 lost 5.50 pounds, reduced overweight by 16%, and received a RI score of 40.19. The rank order response to weight change indicated that Subject 3 had the most favorable response to treatment.

All subjects showed a reduction in fatfold. Subject 1 decreased 4.5 mm, Subject 2, 2.5 mm, and subject 3, 3 mm. Subject 1 demonstrated the greatest decrease in fatfold. All subjects maintained a linear growth pattern throughout the study. The weight-for-length index indicated that all subjects were obese at the beginning and end of the program. All of the subjects, however, reduced their index score with Subject 3 showing the greatest reduction. Changes in eating and exercise behaviors were apparent in all subjects from sources of self-report and observation.

The treatment package evaluated in this study provided a reasonably effective model for treating obesity in subjects with similar characteristics. Future directions for the research could include: 1) determining the effectiveness of this model on maintaining treatment results; 2) isolating the most critical components of the treatment package; 3) testing the model on different types of subjects; and 4) utilizing objective strategies for measuring behavioral changes.

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APPENDICES

APPENDIX A

ADVERTISEMENT FOR SUBJECTS

WEIGHT CONTROL STUDY

Girls, ages 4 to 8, are needed to participate in an obesity treatment-weight reduction project. For information, contact Dr. Dan Hubbard, 974-3491. This is an experimental study and, therefore, there can be no guarantee of success or remuneration for services.

APPENDIX B

METHOD OF OBTAINING "INFORMED CONSENT"

FROM SUBJECTS

"Research investigators from The University of Tennessee are conducting a study on the effectiveness of treating obesity in young girls through the use of dietary intervention, behavioral therapy and exericse. Your participation in the study will be of great value in helping to devise new and effective ways for health professionals to treat overweight girls. You have been invited to this meeting as a potential participant in this study. Your acceptance as a participant will depend upon:

1. Your child receiving a physical examination to determine that she is medically acceptable as a program participant.

2. Your child being determined to have fatfold and height-weight values above the 95th percentile.

3. Your child being evaluated through the Stanford Binet Intelligence Test or the Wechsler Intelligence Scale.

4. Your child verbally stating that it is her desire to participate in the program.

5. One parent agreeing to participate with the child by attending meetings and fulfilling the terms of the contract.

6. Each parent and child (when possible) agreeing to sign a consent form.

7. Each parent agreeing to sign a contract with the investigator.

You will have the opportunity to ask questions at any time and may withdraw your consent at any time, with the understanding that you will be breaking the contract and will thus forfeit the remainder of your initial monetary deposit. Any money that is forfeited during the program will be used to purchase materials to be used in future weight management clinics here at U.T. Your identity as a participant in the study will not be revealed in any way when data from the study are published. Data derived from the program will be identified by code numbers only, not by name."

APPENDIX C

CONSENT FORM FOR PARTICIPATION IN PROJECT OF "AN INTERDISCIPLINARY MODEL FOR THE TREATMENT OF OBESITY IN YOUNG GIRLS"

The effectiveness of a weight management program for children or adults depends upon a well-planned program carried out in a consistent manner. In order to assure optimal success for each program participant, it is important that the following conditions are met.

1. The child must receive a physical examination by a physician to determine that she is medically acceptable as a program participant.

2. The child must be determined to have fatfold and height-weight values above the 95th percentile.

3. The child must be evaluated through the Stanford-Binet Intelligence Test or the Wechsler Intelligence Scale.

4. The child must verbally state that it is her desire to participate in the program.

5. One parent must agree to participate with the child by attending meetings and fulfilling the terms of the contract.

6. Parent and child (where possible) must agree to sign a consent form.

7. Parents must agree to sign a contract form with the investigator.

I have read the prestated conditions for participation in this program and I voluntarily agree to participate. I have been informed to my satisfaction the nature of the program and I understand that I have the right to ask questions at any time during my participation. I understand that the only risk to the participants of this project is the possibility of forfeiting the monetary deposit according to the terms of my contract with the investigator. I have been informed that I may voluntarily withdraw my participation from the project at any time and forfeit the remaining portion of my monetary deposit.

I understand that in the event of physical injury resulting from the research procedure, financial compensation is not available and medical treatment is not provided free of charge.

I further understand that my identity as a participant in this program will not be revealed in any way when the data from this program are published.

Code Number of Subject: _____

Signature of Parent_____

Signature of Child_____
(where possible)

Signature of Investigator_____

Date_____

Project Director
Dr. Daniel W. Hubbard
Associate Professor, Nutrition
330 College of Home Economics
University of Tennessee
Knoxville, Tennessee
Telephone - 974-3491

APPENDIX D

CONTRACT FORM FOR PARTICIPATION IN PROJECT OF "AN INTERDISCIPLINARY MODEL FOR THE TREATMENT OF OBESITY IN YOUNG GIRLS"

I, _____ (parent) agree to enter into this contract with _____ (investigator) with the following terms.

On _____ (date) have made a monetary deposit of $96.00 (amount) with the investigator.

I understand that this deposit will be returned to or forfeited by me under the conditions that I attend all scheduled weekly meetings ($1.00 per meeting) and turn in the daily activity and food intake forms (12 forms due per meeting at a rate of $.25 per form). I understand that I am only required to keep the forms for 6 out of 7 days each week.

Attendance at Meetings:

Week		Monetary Deposit: (Amount) Refunded	Forfeited
1.	yes___ no___	_____	_____
2.	yes___ no___	_____	_____
3.	yes___ no___	_____	_____
4.	yes___ no___	_____	_____
5.	yes___ no___	_____	_____
6.	yes___ no___	_____	_____
7.	yes___ no___	_____	_____
8.	yes___ no___	_____	_____
9.	yes___ no___	_____	_____
10.	yes___ no___	_____	_____
11.	yes___ no___	_____	_____
12.	yes___ no___	_____	_____
13.	yes___ no___	_____	_____
14.	yes___ no___	_____	_____
15.	yes___ no___	_____	_____
16.	yes___ no___	_____	_____
17.	yes___ no___	_____	_____
18.	yes___ no___	_____	_____
19.	yes___ no___	_____	_____
20.	yes___ no___	_____	_____
21.	yes___ no___	_____	_____
22.	yes___ no___	_____	_____
23.	yes___ no___	_____	_____
24.	yes___ no___	_____	_____
	TOTAL	_____	_____

Completed and Returned Forms (Number):

Week	Activity	Food Intake	Refunded	Forfeited
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
		TOTAL		

Any money which is forfeited will be applied toward the cost of purchasing educational materials for future weight control programs by the College of Home Economics.

In the event that this project is terminated before the allotted 24 weeks the remainder of the deposit will be returned to the parent.

Code Number_____

Signature of parent_____

Signature of investigator_____

Date of initiation_____

Date of completion_____

Total amount refunded_____

Total amount forfeited_____

Project Director
Dr. Daniel W. Hubbard
Associate Professor, Nutrition
330 College of Home Economics
University of Tennessee
Knoxville, Tennessee
Telephone - 974-3491

APPENDIX E

INFORMATION CARD

NAME OF PARENT: _____

NAME OF CHILD: _____

ADDRESS: _____

_____

TELEPHONE NUMBER: _____

NAME OF PHYSICIAN: _____

ADDRESS: _____

_____

TELEPHONE NUMBER: _____

APPENDIX F

LETTER TO PHYSICIAN

Address
of
Physician

Dear Dr. _____:

Investigators from The University of Tennessee are conducting a study on the effectiveness of treating obesity in young girls. The program components include dietary intervention, behavior therapy, and exercise.

Prior to acceptance as a participant in this study, all potential subjects must receive an appropriate physical examination to rule out the presence of factors which would suggest an endogenous cause of the obesity and to identify the presence of pathological conditions which would contraindicate treatment.

An article by Michael P. Golden, which describes the steps towards identifying the cause of obesity as endogenous or exogenous, has been enclosed for your information. In addition, we have included an abstract of our proposed project to more thoroughly acquaint you with the particulars of this experimental study.

The family of _____, who is a potential participant in this study, have indicated that you are the physician who they will be contacting to complete an examination of their child.

Upon completion of the examination, please fill out and return the enclosed form. Thank you for your cooperation. If you have any further questions, please feel free to call us.

Sincerely,

Dr. Daniel W. Hubbard
Project Director
Associate Professor, Nutrition
College of Home Economics
University of Tennessee
Knoxville, Tennessee 37916
974-3491

APPENDIX G

AN ABSTRACT OF THE PROJECT "AN INTERDISCIPLINARY MODEL FOR THE TREATMENT OF OBESITY IN YOUNG GIRLS"

Three to five girls, 4 to 8 years old, will be selected from physician referrals or from respondents to an advertisement printed in the U.T. Daily Beacon. Criteria for admission to the program include an appropriate physical examination, fatfold and height-weight values exceeding the 95th percentile, evaluation through the use of the Stanford-Binet Intelligence Test or the Wechsler Intelligence Scale, an indication of motivation by the child to lose weight, an agreement of one parent to participate in the program with the child, and signing of consent and contract forms by the parent.

Subjects will be matched as closely as possible according to age, sex, race, degree of obesity, and IQ status. A single-case experimental design utilizing the multiple baseline across subjects format will be employed. This design includes both baseline and treatment phases.

The baseline phase will consist of at least three independent measures of fatfold thickness, height, and weight of each subject to be taken prior to the introduction of treatment. The baseline phase will last from three to five weeks, with the baseline increasing in length from one subject to the next.

The treatment phase will last approximately 16 weeks and will consist of home monitoring by the parent of daily activity and food intake of the child. In addition, weekly meetings will be held at the Home Economics building for approximately one hour. During those meetings height, weight, and fatfold values will be taken on each child. The child will then be directed in an educational activity.

In a room separate from the child, each parent will meet with a member of the investigative team to determine whether she has met the contract terms of the previous week. The parent will then be presented educational topics to cover the role of nutrition, exercise, and behavioral therapy in a weight reduction program.

A reward system will be employed by the parent to facilitate the child's weight loss. The parent will participate in a contingency contract with the investigator requiring her to make a monetary deposit which will be refunded or forfeited according to whether she attends scheduled meetings and completes the home monitoring forms.

The investigative team consists of:

Project Director: Dr. Daniel W. Hubbard, Associate Professor of Nutrition
Co-Director: Dr. Frances E. Andrews, Assistant Professor of Nutrition
Investigator: Ms. Annell St. Charles, Doctoral Student in Nutrition
Consultant: Dr. Edward T. Howley, Associate Professor of Health, Physical Education and Recreation
Consultant: Dr. Vey M. Nordquist, Associate Professor, Child and Family Studies

This project has been approved by The University of Tennessee Human Subjects Research Committee.

APPENDIX H

STATEMENT FROM PHYSICIAN

To whom it may concern:

I have completed a history and physical examination on the patient, _____, to identify the presence of endogenous causes of obesity or other health conditions which would contraindicate her participation in the study titled "An Interdisciplinary Model for the Treatment of Obesity in Young Girls."

I have determined the patient to be:

_____appropriate
_____inappropriate

for inclusion in the study.

Name of physician_____

Address_____

_____

Date of examination_____

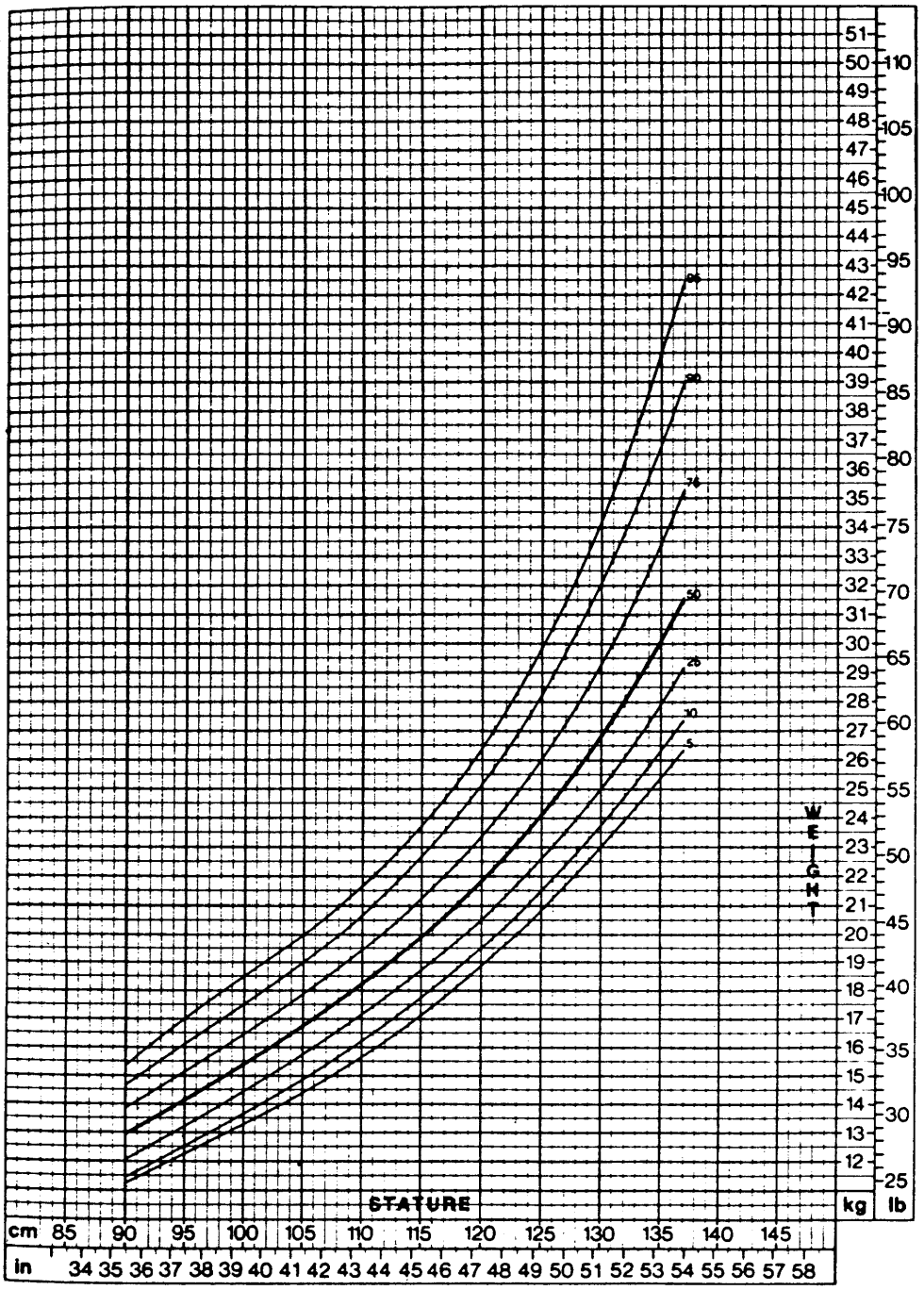
Signature of physician_____

Please return to:

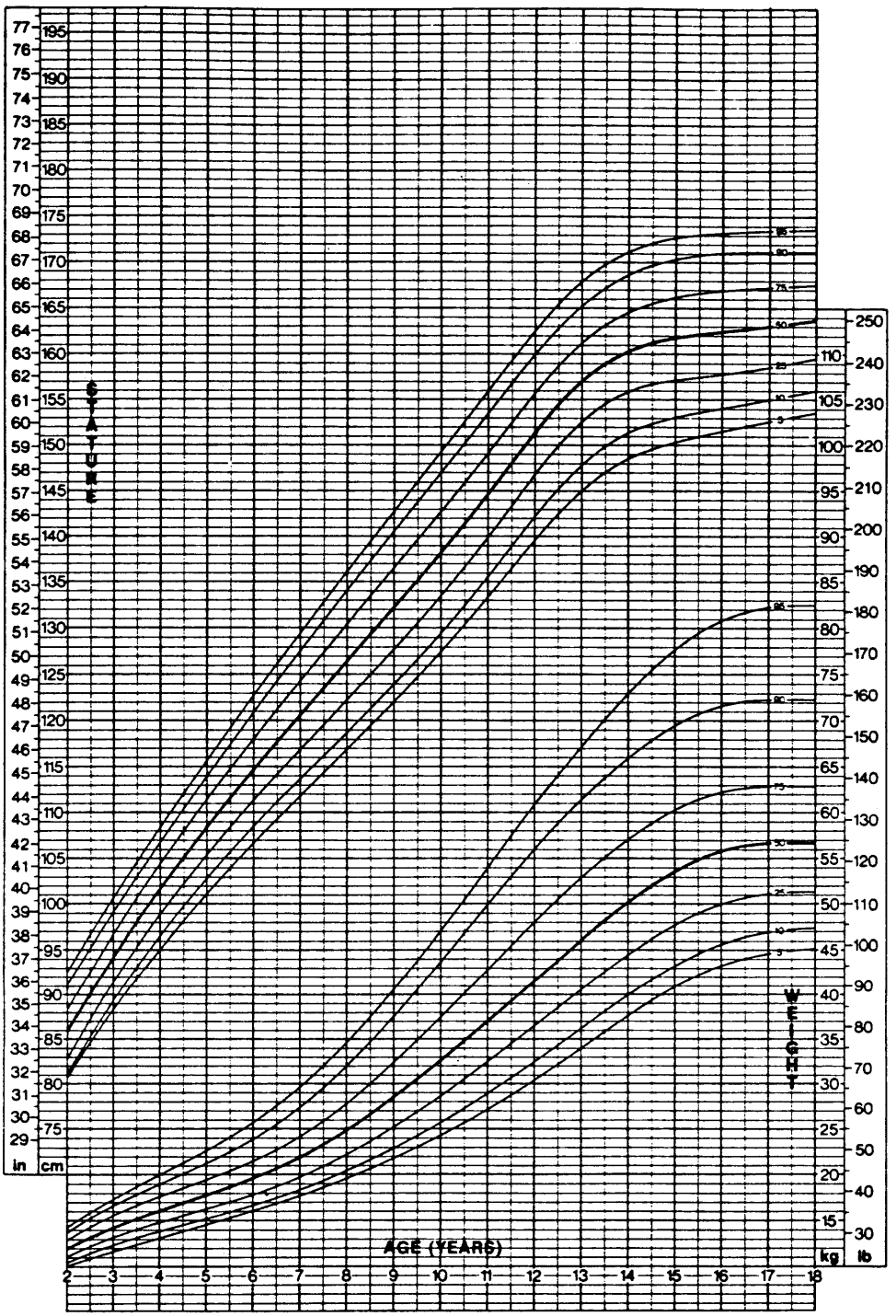
Dr. Daniel W. Hubbard
Project Director
Associate Professor, Nutrition
330 College of Home Economics
University of Tennessee
Knoxville, TEnnessee 37916
974-3491

APPENDIX I

PHYSICAL GROWTH NCHS PERCENTILES



PHYSICAL GROWTH NCHS PERCENTILES (continued)



Source: National Center for Health Statistics: NCHC Growth Charts (1976) Monthly Vital Statistics Report, Vol. 25, No. 3 (Supp. (HRA) 76-1120, Health Resources Adminstration, Rockville, Maryland.

APPENDIX J

TRICEPS SKINFOLD PERCENTILES*

Triceps skinfold measurements based on data obtained using Lange skinfold calipers on white subjects included in the Ten-State Nutrition Survey, 1968-1970.

AGE (years)	MALES					FEMALES				
	PERCENTILES(mm)					PERCENTILES(mm)				
	5th	15th	50th	85th	95th	5th	15th	50th	85th	95th
Birth-	4	5	8	12	15	4	5	8	12	13
0.5-	5	7	9	13	15	6	7	9	12	15
1.5-	5	7	10	13	14	6	7	10	13	15
2.5-	6	7	9	12	14	6	7	10	12	14
3.5-	5	6	9	12	14	5	7	10	12	14
4.5-	5	6	8	12	16	6	7	10	13	16
5.5-	5	6	8	11	15	6	7	10	12	15
6.5-	4	6	8	11	14	6	7	10	13	17
7.5-	5	6	8	12	17	6	7	10	15	19
8.5-	5	6	9	14	19	6	7	11	17	24
9.5-	5	6	10	16	22	6	8	12	19	24
10.5-	6	7	10	17	25	7	8	12	20	29
11.5-	5	7	11	19	26	6	9	13	20	25
12.5-	5	6	10	18	25	7	9	14	23	30
13.5-	5	6	10	17	22	8	10	15	22	28
14.5-	4	6	9	19	26	8	11	16	24	30
15.5-	4	5	9	20	27	8	10	15	23	27
16.5-	4	5	8	14	20	9	12	16	26	31
17.5-24.4	4	5	10	18	25	9	12	17	25	31

Source: Frisanch, A. R. (1974) Triceps skinfold and upper arm muscle size norms for assessment of nutritional status. Am. J. Clin. Nutr. 27:1052-1058.

APPENDIX K

NUTRITION QUESTIONNAIRE AND DIET HISTORY FORM

Code:

NAME_____DATE_____

PARENTS' NAMES_____PHONE_____

ADDRESS_____

BIRTHDATE_____AGE_____GRADE_____

OCCUPATION OF FATHER_____MOTHER_____

HEIGHT_____(% TILE)_____WEIGHT (% TILE)_____

FATFOLD THICKNESS_____

BIRTHWEIGHT_____(% TILE) BIRTH LENGTH_____(% TILE)_____

AGE OF APPEARANCE OF OVERWEIGHT (ACCORDING TO MOTHER)_____

OTHER OVERWEIGHT FAMILY MEMBERS (GIVE RELATIONSHIP)_____

_____

NUMBER OF PEOPLE IN HOME: ADULTS ( ) CHILDREN ( )

PREVIOUS ATTEMPTS AT WEIGHT LOSS? _____YES _____NO

WHEN_____METHODS(S)_____

THE METHOD WAS SUCCESSFUL_____UNSUCCESSFUL_____

MEDICATIONS_____

VITAMIN AND MINERAL SUPPLEMENT_____

PHYSICIAN_____

ADDRESS_____

_____

USUAL DAILY ACTIVITIES:

INDOOR_____

OUTDOOR_____

REINFORCERS:

ITEMS_____

ACTIVITIES_____

FAVORITE NONFOOD TREAT_____

AVERAGE NUMBER HOURS SLEEP PER NIGHT_____NAPS_____

BEDTIME_____WAKE-UP TIME_____

USUALLY UP DURING THE NIGHT?_____HOW OFTEN_____

FOR WHAT REASON(S)_____

HOW MANY MEALS EACH DAY (NUMBER AND TIMES)_____

_____

USUAL SNACK TIMES_____

FAVORITE SNACKS_____

DOES CHILD USUALLY HAVE SECOND HELPINGS?_____

AT WHICH MEALS_____

WHO PREPARES THE MEALS_____

WHO SHOPS FOR THE FOOD_____

WHICH MEALS ARE MOST OFTEN EATEN AWAY FROM HOME?_____

_____

WHERE ARE THOSE MEALS EATEN_____

_____

WHAT DO YOU FEEL ARE YOUR CHILD'S BIGGEST EATING PROBLEMS_____

_____

FOOD INTAKE RECALL

DATE:_____

Time and Place	Type of Food	Amount	Where Eaten	With Whom

Does this represent a typical day's intake? yes___ no___

If not, how does it differ?_____

Favorite foods_____

Foods disliked_____

Foods cannot (will not) eat_____

Estimate of dietary adequacy:_____

_____

_____

Completed by:_____

APPENDIX L

DAILY FOOD INTAKE RECORD

NAME:_____

DATE:_____

TIME (Start & Finish)	PLACE (Home, School, Restaurant, etc.)	AMOUNT EATEN	WHERE EATEN (Table, front of TV, etc.)	EATEN WITH WHOM

WERE YOU: Satisfied_____Dissatisfied_____ with your child's food intake today?

HOW DO YOU THINK YOUR CHILD'S FOOD INTAKE COULD HAVE BEEN IMPROVED TODAY?_____

APPENDIX M

DAILY ACTIVITY RECORD

CODE:_____

DATE:_____

Light Exercise - Each box = 5 min. = 10 points

Table Tennis
Dancing (slow)
Volleyball
Walking (slow)
Playing musical instrument

_____

Time of Day: _____

Alone or with Parent: _____

___✓'s x 10 = _____ pts.

Moderate Exercise - Each box = 5 min. = 15 points

Badminton
Dancing (fast)
Walking (fast)
Cycling
Swimming (slow)
Tennis
Calisthenics (slow)
Basketball

_____

Time of Day: _____

Alone or with Parent: _____

___✓'s x 15 = _____ pts.

Heavy Exercise - Each box = 5 min. = 20 points

Swimming (fast)
Calisthenics (fast)
Jogging
Jumping rope
Stationary cycling
Stationary jogging

_____

Time of Day: _____

Alone or with Parent: _____

___✓'s x 15 = _____ pts.

DAILY TOTAL _____ pts.

Reward Given: __Yes __No

If yes, what was rewarded: _____

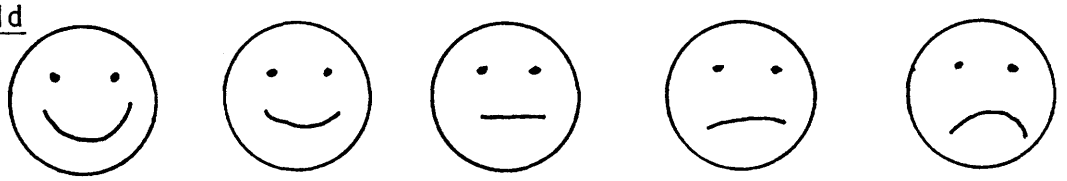
If no, what was rewarded: _____

HOW SATISFIED WERE YOU WITH TODAY'S ACTIVITIES:

Parent

very pleased _____ somewhat pleased _____ had no feelings about today _____ not pleased _____ very displeased ___

Child



APPENDIX N

TREATMENT PHASE RESULTS

Date	Ht./Wt.	Fatfold	Behavior Targeted	Goal	Reward	Comments

APPENDIX O

EXPLANATION OF TREATMENT ACTIVITIES

Activity	Explanation
1. "The Snacking Mouse"	An 8-minute filmstrip with cassette showing showing how poor snacking habits result in obesity. Produced by the Polished Apple, California.
2a. Food Groups Game	Uses plastic food models to teach the concepts of food groups and a balanced diet. Developed by the PI.
2b. Food Fads Quiz	A true/false quiz designed to correct misinformation about foods and nutrition. Developed by the PI.
3. "Nutritional Needs of Your Body"	A 15-minute filmstrip with cassette illustrating the importance of eating a variety of foods in order to obtain all the nutrients the body needs to function properly. Produced by Sunburst Communications, Dept. TG, Pleasantville, New York 10570.
4. "How to Diet Sensibly"	A 15-minute filmstrip with cassette which contrasts sensible approaches to dieting with fad diets. Also encourages viewer participation in selecting foods to balance illustrated unbalanced diets. Produced by Sunburst Communications, Dept. TG, Pleasantville, New York 10570.
5a. "Fun with Good Foods"	Coloring book for children 4-8 years old containing activities designed to teach about foods and their sources, the basic four food groups, and a balanced diet. Produced by the USDA Food and Nutrition Service, Program Aid No. 1204, October 1978.
5b. "Shaping Up for the Long Run"	A 24-page booklet presenting ideas on diet and exercise to support the maintenance of lifelong fitness. Produced by Best Foods, a unit of CPC North America, Dept. SU-X, Box 307, Coventry, Connecticut 06238.

6a. "The Physiology of Exercise"	A 13-minute filmstrip with cassette which provides a simplified presentation of the physiological basis of physical fitness. Produced by Sunburst Communications, Dept. TG, Pleasantville, New York 10570.
6b. Walk	While the parent was viewing the 6a film, the subject and PI took a 20-minute walk outside. The purpose of the walk was: (1) to observe the subject's physical and verbal reactions to walking; (2) to discuss the benefits of physical activity; and (3) to create an informal atmosphere between the subject and PI.
7. "Your Exercise Program"	A 13-minute filmstrip with cassette presenting a practical guide to planning a personal exercise program. Produced by Sunburst Communications, Dept. TG, Pleasantville, New York 10520.
8. Home Visit	The PD and PI visited the home of each subject with the purpose of: (1) observing the natural environment; (2) meeting other family members; (3) gaining a more realistic impression of the subject's home situation; (4) creating a less formal association with the subject and family; (5) to take height, weight, and fatfold measures on the child and reinforce the use of home weighing apparatus; (6) to view apparent opportunities (equipment, space, etc.) for exercise; and (7) to reinforce family participation in the child's program.
9. Modeling	The subject, parent, PD, and PI went jogging together at the University track. The child was allowed to set a comfortable pace. The purpose of this activity was: (1) to model exercise to the subject; (2) to discuss the benefits of physical activity; (3) to encourage family involvement in the subject's exercise program; and (4) to reinforce the subject for physical activity.

10.	"Fast Food Calories"	A pamphlet listing the approximate amounts of calories in foods available from 9 of the most popular local fast food establishments. Prepared by the Knox County Health Department.
11.	Certificates	At the final meeting of the active treatment phase a certificate of appreciation was given to each parent participant (Appendix P), and a "good work" certificate was given to each subject (Appendix Q).

APPENDIX P

CERTIFICATE OF APPRECIATION PRESENTED TO PARENT

Certificate of Appreciation

This certificate is presented to

_____

in appreciation for the valuable contribution

given to _____.

Our sincere gratitude is extended to you this

_____ *day of* _____ *19*____.

Signed _____

APPENDIX Q

"GOOD WORK" CERTIFICATE PRESENTED TO SUBJECT



GOOD WORK! ...

and that's no blubber!

did a whale of a good job at _____

_____ **and**

deserves a N'ICE AWARD! CONGRATULATIONS!

_____ _____

Signed Date

T-364 GOOD WORK! ©1975 TREND enterprises, Inc., St. Paul, Mn. 55165 50 SHEETS PER TABLET

APPENDIX R

MONTHLY PROGRESS REPORT FROM THE PROJECT TITLED "AN INTERDISCIPLINARY MODEL FOR TREATING OBESITY IN YOUNG GIRLS"

DATE:_____

PATIENT'S NAME:_____

FAMILY MEMBER(S) PARTICIPATING:_____

DATE OF ADMISSION TO PROJECT:_____

BASELINE PHASE:
STARTING DATE:_____

ENDING DATE: _____

TREATMENT PHASE:
STARTING DATE:_____

ENDING DATE: _____

INITIAL VALUES:	CURRENT VALUES:
HEIGHT: _____	HEIGHT: _____
WEIGHT: _____	WEIGHT: _____
FATFOLD: _____	FATFOLD: _____

ADDITIONAL COMMENTS:

_____

_____

_____

_____
Principal Investigator

APPENDIX S

OBESITY TREATMENT PROGRAM EVALUATION

Code_____

The obesity treatment program is incomplete until we have evaluated its strengths and weaknesses. This is partially accomplished by having our parent participants comment on the program components. Please read and respond to the following questions as honestly and thoroughly as possible.

---

1. Name:_____ 2. Date:_____

3. After hearing or reading about this program, why did you decide to investigate enrolling your child in it? _____

4. What was your first impression of the program after the introductory meeting? _____

5. How did you feel about the following program components? (Answer as completely as you can.)

   a. the location of the meetings _____

   b. the frequency of the meetings _____

   c. the techniques used to measure/weigh your child _____

   d. the individual meetings between yourself and the program investigator _____.

   e. the cassette/slides shown _____

f. the use of the daily food intake and daily activity forms

_____
_____
_____

g. the use of a goal and reward system _____
_____
_____

h. the home visits by the program director and investigator

_____
_____
_____

i. the education handouts _____
_____
_____

PROGRAM COMPONENTS:

a. meetings
b. home visits
c. weights
d. fatfold measures
e. daily activity forms
f. daily food intake forms
g. goal/reward system
h. cassette/slides
i. involvement of family
j. follow-up contact
k. education handouts
l. other (specify)

6. Out of the above list of program components, which do you feel most helped your child control her weight? _____
_____
_____

7. Which of the above was most helpful to you in working with your child to control her weight? _____
_____
_____

8. Which of the above was most enjoyable to you? _____
_____
_____

9. Which of the above do you think was most enjoyable to your child?
_____
_____
_____

10. Which of the above do you feel will most help your child control her weight in the future? _____
_____
_____

11. Which program component(s) was/were the least helpful? _____

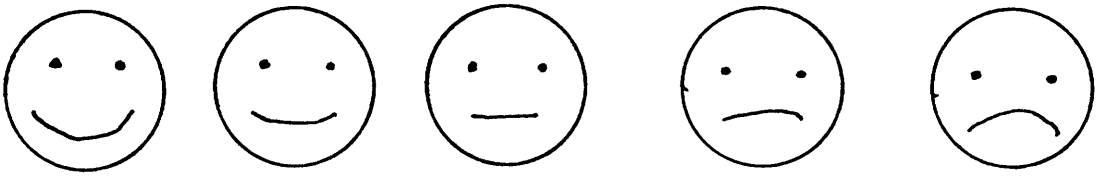
12. Do you feel the program was successful in helping your child control her weight? (Explain) _____

13. Does your family feel the program was successful? (Discuss this question with family members.) _____

14. How does your child feel about her participation in the program? (Discuss this question with your child.) _____

15. Rate your degree of satisfaction with the total program:
highly satisfied_____ satisfied_____ somewhat satisfied_____
not very satisfied_____ dissatisfied_____ very dissatisfied_____

16. Ask your child to indicate her degree of satisfaction with the total program according to the following pictures:



17. What was your impression of the program director (Dr. Dan Hubbard) in terms of the following factors:

a. attitude towards your child _____

b. attitude towards you _____

c. professional competency _____

d. role in this program _____

e. working relationship with the principal investigator _____

f. what do you feel he contributed most to the program _____

18. What was your impression of the principal investigator (Annell St. Charles) in terms of the following factors:

a. attitude towards your child _____

b. attitude towards you _____

c. professional competency _____

d. role in the program _____

e. working relationship with the program director _____

f. what do you feel she contributed most to the program _____

g. what would you recommend that she change or improve for the benefit of the program _____

19. The project director and principal investigator will continue to follow-up on your child's progress in controlling her weight by phone contact and occasional meetings. Which of the program components will <u>you</u> use to help your child continue to control her weight? _____

20. Use the following space to make any additional comments you have about the program _____

Thank you!

APPENDIX T

CASE HISTORIES

Case A

Subject 1 was an 8-year-old girl who stood 4 feet 6 inches tall and weighed 136 pounds which placed her above the 95th percentile for both height and weight. She was initially 149% overweight with a fat-fold of 42 mm which was also above the 95th percentile. She was classified as obese according to these measures. Subject 1 gave an appearance of being both tall and heavy, which was in striking contrast to her short, thin mother. Her mother reported that the subject's father had been tall and overweight. The family history revealed that the subject's parents were of mixed race. The mother was white and the father was black. The subject appeared to be black. The mother and father had never married and the mother had given birth to a second child by a different black man. The mother was presently living with the father of the second child but they were not married.

The subject stated that she wished to lose weight because her friends at school teased her. The mother reported that the subject had attempted to lose weight but had been unsuccessful. She also stated that a school teacher refused to allow the subject to wear shorts to school because of her weight. The subject was asked to repeat the second grade that year. She subsequently transferred schools.

Subject 1 seemed confident and comfortable during the treatment sessions except when asked to take the intelligence test. The tester reported that she appeared to have visual-motor difficulties and a short

attention span which contributed to her receiving a low-normal score. During the weekly meetings she expressed particular enthusiasm for watching films and always asked to see them twice.

The mother reported that the main reason for the subject's obesity was eating the wrong foods. She also stated that the subject frequently visited her grandmother's home where she was allowed to buy snacks at a local store. The subject admitted that this information was correct and listed her favorite snacks as soft drinks, ice cream, and chips. The mother listed her favorite snacks at home as peanut butter and crackers, grilled cheese sandwiches, and cereal.

Both the mother and subject agreed that the subject was physically very active with swimming listed as the favorite activity. The availability of a swimming pool at the apartment complex where the family lived allowed her to swim frequently.

Information gathered from the daily records and comments made by the mother and subject during the meetings suggested that frequent, rapid consumption of high calorie foods was the main factor contributing to her obesity. The subject seemed very pleased whenever weight loss was observed and expressed motivation to continue treatment success. When weight loss was not apparent she became sullen and began listing all of the high calorie foods she intended to eat that night. The mother seemed unable to provide consistent reinforcement for the subject in changing these eating behaviors, even though she expressed a desire for her to do so.

A home visit was made during the study. The subject seemed very pleased to see the PI and PD and called several of her friends to come meet them. The home appeared neat and clean and included a private

bedroom for the subject. During the visit the subject was physically active, running in and out of the apartment and riding her bicycle in the parking lot.

The mother, younger brother, and father of the brother were all present during the visit. The father was observed eating a candy bar while the younger brother was eating some cereal. At one point the subject brought in a cookie, given to her by a friend, and placed it in a cookie jar.

Two of the treatment sessions involved the subject participating in physical activity with the PI. A walk was scheduled during the first of these sessions. The subject appeared to have great difficulty maintaining a moderate walk pace and expressed a desire to stop several times. In contrast to her observed behavior, she reported during the walk that she was jogging regularly and was the captain of a neighborhood jogging club. She also described a film she had viewed in church that morning on the topic of exercise and weight control and stated that all of the church members were fat. She further reported that she had received praise from friends and acquaintenances for her observed changes in appearance.

The subject, PI, PD, and mother met at the University track to jog during a second session. The subject was again observed to experience much difficulty at this activity even when she was allowed to set a slow pace. She refused to walk even one lap around the track. The mother completed two laps and encouraged the subject to try harder.

During the final treatment sessions the subject appeared to have maintained a positive attitude about contributing to lose weight. When asked how she could do this she stated, "exercise, exercise, exercise,

and don't eat any of that stuff with lots of calories." When questioned as to what those foods were she successfully listed several high calorie snack foods which she had previously consumed in excess. Her swimming had stopped due to the weather change but she had substituted bicycling, roller skating, and school gym class to maintain her activity level. She appeared happily adjusted to her new school, and reported that her teacher was praising and encouraging her weight loss.

Case B

Subject 2 was a 4-year-old girl, 3 feet 8 inches tall, and 71 pounds which placed her above the 95th percentile for height and weight. She was initially 104% overweight with a fatfold of 23 mm which was also above the 95th percentile. She arrived at the first meeting with her mother and older brother. The mother also appeared obese while the brother gave the appearance of normal weight. The mother reported that the father was overweight and tall. The subject stated that she wished to lose weight and had not tried before. The mother reported that the subject had been overweight for one year.

At the beginning of each meeting the subject would appear pouty, frown at everyone, state that she wanted to leave, and give an angry cry if addressed. This behavior quickly changed when it was ignored and the subject was taken to be measured. Her mother reported that the subject's mood was a reflection of how she felt about her eating and exercise habits of the previous week and whether or not she anticipated a weight loss.

The mother stated that the subject's snacking habits contributed most to her obese condition. When questioned about this the subject

commented that her brother ate lots of snacks and she wanted to snack whenever he did. Upon hearing this, the brother was observed to tease the subject with boasts that he could eat anything he wanted because he was not fat. At this point, an attempt was made to involve the brother in the treatment program by encouraging him to eat appropriate snacks or to consume other snacks out of view of the subject. Initially, he was rewarded for this behavior. The mother also reported that the father liked to have a high calorie dessert every night with dinner. The family agreed to change this pattern so that the father would have his dessert with his lunch at work or would substitute fruit for the evening dessert.

The subject's initial activity level was low and sporadic consisting primarily of playing outdoor running games. During the treatment program the family became involved in taking evening walks with the subject several times a week and the subject began jumping rope indoors. When the subject went on a walk with the PI she maintained a steady pace although she requested returning to the meeting site several times. During a visit to the University track the subject jogged two laps without stopping and seemed particularly interested in racing with the PI.

During a home visit, the PD and PI observed the interactions of all the family members. The house was neat and clean with no evidence of food in sight. The subject had her own bedroom. A swing-set was in view in the back yard and the subject was anxious to show the PI and PD the route where she took her walks. All the family members were present during the visit. The father expressed his enthusiasm for the subject's continued weight loss and stated that he was pleased with the results so

far. The subject appeared happy during the visit and related her disappointment when it was time for the PI and PD to leave.

At the final treatment session the subject expressed her intention to continue weight loss by "not eating as much and trying to exercise." The mother's attitude seemed positive and she expressed a desire to enroll the subject in an exercise club.

Case C

Subject 3 was a 4-year-old girl weighing 65 pounds and standing 3 feet and 6 inches tall. She was initially 86% overweight with a fatfold of 26 mm. Her weight and fatfold measures were above the 95th percentile while her weight was in the 75-90th percentile range. The subject's mother and maternal grandmother attended meetings with the subject. Both appeared to be obese and the mother reported that the father was also obese. The mother and father had divorced approximately one year earlier which, according to the mother, was also the time the subject's weight problem began. The mother suggested that the subject's weight problem was the result of the subject spending more time at the grandmother's home where she was overfed.

The grandmother seemed very interested in helping the subject to lose weight and invited suggestions as to how she might play an active role in treatment. The mother was actively attempting to lose weight herself by a self-monitored reduced calorie intake, and by attending exercise classes at a local health club.

The subject was initially nervous at attending the meetings but appeared to relax after the first session. She stated a desire to lose weight and made frequent reference to exercising with her mother. Both

the mother and the grandmother reported that the subject was highly active and "constantly moving around." The subject had not attempted to lose weight before this time.

The mother stated that the main reason the subject was obese was that she ate the wrong foods, principally as snacks. The subject said that she believed she was overweight because she ate too much food.

The subject's main source of physical activity was reported to be dancing indoors to music. The subject was observed to walk at a steady pace without apparent effort. In addition, during a visit to the University track she successfully jogged 4 laps with the PI. During the jog, the subject talked continuously about her plans for losing weight by "not eating much and exercising a whole lot."

Partway through the treatment program the mother expressed a need to stop attending meetings because of the financial burden of paying for gas. She insisted that she had not lost interest in the program and regretted dropping out. The PI and PD chose to maintain contact with the subject by making frequent visits to the home.

The home visits disclosed that the subject and mother were residing in a small apartment behind the grandmother's house. The mother frequently stated a desire to move farther away and indicated that she felt her mother interfered with the subject's progress in the program. During the visits the grandmother was usually present and always expressed interest in the subject's treatment. She frequently related what the subject had been eating and questioned the appropriateness of the food selections.

The mother continued her own attempts at weight loss with moderate success. It was observed that her periods of weight loss

coincided with loss by the subject, and the mother's weight gain paralleled the subject's gains. During the final treatment visit the subject expressed the intention of continuing treatment success. Both the mother and grandmother stated their desire to help the subject manage her obesity.

VITA

Annell St. Charles was born in Nashville, Tennessee, on November 8, 1951. She attended elementary school in that town and was graduated from St. Bernard Academy High School in May 1969.

She received the Bachelor of Science in Human Behavior from George Peabody College, Nashville, Tennessee, in May 1973. The following two years she worked as a daycare teacher and flower gardener in the New England area.

In September of 1976 she moved to Knoxville, Tennessee, and began work on a Master's degree at The University of Tennessee, Knoxville. She received a Master of Science degree in Public Health Nutrition in August 1977.

She accepted a graduate teaching assistantship in Nutrition Science from The University of Tennessee, Knoxville, in September 1977 and began working towards a Doctor of Philosophy degree. In April 1979 she resigned from her assistantship and accepted the position of Perinatal Nutritionist with the Regional Perinatal Program, The University of Tennessee Memorial Hospital and Center for the Health Sciences. She received the Doctor of Philosophy degree with a major in Nutrition in March 1981.

Ms. St. Charles is a registered dietitian. She is a member of Omicron Nu and Phi Kappa Phi honor societies, the American Dietetic Association, American Public Health Association, the Society for Nutrition Education, the National Jogging Association, and the Association for the Advancement of Behavior Therapy. She is employed as a nutritionist with the East Tennessee Regional Obstetrical Program, Knoxville, Tennessee.