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Obesity Management: A Meta-Analysis of Key Factors

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OBESITY MANAGEMENT: A META-ANALYSIS OF KEY FACTORS

by

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Special thanks go to my wife, Marianne, who motivates me more than she knows by telling me that I can become a gardener upon completing my academic sojourn.

David E. Christian

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ABSTRACT

Obesity Management: A Meta-Analysis of Key Factors

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Obesity is a prevalent and refractory disorder. This study consisted of a meta-analysis of research focusing on diet and exercise treatments and their impact on obesity-related measures. Only studies that report data for periods of 6 months or more after treatment onset were included. Forty-four studies were analyzed. These were drawn from 16 previous reviews of the literature as well as several computer data bases.

Following are some of the tentative conclusions drawn: (a) diets consisting of improved nutritional quality yield superior results to restricted calorie diets; (b) flexible, self-directed exercise yields better results than more regimented exercise; (c) individual administration of treatment produces more weight loss than group-based treatment; and (d) long-term efficacy has not yet been demonstrated by any treatment type or modality.

(105 pages)

CHAPTER I

INTRODUCTION

Over the past three decades, obesity has come to be recognized as a prevalent and serious disorder. Studies by the National Center for Health Statistics (1985) revealed that 28% of adults ages 25-74 are overweight. Numerous physiological hazards are associated with excessive weight. These include digestive and neurological disorders, hypertension, musculoskeletal problems, endocrine and metabolic disturbances, cardiovascular disease, and diabetes.

In spite of these serious health hazards, obesity remains extremely resistant to treatment. A plethora of treatments, including surgical procedures, appetite suppressant drugs, group reducing plans, medically supervised fasting, bizarre diets, and pure quackery, have on the whole yielded miserable results. Americans, while spending an estimated $8 billion annually on reducing methods, regain 105% of the weight they lose (Stuart, 1967; Jeffrey & Katz, 1977).

In short, the great attention and expenditure of resources focused on obesity have resulted in pathetically little progress in its treatment. Experts are now concurring that the most promising long-term treatment of obesity requires adherence to a regimen combining appropriate diet and exercise. Research by Bailey (1978); Remington, Fisher, and Parent (1983); and Leville (1985)

pointed to the importance of maintaining a moderate caloric intake high in nutritional value. The exercise component of the treatment regimen should consist of moderate aerobic exercise engaged in for 15 to 60 minutes per day, 3 to 5 times per week. It appears that long-term adherence to such a regimen lowers the body's set point for stored fat and at the same time raises the metabolic rate. In tandem, these effects yield the best promise for long-term fitness. These effects accrue only if the subject adheres to such a regimen. In short, adherence is emerging as the key factor in successful obesity treatment.

Over the past two decades there have been several reviews of literature that have directly and indirectly addressed the issue of obesity treatment and adherence to diet and exercise regimens. Unfortunately, these have had narrow foci, concentrating on the use of a particular method (e.g., behavior modification), a specific population (e.g., cardiac rehabilitation patients), or a single treatment aspect (e.g., diet or exercise). This has resulted in a rather fragmented picture of adherence, especially as it relates to obesity management.

The situation described above points to the need for a review of literature that explicitly summarizes what is known about diet and/or exercise treatments of obesity and adherence to such programs. With this as the content focus of the review, the question arises, "What type of

methodology should be employed to best elucidate the factors of importance and their interrelationships?"

In his Methods of Integrative Reviews, Jackson (1980) outlined six guidelines to be followed if a review is to successfully infer generalizations about important issues from a body of primary research that addresses those issues. Those guidelines are as follows:

1. Carefully select the questions or hypotheses to be addressed. This selection process should be guided by 1) available theory on the topic; 2) careful examination of prior research on the topic; 3) primary research on the topic; and 4) personal intuition, insight, and ingenuity in recognizing factors that bear upon the topic. As a part of this process, previous reviews should be examined for factors already found to be of importance.

2. The method used to sample articles for inclusion should be systematic and explicit. This not only allows a more complete pool of studies to be selected, but it also provides the specificity necessary for replication.

3. Quantitatively represent the characteristics and findings of primary studies. This requires a systematic coding system for article characteristics and conversion of outcomes to a common metric.

4. Analysis of primary studies should be comprehensive. Statistical analysis should include consideration of the methodological strengths and weaknesses of individual

studies, subject characteristics, treatment variables, and how these factors interact with outcome.

5. Interpret results so as to illumine theory, policy, and practice. Given the amount of effort that goes into a high-quality review, maximum utilization of interpretation should be made.

6. Report the review in a way that permits full critique and replication. The methods, conventions, and other procedures employed should be made explicit in the report of the study.

Although Jackson's (1980) criteria seem highly demanding, there is a review methodology that satisfies all of them. This method, known as meta-analysis, was developed and first utilized in a classic study by Smith and Glass (1977). Since that time, criticism and continued refinement have facilitated the evolution of meta-analysis into a valuable tool for quantitative integration of research. Properly applied meta-analysis goes further than any other review method in meeting the criteria set forth by Jackson.

This study consists of a meta-analysis of the available literature on diet and exercise treatments of obesity. Because of the meta-analytic methodology employed, it is considerably more comprehensive than previous reviews in this area. It reveals the relationship among a wide range of subject characteristics, treatment factors, and outcome variables. The conclusions drawn from this study are

directly applied to the treatment of obesity and other disorders requiring adherence to diet or exercise regimens.

Researchers are currently calling for more holistic approaches to diet and exercise promotion. Such approaches would address adherence with multimodal treatments as opposed to previous approaches that have tended to modify one or a few factors thought to affect adherence. In a recent review of exercise adherence studies, Martin and Dubbert (1982) concluded that:

> One of the most important tasks facing behavioral medicine/health psychologists studying exercise and exercise adherence is the development of powerful treatment "packages"- suitable for individual tailoring- that will produce acceptable adherence to both home and institutional/structured exercise programs. (p. 1013)

This study provides the kind of integrative review of primary research necessary for the creation of the treatment packages outlined by Martin and Dubbert. It also focuses on those studies that provide obesity-related data for periods of 6 months or more (from the onset of treatment). This permits analysis of the long-term effects of treatment.

In the following chapter is found a more detailed analysis of previous reviews and a description of how this study will improve upon them.

CHAPTER II

REVIEW OF LITERATURE

In the first section of this chapter, previous reviews of literature dealing with diet and exercise programs are considered in more detail. The second section of this chapter reviews literature concerning the meta-analytic method. Finally, a description is given of how this meta-analytical study will specifically improve upon previous reviews.

Computer-assisted searches of Index Medicus, Psych Abstracts, ERIC, and Sportfile data base systems were used to generate a starting list of references relative to diet and exercise adherence literature. Networking procedures were then used to expand the pool of references even further. These methods yielded 16 reviews of literature relating to diet and exercise adherence.

Following is a brief summary of each of these reviews. Though several provide quite thorough analyses of treatment factors within a given domain, note how narrow these domains are.

Reviews of Diet Adherence Literature

Abramson (1973) reviewed several behavioral approaches to weight control. He grouped studies together according to the type of procedure used: aversive conditioning, covert sensitization, coverant conditioning, therapist

reinforcement for weight loss, and self-control of eating. Of these, Abramson concluded that self-control strategies hold the most promise for success. Unfortunately, few of the studies he included provide the follow-up data necessary to evaluate long-term effectiveness. Abramson suggested that consideration of the effects of certain demographic factors, such as sex, age, and external sources of reinforcement, should also be considered in future studies.

In an updated review of behavioral approaches to weight control, Abramson (1977) examined several studies published after his previous review. In this review he included articles in each of the categories mentioned above and added a new category: bibliotherapy. His major conclusion is that self-control treatments are superior to other behavioral methods. Abramson avoided any in-depth summary of long-term effectiveness, indicating that to do so would require a greater number of studies with follow-up data.

Stuart (1973) reviewed 37 studies of behavioral control of overeating. He presented the procedures employed and the outcome at termination and follow-up in tabular form. He concluded that operant studies employing reprogramming of the environment showed the best results of any of the behavior modification approaches. Though he made some useful recommendations for primary research, he failed to describe such things as the nature of the treatment programs used in the primary studies, mode of treatment delivery (individual vs. group), or the pattern of adherence or

attrition.

Stunkard and Mahoney (1976), in a book chapter on the behavioral treatment of eating disorders, provided a nice matrix analysis of 52 studies of behavioral treatments. Maintenance data were available for some of these studies, but the authors did not systematically analyze or synthesize it. Instead, they simply provided a handful of adherence guidelines randomly derived from these studies. These guidelines include: (1) use of self-monitoring systems, (2) nutrition education, (3) instruction in exercise management, (4) instruction in stimulus control, (5) therapist and group reinforcement, (6) training significant others in social reinforcement strategies, (7) training in cognitive behavior modification, (8) development of problem solving skills and establishment of self-regulated incentive systems, and (9) provision of booster sessions and contracts.

Stunkard and Penick (1979) reviewed 10 studies of behavior modification for obesity that included follow-up data. Though the number of studies in this review is small, unlike the studies mentioned above, it does focus on maintenance of weight loss. Rather than looking for systematic patterns of factors affecting maintenance across studies, the authors simply provided a narrative assessment of each study's findings. They concluded that clinically important weight losses produced by behavioral treatments are not well maintained. They suggested that behavioral treatments produce fewer negative side effects and lower

treatments produce fewer negative side effects and lower dropout rates than traditional treatments.

Jeffery, Wing, and Stunkard (1978) compared the findings of 21 behavioral treatments for obesity with the findings of a study they conducted themselves. They concluded that (1) longer treatments produce greater weight losses; (2) weight losses resulting from behavioral self-control techniques persist for at least one year but additional losses are not achieved without therapist assistance; and (3) greater treatment intensity (individual rather than group intervention with greater frequency and duration of treatment sessions) leads to greater losses.

Reviews of Exercise Adherence Literature

Godin and Shephard (1983) reviewed 15 studies, most of which were health education interventions. The most helpful aspect of Godin's work is his matrix presentation of the objectives, duration, setting, target group description, methodology, measurement criteria, treatment description, major findings, and study design. Unfortunately, an unusual mixture of outcome variables appears among these studies. These include such things as attitude change, mood change, anxiety level, productivity, absenteeism, and perceived health status. The key factor of physical activity change receives scant attention.

list of principles useful in promoting exercise adherence. These include (1) educational meetings, (2) providing a fitness newsletter, (3) minimizing injury with a moderate exercise prescription, (4) emphasizing group participation, (5) deemphasizing regimented calisthenics, (6) including the spouse in activities, (7) providing feedback of results, (8) incorporating recreational games, (9) cultivating personal relationships with subjects, (10) establishing regularity of workouts, (11) providing music during workouts, and (12) providing awards recognizing accomplishment. Franklin did not systematically review these studies in a way that permits generalizations about the impact of specific treatment components.

One of the most prolific writers in the area of exercise adherence is Oldridge. In a book chapter published in 1979, he reviewed studies of exercise adherence employing postmyocardial infarction patients and healthy patients. A major focus of his review is the examination of treatment dropout characteristics. Based upon his analysis he recommended that treatment programs include (1) an exercise prescription, (2) access to facilities, (3) educational opportunities, (4) small group discussion, (5) a forum for social interaction for participants, (6) spouse and family interaction, and (7) continued feedback from personnel.

These recommendations are not systematically tied to the studies from which they are derived.

In 1982 Oldridge conducted a more formal review of the literature, in which he looked at studies of compliance and exercise in primary and secondary prevention of coronary artery disease. Although the number of studies reviewed is fairly large (29), the author resorted to a narrative account of the overall findings without systematically assessing, item by item, factors thought to improve or detract from adherence. He concluded that the following factors impinge significantly on adherence: (1) promotion of an organized support system, (2) number of supervised sessions, (3) likelihood of injury, (4) financial commitment, (5) time commitment, (6) promotion of other health behaviors (smoking cessation), (7) accessibility of facilities, and (8) self-selection for participation.

Oldridge and Stoedefalke (1984) examined compliance rates from different exercise programs involving cardiac rehabilitation populations. After looking at dropout patterns, they used the Porter-Lawler process model and Maslow's hierarchy of needs as schemas for conceptualizing the adherence phenomenon. The authors suggested several methods for promoting adherence but again, did not systematically tie them to the studies from which they came. Their recommendations include: (1) use of participant report cards, (2) health education, (3) spouse involvement, (4) participant selection of activities, and (5) extrinsic rewards for adherence.

Martin and Dubbert (1982) summarized the findings of a number of articles that focus on aerobic exercise and its impact on cardiovascular risk reduction, obesity, diabetes, and smoking. In this review, too, there is no evidence of a systematic approach to gathering or synthesizing the findings of the primary research included. The authors simply provided a sketchy summary of adherence findings under headings such as subject factors, program factors, social/environmental factors, and so forth. Manipulatable adherence-related factors considered by the authors include (1) subject's attitude toward exercise, (2) subject's self-motivation, (3) spouse and family support, (4) exercising with others, (5) intensity level of exercise, (6) use of behavioral contracting strategies, (7) contingency management strategies, (8) direct reinforcement, (9) stimulus control, and (10) cognitive self-control strategies.

Dishman (1982a) organized his review of adherence literature around three models (psychological, biological, and psychobiological). The goal of his review was the promotion of study of behavioral prescriptions for exercise adherence. Dishman also considered stage theory, which proposes that adherence is developed progressively and in distinct stages with behavioral influences operating differentially across time. Dishman concluded his mostly theoretical review by suggesting that promotion of adherence may be best facilitated by (1) accurately diagnosing the

dropout-prone individual, (2) determining the key environmental influences impinging on the individual's adherence, and (3) manipulation of the appropriate environmental controls.

A second review by Dishman (1982b) only briefly summarizes factors found to be related to exercise adherence. These include (1) spouse and family support, (2) accessibility of the treatment facilities, (3) self-motivation, (4) location of exercise site, (5) use of behavioral management techniques, (6) social reinforcement, (7) goal setting, (8) cognitive restructuring, (9) tailoring of program to participants based upon screening measures, (10) injury prevention, and (11) follow-up sessions after treatment ends. The emphasis of his paper is a call for further study of factors promoting adherence. Dishman pointed out that the majority of studies have looked at the results of exercise (e.g., increased stamina and improved psychological functioning) while neglecting its causes.

Dishman has recently edited a valuable sourcebook: Exercise Adherence: Its Impact on Public Health (1988). Two of the chapters in this book review exercise adherence literature. The first of these, by Knapp, looks specifically at the use of behavioral management techniques in promoting exercise. Knapp conceptualized adherence as a stage process, involving (1) the decision to start exercising, (2) early phases of habit acquisition, and (3) maintenance of the new behavior. She considered these

exercising, (2) early phases of habit acquisition, and (3) maintenance of the new behavior. She considered these stages from the perspective of the health belief model, the self-regulatory model, the decision-making model, and the relapse prevention model. Knapp outlined several procedures linked to exercise adherence: (1) assessment and modification of health beliefs, (2) use of decision-making strategies, (3) modeling, (4) increasing exercise cues, (5) decreasing cues for competing behavior, (6) reduction of punishing consequences associated with exercise, (7) positive reinforcement for exercising, (8) self-monitoring, and (9) relapse prevention strategies. Though Knapp's chapter is very readable, it fails to describe the process of study selection and says little about characteristics of individual studies included.

Pollock's (1988) chapter in Dishman's book reviews literature dealing with an important issue: the nature of exercise prescribed and its impact on adherence. Pollock attempted to answer questions regarding the relationships between exercise adherence and (1) frequency of training, (2) duration of training, (3) mode of training, and (4) ratings of perceived exertion. One major drawback to this review is that it includes only 17 studies, all of which were conducted by Pollock and his associates. The analyses presented are largely correlational rather than comparative.

Summary of Previous Reviews

Each of the reviews cited above tends to focus on (1) a narrow subject population, (2) a narrow range of treatments, or (3) a single aspect of obesity-related adherence (i.e., diet or exercise promotion). And none are designed to present their findings so as to foster development of the multimodal treatment packages called for by Martin and Dubbert (1982). In addition, When Jackson's (1980) criteria are used to evaluate the foregoing reviews, few satisfy more than two or three of these points.

A Review of the Meta-Analytic Method

The present study meets the criteria outlined by Jackson (1980) and provides the program-development-oriented information called for by Martin and Dubbert (1980). This is made possible by the meta-analytical method it employs.

Since its emergence as an integrative review method, meta-analysis has been utilized with a variety of subject matter ranging from headaches (Blanchard, Andrasik, Ahles, Teder, & O'Keefe, 1980) and psychotherapy (Smith & Glass 1977) to the impact of reinforcement on standardized test results (Taylor & White, 1981). To date, more than 100 meta-analyses have been reported in the literature. A wide range of technical evaluation and commentary regarding it has also emerged (Eysenck, 1978; Fiske, 1983; Glass &

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Kliegl, 1983; Leviton & Cook, 1981; Strube & Hartmann, 1982; and Wilson & Rachman, 1983).

The upsurge in use of meta-analysis led to its feature in a special section of the February, 1983, issue of Journal of Consulting and Clinical Psychology. Mintz, one of the contributors to this section, acknowledged the utility of meta-analysis but provided several useful cautions: (1) Questions to be answered must be specifically defined, (2) there may be poor correlation between the data base and clinical realities, (3) there is potential for confounding variables if data aggregation across studies is too extensive, (4) study quality must be considered in the findings, and (5) one must not jump to the conclusion that because a review employs meta-analysis it must be more objective than other methods.

Fiske, another reviewer of the meta-analysis approach, summed up his evaluation in this way:

> Meta-analysis is new. Its methods have not been perfected. We may well find grounds for criticizing any given meta-analytic investigation. Nevertheless, meta-analytic studies are clearly superior to the conventional qualitative reviews of research domains, simply because they are more scientific and because they more closely approximate the ideal in scientific work. As in the best of science, all steps are explicit. The studies included are identified, the computations of effect sizes can be verified, and the criteria for inclusion and for categorization are stated. (1983, p. 70)

This review of literature differs from and extends previous reviews in several important ways.

1. This review draws upon all of the available studies included in previous reviews plus all others that could be located that deal with exercise or diet interventions and their impact on obesity-relevant measures.

2. Rather than focusing attention on short-term treatment efficacy, this study addresses the more substantial question of long-term maintenance of outcome. Hence, to be included studies must have had outcome measures extending beyond 6 months.

3. A wide range of variables (e.g., subject characteristics, study quality, treatment type and intensity, etc.) are measured quantitatively to better reveal interrelationships.

4. All obesity-related outcome measures reported in studies are coded. This permits assessment of differential outcome due to measurement type as well as measurement correlation.

5. Methods and procedures are standardized and reported in a way that permits replication.

6. Findings of this study are interpreted so as to be of particular use in the design of treatment programs.

CHAPTER III

METHOD

The general methodological approach of this study can be described in terms of the guidelines provided by Jackson (1980).

Topic Selection

In selecting the topic areas to be included in this study, several factors were considered. First, the currently popular view of obesity etiology was considered. Specifically, if obesity is the product of an unbalanced energy equation, there are two primary angles of attack on the problem: (a) Decrease caloric intake levels (while maintaining adequate nutrient intake), and (b) increase the level of activity. This etiological/treatment paradigm pointed to the inclusion of studies which focus on promoting adherence to either a diet or an exercise regimen.

As indicated earlier in this thesis, there is mounting evidence that in spite of what can seem to be significant initial improvements with many obesity treatments, long-term maintenance of improvement is of greater importance (Stuart, 1967; Jeffrey & Katz, 1977). For this reason, only studies with treatment onset to outcome measure periods of 6 months or greater were included. Outcomes were coded for additional follow-up measures up to the last of these provided.

Since the general focus of this study is obesity treatment, the outcomes selected for inclusion are those that relate directly to obesity measurement. Nine different measures were reported in the pool of studies analyzed. Any of these measures provided by study authors were coded. Wherever possible, standardized mean difference effect sizes corresponding to these nine measures were calculated. (See Appendix A for list of these measures.) An addition to these measures, where authors reported data concerning it, the percent of subjects adherent to the regimen at the time of outcome measurement was also recorded. This provides some idea of the relationship between the treatment dosage level and outcome.

Sampling Method

With the assistance of a computer consultant, several computer data bases were searched for articles that met inclusion criteria. These data bases included Psychological Abstracts, Index Medicus, Education Resource Information Center (ERIC), and Sport File. From these searches the fifteen reviews cited earlier were located and the available studies from them were copied and filed. Reference sections of all of these publications were examined for relevant studies. This resulted in a pool of over two hundred articles. Careful examination reduced this pool to a group of 44 articles that met all criteria for inclusion. These

articles provided a total of 85 unique treatment evaluations with outcome measures. Those with additional follow-up measures provided an additional 40 cases, making 125 cases in all.

Quantitative Representation of Primary Study Characteristics

In the review of reviews described above, a list of variables previously evaluated was compiled. A coding sheet and corresponding conventions were developed to capture the most salient of these variables. As the coding of studies progressed, additional variables of importance were noted and incorporated into the conventions and coding sheet. During the analysis phase of the project, variables which were functionally equivalent were collapsed into a common variable. The final variables defined and measured by this process are described in Appendix A.

Analysis of Primary Studies

In the Results section that follows is found a wide variety of analyses. Given that the pool of studies collected comprise virtually the entire population of studies meeting the inclusion criteria, the data analysis consists of descriptive statistics (parameters) for this population. This includes means, (usually weighted by the number of subjects per study), standard errors for means

(which provide confidence intervals), standard deviations, and correlation coefficients.

Interpretation of Results

As suggested by Jackson (1980), the results of this study are interpreted so as to shed light on the design of treatment programs for obesity. Findings are also considered in light of current theory regarding obesity etiology and treatment. In addition, observations are made relative to the correlations between different outcome measures. Suggestions for future research are also made.

Report of Meta-analytic Process

The description of the process used to derive the findings of this study is as important as the findings themselves. For this reason, care has been taken to provide a description of the conventions used to code articles. In the section that follows, descriptions will also be given for the statistical procedures used to derive summary statistics. All computations were made using the Statistical Package for the Social Sciences, (version 10).

For a detailed description of subject, treatment, and study variables, the reader is referred to Appendix A.

CHAPTER IV

RESULTS

The results of this study are subdivided into four major sections. These consist of (a) a description of subject characteristics, (b) an account of the different dimensions along which study characteristics were coded, (c) a description of treatment variables, and (d) a number of comparisons between different treatment variables, study variables, and subject variables as these relate to outcomes.

Subject Characteristics

Age

As indicated in Table 1, the mean age of subjects in studies was 34.3 yrs. Means ranged from 10 yrs. to 51 yrs. The standard deviation suggests that most subjects were in the 24-44 yr. age range. This is a fairly young group, that is, the geriatric population is not represented here. This could be the result of subject self-selection. In other words, younger people may be more weight and fitness-conscious both for health reasons and aesthetic purposes.

Gender Distribution

Examination of the mean for percent male suggests that only a quarter of subjects were male. However, a mean weighted by number of subjects per study shows that males

Table 1

Subject Age and Sex: Means and Standard Deviations

Subject Characteristic	Mean	S.D.	n
Mean Age	34.3	10.49	56
Percent Male	25.7	35.69	85
Weighted Mean	45.6	39.60	85

comprised nearly half of all subjects. In most of the tables that follow, only one mean will be presented. (Generally weighting of means makes little difference). However, in this case, the observed difference is considered noteworthy. What accounts for the difference? Examination reveals that several studies employed large numbers of cardiac rehabilitation subjects. Such samples tend to be almost exclusively male. It would appear that the majority of traditional obesity treatment studies employ predominantly female subjects. (Note: Throughout this study, n is used to denote the number of studies or "cases". N will be used to denote the total number of subjects upon which a statistic is based.)

Obesity Level

The obesity level of subjects was rated in terms of criteria developed after obesity data for all articles were

gathered (See Table 26, Appendix A.). These criteria were designed to divide the original 85 cases into three groups of roughly equal size. From Table 2 it will be noted that the lowest category contains the largest proportion of subjects (43.5 %). This was allowed since a number of subjects were selected primarily because of their cardiovascular profile rather than for explicit obesity problems, and therefore were of lower level obesity to begin with.

Based on those studies that provided pre-treatment obesity data, an obesity profile of subjects can be constructed. Table 3 provides this profile.

Unfortunately, there is little consistency in the measures used by researchers in describing pretreatment obesity level. The most common measure used is weight in pounds, used in 47% of cases. Percent overweight was reported in 40% of cases, pounds overweight in 6% of cases, and percent fat in 5% of cases. Two threshold criteria were

Table 2

Obesity Level: Categorical Distribution

Obesity Category	Percent	n
Low	43.5%	37
Medium	25.9%	22
High	30.6%	26

Table 3

Subject Pre-Treatment Obesity Level: Selected Measures

Measure	Mean	Max.	Min.	S. D.
Weight in Pounds	193	407	143	39.0
Pounds Overweight	40.4	60.0	9.0	26.9
Percent Overweight	45.4	78.0	10.0	14.3

also reported: minimum pounds overweight (8%), and minimum percent overweight (48%). Since these latter measures are thresholds, they provide almost no idea of the obesity level of subjects actually in the sample.

Methods of Subject Selection

The methods used for selecting subjects were also diverse. As can be seen in Table 4, the most common method involves advertising for subjects, usually in a local newspaper. The next most frequently used methods involved referrals from physicians and volunteers solicited directly (e.g., students offered extra credit for study participation).

It will be noted in Table 4 that the total percentage is over 100%. This results from studies which employed more than one selection criteria.

Table 4

Method of Subject Selection: Percents by Category

Selection Method	Percent	n
Hospital Inpatients	3.5%	3
Employee Participants	2.4%	2
Physician Referral	15.3%	13
Advertisement Respondents	49.4%	42
Treatment Seekers	8.2%	7
Volunteers	15.3%	13
No Indication	10.6%	9

Health Status of Subjects

The health status of subjects is especially important to assess in obesity treatment studies. Treatments which promote change in diet and/or exercise pose a variety of physiological risks to subjects. Hence, the careful pretreatment assessment of subjects is ethically important. In view of this, it is peculiar that only half of the studies reported a medical screening for their participants. (See Table 5 for health status information.)

Only one third of studies indicated that subjects were found to have no health problems that would affect their participation. Although metabolic disorders were commonly screened for, no studies indicated that subjects with such problems were included in their samples.

It is interesting that 5% of studies used psychiatric patients as subjects. Treatment efficacy with such subjects can be expected to be enhanced due to the more structured setting most are found in. On the other hand, treatment efficacy can also be hampered by the psychiatric disorders present. This leads one to wonder why specific psychological testing information is never reported. Indices of anxiety, depression, body image, and other obesity-related factors could provide useful information regarding differential effectiveness of treatment for all subjects.

Table 5

Health Status of Subjects: Percents by Category

Health Status	Percent	n
Cardiac History	5.9%	5
Metabolic Disorders	0.0%	0
No Health Problems	35.3%	30
Psychiatric Patients	4.7%	4
Medically Screened	49.4%	42
No Indication	9.4%	8

Study Characteristics

Year of Publication

Of the over 200 articles originally screened for inclusion in this study, only 44 met the criteria previously described. In Table 6 is found a frequency distribution of the year of publication for each article and the number of cases derived from articles of a given year of publication. Most articles are from the period 1971 to 1980.

Table 6

Year of Publication: Frequency Distribution

Year of Publication	# of Articles	# of Cases
67	1	1
68	1	1
69	1	1
70	1	2
71	5	7
72	3	4
73	7	12
74	3	7
75	1	1
76	5	9
77	4	14
78	3	6
79	3	4
80	3	3
81	1	1
82	1	4
85	1	6
Total	44	85

Period

Table 7 provides a summary of several study variables as of the first outcome measure. (Unless stated otherwise, statistics presented throughout this chapter represent variables as of the first outcome measure.) The variable "period" indicates the amount of time lapsing between the onset of treatment and the time of the outcome measurement. As can be seen, on average, the first outcome measurement accepted for inclusion in this study occurred 9 months after treatment onset. The shortest period accepted for inclusion in the study was 6 months. About 85% of first outcome measures occurred between 6 and 12 months after treatment onset.

Threats to Validity

The sum of the individual threats to validity are also summarized in Table 7. On average, studies scored 4 total points for threats to validity. Such a score could be given for four minimal threats to validity or a single moderate threat. (See Appendix A for a detailed definition of threats to validity and descriptions of scoring conventions.) This suggests that the methodological rigor of this body of studies is not exemplary. The coding of this information is perhaps most useful in examining the relationship between study quality and outcome. This will be explored later.

Treatment Components

This section provides information about the various dimensions with which obesity treatments are categorized and quantified.

Treatment Components

Treatment components are the specific strategies and procedures used to reduce obesity level. (See Appendix A for descriptions of each treatment component.) As indicated in Table 8, 41 different procedures were employed in the studies coded. Frequency refers to the number of studies in which a particular procedure was employed. The column labeled "Type" indicates which broad treatment category a procedure represents. These listings are used to group studies for categorical analyses presented later in this section.

By far the most commonly used procedure was self-monitoring. Self-monitoring serves as an adjunct in a wide variety of treatments, and in some cases, figures as a major treatment component itself. Nutritional education and therapist reinforcement for progress also figured prominently. Some procedures occurred too rarely to offer any indication of their unique contribution to outcome. For example, use of the buddy system, T.V. videotaping of progress, and self-management occurred only once each. Even these infrequently used treatments provide useful outcome information when grouped with similar interventions.

Table 8

Treatment Components: Frequencies and Categorizations

Treatment Component	Frequency	Type
Access to facilities	4	Beh
Aversive conditioning	3	Beh
Bibliotherapy	11	Ed
Booster sessions	8	Soc
Chaining procedures	5	Beh
Buddy System	1	Soc
Cognitive behavior modification	1	Cog
Commitment- verbal	1	Soc
Commitment- Written	3	Soc
Contracting procedures	19	Beh
Covert sensitization	6	Cog
Discussion- general	1	Soc
Education- exercise	14	Ed
Education- general	17	Ed
Education-nutrition	26	Ed
Goal-setting	7	Ed
Group discussion	1	Soc
Group reinforcement	1	Beh
Hypnotherapy	2	Oth
Imagery	6	Cog
Individualization of tx.	1	Oth
Induced anxiety training	2	Cog
Insight therapy	3	Cog
Modeling	10	Beh
Monitoring- by other	6	Beh
Monitoring- by self	60	Beh
Photographed- T.V picture	1	Soc
Problem solving	10	Ed
Reinforcement- by other	6	Beh
Reinforcement- by peer	5	Beh
Reinforcement- by self	24	Beh
Reinforcement- by family member	5	Beh
Reinforcement- by therapist	30	Beh
Relaxation	11	Beh
Self motivation/management	1	Beh
Self punishment	3	Beh
Shaping	1	Beh
Slowed eating rate	3	Beh
Stimulus control	37	Beh
Supervised exercise sessions	7	Soc
Tokens	9	Beh

Key: Beh= Behavioral Ed= Educational Cog= Cognitive
Soc= Social Oth= Other

For each study, up to ten treatment components were coded. All studies had at least one treatment component, 41% had at least 5 components, and 2% had 10. On average, cases had 4-5 components. Having multiple treatments being tested with a single group of subjects creates a great potential for confounding of outcome. This problem would be less significant if only treatments of a single general type were tested simultaneously (e.g., all behavioral or all cognitive). However, treatments of differing general types were often combined within the same study.

The list presented in Table 8 provides considerable insight into which treatments have received much experimental attention and which need more examination. By and large, behavioral treatments as a class have received the most scrutiny. This is not surprising given that many of the studies reviewed were published during behaviorism's heyday.

What is more surprising is the dearth of studies that employ cognitive or cognitive behavioral methods. Given the rise in popularity of cognitive approaches to treatment in the seventies, it seems strange that these treatments are so under-represented in the area of obesity management. In view of their efficacy with related disorders (e.g., depression, anxiety management, self-image, self-defeating behavior, etc.), this finding suggests that their impact on obesity needs further investigation.

Treatment Mode

This variable indicates whether treatment was administered to subjects individually, in groups, or as a mixture of of these two. As can be seen from Table 9, three quarters of researchers opt for group administration of treatment. This is probably due to the fact that treating a group is usually much more costly than individual treatment. Unfortunately, many subjects require individual tailoring of programs to their unique needs. As can be seen, the individualized mode of treatment constitutes a minority.

Table 9

Treatment Mode: Distribution

Treatment Mode	Percent	Frequency
Individual	20.0%	17
Group	76.5%	65
Combination	1.2%	1
No Indication	2.4%	2

Also, the use of a combined approach would also seem to have its merits, but as Table 9 indicates, this mode too has received very little attention.

Treatment Quantity and Cost

Table 10 provides summary statistics for treatment duration (number of weeks treatment lasted), intensity

Table 10

Treatment Duration, Intensity, Total, Cost: Summary Statistics

Variable	Mean	Max.	Min.	S. D.
Treatment Duration	11. 7 wk.	77 wk.	1 wk.	9. 50
Treatment Intensity	1. 36 hrs.	. 3 hrs.	5. 0 hrs.	. 87
Treatment Total	20. 1 hrs.	231 hrs.	1 hr.	35. 19
Treatment Cost	18. 8 $	250 $	0. 0 $	38. 10

(number of hours per week subjects spent in direct treatment), total treatment (the product of duration and intensity; yielding total hours in direct treatment), and cost (the amount subjects paid for treatment, including deposits). Three quarters of studies had treatment durations between 8 and 15 weeks. This may be more a reflection of the logistic constraints of university quarter and semester systems (most studies are conducted by university clinicians) than it is a reflection of ideal treatment duration.

There is surprisingly little variation in treatment intensity. Most subjects were in direct treatment from 1-2 hours per week. The mean treatment total of 20 hours is also remarkable. To believe that significant improvement with a disorder as refractory as obesity can be achieved in 20 weeks requires considerable faith, at least. However,

when we consider the time and financial constraints on treatment, if progress is to be made, it must be made with a minimum expenditure of each.

In most studies (72%) there was no charge to the participants. Most fees charged were in the form of deposits, some or all of which could be earned back by adhering to contractual arrangements.

Diet Types

As indicated in the Introduction of this paper, the most popular dietary method for treating obesity has been the reduced calorie diet. Current research (also cited in the Introduction) suggests that the diet type of choice for treating obesity consists of improving the nutritional quality of subject's intake, with caution not to reduce

Table 11

Diet Types Employed: Percents and Frequencies

Diet Type	Percent	Frequency
Avoidance of Sel. Foods	7.1%	6
Improved Nutritional Quality	8.2%	7
Reduced Calorie	40.0%	34
Target/Traffic Light	9.4%	8
Counting Mouthfuls	3.5%	3
Diet Used But Not Described	17.6%	15
Total Using Diet(s)	78.8%	67

caloric intake excessively. As indicated in Table 11, the majority of studies using diets have promoted simple reduction of caloric intake. Only about a tenth of studies explicitly employed diets based on improved nutritional quality. Careful examination of "avoidance of selected foods", and the "target/traffic light diet" (See Appendix A) suggests that these diets too would result in improved nutritional quality in most cases. Hopefully, researchers in this area will become more aware of the fact that prolonged caloric restriction can inadvertently increase the difficulty of maintaining weight loss. As such awareness increases we should see a move away from reduced calorie diets in favor of nutritional quality-based diets.

Exercise Types and Intensity

It is now generally accepted that for exercise to be of maximal value in obesity management, it must be of an aerobic level. Aerobic level is most simply determined by measuring one's pulse during exercise and comparing this to publicly available charts for target aerobic heart rates.

It is disconcerting to note that within studies employing exercise (36 of 85), very rarely was it indicated that subjects were instructed as to the importance of maintaining an aerobic pace during their workout. As can be seen in Table 12, only 14% of studies indicated that the prescribed exercise was specifically "aerobic". Although all of the other types of exercise could be conducted at an aerobic level, this was not made specific. For some

Table 12

Exercise Types Employed: Percents and Frequencies*

Exercise Type	Percent	Frequency
Aerobics	14.1%	12
Calisthenics	7.1%	6
Jogging/Running	8.2%	7
Lifestyle Exercise	8.2%	7
Walking	3.5%	3
Games	2.4%	2
Self-Selected	4.8%	4
Other	1.2%	1
Exercise Used but not Described	5.9%	5
Total Using Exercise(s)	42.3%	36

* This table collapses some categories listed separately in the conventions.

exercises (e.g., jogging/running), without proper training, subjects can easily exceed their aerobic heart rate range and enter the "anaerobic" range. This is a situation where more is not necessarily better. The metabolic processes set in motion by anaerobic exercise are not conducive to long-term treatment of obesity. In spite of this, few studies reported making these facts known to subjects.

From studies which reported exercise intensity (hours of exercise per week) it can be seen that most subjects were

exercising between 2 and 5 hours (See Table 13). Is this appropriate? It is hard to tell from the way the data are reported. When previously sedentary subjects are beginning an exercise program, caution must be taken to start gradually. During the first weeks, a prescription of only 15 minutes per day, three times per week may be appropriate. This can be progressively stepped up depending upon each individual's physiological profile. In the majority of cases included in this study there was little indication of such program tailoring. Future studies would do well to describe more explicitly the nature of exercise prescription.

Table 13

Exercise Intensity: Summary Statistics*

Variable	Mean	Max.	Min.	SD	N
Exerc. Int.	3.4 Hr/Wk	6.0 Hr/Wk	1.0 Hr/Wk	1.53	70

* 14 Cases employing exercise did not report exercise intensity.

It is interesting to note that out of the 85 cases, only 13 employed both an exercise and a diet component in their treatment. With current knowledge in the field pointing toward the utility of combining diet and exercise, the incidence of studies considering both will hopefully increase.

Outcome Measures

Perhaps the most interesting questions to be answered by a meta-analysis of this sort are those related to treatment efficacy. Researchers and practicing clinicians alike are always asking "What treatments work best?" and "What factors impinge on treatment efficacy?". This section provides statistical information which begins to answer such questions.

Before examining the outcome data, a cautionary note is warranted. As has been noted earlier in this section, the studies included in this analysis contain (in most cases) a variety of treatment components. Therefore, the possibility of confounding outcomes warrants constant attention. In most cases, the effects of these confounds, as well as the impact of treatment interaction, present a problem not unlike that of untangling a great wad of ropes and strings. Put more simply, outcome statistics for any treatment factor should be interpreted as only <u>suggestive</u> of its effectiveness. This is because it is very difficult to control for the multiplicity of treatment factors that co-occur when pooling the results of large numbers of studies.

<u>Outcome Measure Distribution</u>

When using meta-analytical methods it is important to develop a common metric, that is, a measure into which all reported outcomes can be distilled. This allows uniform

quantitative comparison of outcomes across studies. In most experimental studies, the standardized mean difference effect size is used for this purpose. This measure is calculated by dividing the difference between the means of the control and experimental groups by the standard deviation of the control group. The effect size allows us to say how impactful a treatment is in terms of the subjects' pretreatment or untreated variability on the outcome measure.

Wherever possible in this study, effect sizes were calculated. The data in Table 14 describe how frequently any given measure was available along with the frequency of availability of corresponding effect sizes. As can be seen, data for pounds lost is most frequently reported. Unfortunately, in only a third of these cases was there sufficient data to compute an effect size for pounds lost. The next most frequently reported outcome measure, percent of overweight lost, is available for only one fifth of all studies. And in only a third of these was calculation of an effect size possible.

Rather than drop a large proportion of studies from the pool, pounds lost was selected as the common metric. In the analyses that follow, it and the effect size for pounds lost will be reported.

Table 14 also reveals a glaring lag in the state of obesity research. Currently, leaders in the fields of exercise physiology and bariatrics are agreeing that the

Table 14

Outcome Measures: Frequency of Occurrence

Outcome Measure	Frequency	Percent
Pounds	69	81%
E. S.	23	27%
Percent Overweight	18	21%
E. S.	6	7%
Percent Body Fat	5	6%
E. S.	4	5%
Skinfold Thickness	7	8%
E. S.	5	6%
Percent Body Weight	3	4%
E. S.	0	0%
Percent Excess Weight	2	2%
E. S.	0	0%
Weight Reduction Index	4	5%
E. S.	0	0%
Body Mass Index	4	5%
E. S.	0	0%
Body Density	1	1%
E. S.	1	1%

outcome measures of choice for obesity research are those which reflect percent body fat. This measure provides the best index of change in body composition (relative to the adipose/lean body mass ratio).

Use of percent body fat or "adipose" (fat) measures is especially important when exercise is a part of the treatment regimen. Exercise builds lean body mass. This can cause an initial paradoxical weight gain, even though

body fat and body volume are decreasing. Adipose measures are also less influenced by meaningless fluid loss which frequently accompanies reduced calorie dieting. In view of all of this, it is sad that so much of the literature is based on outdated measures.

Treatment Components

Table 15 provides weighted means for pounds lost and corresponding effects sizes for select treatment components. SE stands for standard error of the mean and serves as a confidence interval for comparing any given pair of means. For example, the mean weight loss for covert sensitization is -11.9 lbs. and the mean for bibliotherapy is -6.0 lbs. If we create a confidence interval of two standard errors around each of these measures, we find that there is no interval overlap. This suggests that the difference in means is a "true" difference and is probably not attributable to sampling error. The standard error for the weighted mean is calculated by dividing the standard deviation for all subjects by the square root of N. N is the number of subjects represented by the weighted mean and n represents the number of studies from which these subjects come.

The greatest weight loss (-14.3 lbs.) occurred with modeling procedures. (See the Treatment Components section of Appendix A for detailed descriptions of treatment components.) Also showing considerable effects were problem

Table 15

Weighted Means for Weight Loss: Selected Treatment Components

Treatment Cmpnt.	Lbs.	SE	N	n	ES	SE	N	n
Contingency Proc.	-12.1	.3	222	18	-.42	.02	75	7
Covert Sensit.	-11.9	.4	74	7	-	-	-	-
Bibliotherapy	-6.0	.2	270	7	-.13	.00	179	1
Educ/Discussion	-7.5	.2	721	37	-.14	.01	259	8
Hypnotherapy	-2.2	.1	20	2	-.16	.00	12	1
Imagery	-11.9	.6	68	6	-	-	-	-
Modeling	-14.3	.6	70	6	-.46	.01	70	6
Problem Solving	-12.4	.2	219	10	-	-	-	-
Reinforcement	-12.3	.3	362	31	-.45	.03	128	13
Reinf- Thrpst.	-7.5	.6	291	22	-.25	.02	58	5
Self Monitoring	-8.8	.2	885	49	-.23	.01	365	18
Stimulus Control	-11.4	.2	488	29	-.43	.06	65	8
Supvsd. Exercise	-3.6	.0	218	3	-.13	.00	218	3
Token Economy	-10.5	2.5	39	5	-	-	-	-

solving (-12.4 lbs.), contingency procedures (-12.1 lbs.), and reinforcement by associates (-12.3 lbs.). The latter is a composite of the categories; reinforcement by peer, self, family member and other. It is interesting that the treatment effect for reinforcement by associate is considerably larger than that for subjects receiving

reinforcement from their therapist (-7.5 lbs.). This might suggest that in spite of therapists' "authority" status, reinforcement by oneself or one's significant others is more impactful.

Treatment components showing minimal effects are also of interest. Hypnotherapy (-2.2 lbs.) was used in only two studies. Since this figure is based on only 20 subjects, judgment of this intervention should be suspended until further evidence is available. Supervised exercise sessions showed a minimal weight loss also (-3.6 lbs.). Even though this is based on only three studies, 218 subjects are represented. What could explain such a small weight loss? As pointed out earlier, pounds lost provides a weak measure of exercise efficacy. Subjects in this group may have lost as much or more fat than others, yet gains in lean body mass (muscle) could have camouflaged this. Also, subjects in studies using exercise tend to be less obese to start with than other subjects.

Educational/discussion treatments (this includes the categories of nutritional, exercise, and general education as well as general discussion treatments) showed only moderate effects (-7. 5 lbs.). This figure is based on one of the larger subject pools, N= 721.

Outcome: Major Treatment Groups

It can easily be argued that the analysis above is too fine-grained. That is, its unit of analysis, individual

treatment components, is artificial. Rarely is any one of these treatments the sole treatment component in a study. Therefore, a more general analysis, based on broad treatment categories, is also presented. All treatment components were categorized as being primarily behavioral, educational, cognitive (including cognitive behavioral), social, or "other" in nature. These classifications are recorded in Table 8.

All treatment components for each study were recoded based on the five general categories outlined above. These new codes were then used to group each of the 85 cases into one of the five major treatment groups described. Outcomes for these groups are presented in Table 16.

Table 16

Pounds Lost for Five Major Treatment Categories (All Subjects)

Trtmt. Category	Lbs.	SE	N	n	ES	SE	N	n
Behavioral	-10.4	.3	607	47	-.36	.03	170	18
Educational	-5.0	.2	298	6	-.15	.00	201	2
Cognitive	-11.5	1.1	91	10	-	-	-	-
Social	-2.2	.1	299	3	-.19	.02	41	2
Other	-3.0	.1	38	3	-.16	.00	12	1

A rather surprising fact is that cognitive treatments show the greatest overall effect (-11.5 lbs.). Whether or not cognitive treatments are clearly better than behavioral treatments (-10.4 lbs.) is not certain given the size of the SE for cognitive treatments. However, it is interesting that a treatment classification that has received little attention (10 studies compared to 47 for behavioral treatments) shows up so well in terms of outcome. This finding points to a need for more studies of cognitive treatments of obesity.

The other two general treatment categories; social and educational, show less than half the impact of cognitive and behavioral treatments. Though their outcomes (-5.0 lbs. and 2.2 lbs. respectively) are based on small numbers of studies (6 and 3), they represent fairly large numbers of subjects (298 and 299).

Differential Treatment Effects

As with any treatment, the question can be asked: "Do obesity treatments have differential effectiveness with different subgroups of the population?" One of the most obvious ways of subgrouping the population of obese subjects is by obesity level. As described earlier, a set of conventions for this purpose was developed and used to divide subjects into three groups: low, medium, and high levels of obesity. Tables 17, 18 and 19 provide outcome statistics for these three groups by treatment category.

Table 17

Pounds Lost for Five Major Treatment Categories

(Low Level Obesity Subjects)

Trtmt. Category	Lbs.	SE	N	n	ES	SE	N	n
Behavioral	-10.4	.4	208	20	-.16	.02	75	8
Educational	-5.7	.2	264	5	-.15	.00	201	2
Cognitive	-48.0	.0	1	1	-	-	-	-
Social	-2.1	.1	269	2	-.36	.00	11	1
Other	-3.0	.1	38	3	-.16	.00	12	1

Table 18

Pounds Lost for Five Major Treatment Categories

(Medium Level Obesity Subjects)

Trtmt. Category	Lbs.	SE	N	n	ES	SE	N	n
Behavioral	-10.1	.5	183	13	-.45	.01	92	9
Educational	+.7	.0	29	1	-	-	-	-
Cognitive	-11.2	.7	41	4	-	-	-	-
Social	-2.9	.0	30	1	-.13	.00	30	1
Other	-	-	-	-	-	-	-	-

Table 19

Pounds Lost for Five Major Treatment Categories (High Level Obesity Subjects)

Trtmt. Category	Lbs.	SE	N	n	ES	SE	N	n
Behavioral	-11.1	.6	203	14	-2.53	.00	3	1
Educational	-	-	-	-	-	-	-	-
Cognitive	-11.1	1.8	49	5	-	-	-	-
Social	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-

In general it appears that the relative efficacy of these general treatment types does not change appreciably across obesity levels. This finding is very tentative, however, given the low number of studies represented in some cells of these matrices.

Treatment Mode

Does the mode in which treatment is presented affect outcome? Table 20 outlines the differential effects of the three levels of treatment mode. These data suggests that individual administration of treatment may have as much as three times the effect of group-administered treatment. Although the statistics for individual administration of treatment are based on only 75 subjects, these subjects represent a total of 14 studies. It appears that the

Table 20

Treatment Mode: Outcome Effects

Treatment Mode	Lbs.	SE	N	n	ES	SE	N	n
Individual	-17.9	1.7	75	14	-.85	.23	15	3
Group	-6.6	.2	1225	52	-.21	.01	389	18
Combined	-1.7	-	8	1	-	-	-	-

benefits of individual treatment administration might outweigh the increased costs associated with it. Such conclusions are only tentative until it can be demonstrated that similar effects occur with randomized experimental studies. Such research would prevent the possibility of bias arising from more obese subjects being assigned individual treatment more often than less obese subjects.

Treatment Variable Correlations

The Treatment variables we have examined up until now have been dichotomous, that is, a particular treatment is either present or not present. Now we will consider several variables which are continuous, and therefore lend themselves to correlational examination. Table 21 contains Pearson correlation coefficients for each of several variables with three of the most commonly occurring measures and their corresponding effect sizes. Pounds lost, of course, is a simple measure of weight change. Percent

Table 21

Selected Treatment Variables and Outcome: Correlations

Variable	LBS	LBSES	POW	POWES	STHK	STHKES
Treatment Cost	.01	-.03	.03	-	.09	-.38
Trtmt Total	.14	.39	.26	-	-	-
Exerc. Intens.	-.24	-.25	.29	-	.26	.99!
F-U Frequency	.16^	-.14	-.14	.21	.56^	.74^
Threat to Val.	.31!	.31^	.17	-	.61^	.49

Significance Level ^= .1, *= .05, ! = .01

overweight provides a measure of the proportion of weight lost which was deemed to be "excess". For example, if the Metropolitan standards indicate a 5-foot 8-inch female subject should weigh 135 lbs and the subject's actual weight is 165 lbs, 30 lbs are deemed excess. If treatment produces a 10 lb loss, the subject's percent overweight score would be -33.3%.

The third measure in Table 21, skinfold thickness, indicates the loss in millimeters of skinfold thickness as measured by a skinfold caliper. Of the three measures, skinfold thickness is the only one which provides a direct measure of fat loss rather than pounds lost.

Treatment cost seems to have little effect on the outcomes considered. This is a bit surprising in view of cognitive dissonance theory. This theory suggests that the

more one becomes invested (financially or otherwise) in treatment, the more committed one will be.

Total hours of treatment was NOT observed to have a statistically significant effect on outcomes. This is remarkable. A scatterplot was made to look for a curvilinear relationship but none was present. This would suggest that the sheer amount of therapy has less impact on weight loss than other treatment or study characteristics.

Study quality, as represented by the score for threats to validity, seems to be positively associated with both pounds lost and skinfold thickness lost. In other words, studies of poorer quality produced smaller losses in terms of pounds and skinfold thickness. An analysis was done in which a weighted mean for pounds lost was calculated for studies with validity threat scores of 3 or lower (n=37). The result; -11.0 lbs, SE=.4. A parallel calculation for studies with scores of 4 or greater (n=48) produced a weighted mean of -5.3, SE=.2. Therefore, it would appear that studies of good methodological quality show weight losses over twice as large as those of studies employing poor methodology.

Diet Type

Does the type of diet used make a difference in outcome? Data in Table 22 suggest that avoidance of selected foods may be the most effective of the diets

Table 22

Weighted Means and Confidence Intervals: Diet Type

Diet Type	Lbs.	SE	N	n	ES	SE	N	n
Avoid. Sel. Fds.	-20.0	2.9	26	5	-.27	.00	6	1
Impr. Nut. Qual.	-12.9	.7	78	7	+.01	.03	13	2
Reduced Calorie	-8.8	.4	399	27	-.42	.01	49	5
Target/Traffic	-14.3	.6	70	6	-.46	.01	70	6
Counting Mthfl.	-11.0	.4	23	2	-	-	-	-

reported. However, the number of studies and subjects on which this is based are both low.

Diets involving improved nutritional quality, target/traffic light methods, and counting mouthfuls lead to losses ranging from 11 to 14 pounds.

Ironically, reduced calorie diets, employed in 27 studies, with nearly 400 subjects, produced the smallest losses. The three diet types associated with the greatest losses are all variations of improved nutritional quality diets. This provides further evidence that it is time for researchers in this area to abandon reduced calorie diets for diets that are based more on the nutritional composition of foods in the diet.

Exercise Type

Table 23 presents comparisons of four general categories of exercise in terms of pounds lost. Note that

Table 23

Weighted Means and Confidence Intervals: Exercise Type

Exercise Type	Lbs.	SE	N	n	ES	SE	N	n
Aerob./Calisth.	-3.8	.3	463	16	-.23	.03	187	14
Jogging/Walking	-4.0	.2	214	4	-.16	.22	214	4
Lifestyle Exer.	-6.8	.6	58	5	-.26	.03	43	3
Self-Selected	-14.9	.3	19	2	-	-	-	-

the magnitude of weight loss is small compared to diet and other interventions. Again, this could be the combined effect of less obese subjects and the fact that exercise increases lean body mass.

Although the number of studies is small in some cases, there appears to be a general trend. That is, as degree of exercise structure decreases, weight loss increases. The exercise types in Table 23 are arranged in what could be considered an order of descending structure. That is, Aerobics/calisthenics are usually highly structured, requiring participants to meet at specified times and places, follow exercise directions, and continue routines for prescribed amounts of time. Jogging and walking require some special gear (shoes) but otherwise leave other aspects up to the discretion of the exerciser. Lifestyle exercise builds upon the subject's present routine of activities and self-selected exercise allows for complete

freedom of choice as to time, place, and type of exercise. As one moves down the list, outcomes become larger. It appears that a fruitful area for future research will be the exploration of the relationship between exercise regimen flexibility and adherence/outcome.

Long-Term Efficacy of Treatment

A great issue in the treatment of obesity is long-term efficacy or maintenance of treatment outcome. Even though a treatment may produce rapid improvement, if subjects also quickly regain most of the weight/fat, the utility of the treatment has to be questioned.

Table 24 lists summary statistics (weighted means and number of subjects) for all treatments during four distinct

Table 24

Outcome Measures For Specific Time Periods

P	LBS	N	LBSES	N	POW	N	POWES	N	STHK	N	STES	N
A	-6.8	897	-.32	168	-18.9	218	-.92	70	-4.22	57	-.49	31
B	-6.2	663	-.20	336	-14.3	162	-.74	60	-.91	53	-.33	53
C	-16.0	138	-.56	50	-	-	-	-	-	-	-	-
D	+1.0	119	+.03	119	-7.2	70	-.41	70	-.20	22	-.40	22

Key: P= Period, A= 6-11 mos., B= 12-17 mos., C=18-23 mos., D= Over 24 mos., N= Number of Subjects Represented, LBS= Pounds Lost, POW= Percent Overweight Lost, ST= Skinfold Thickness Lost, ES Suffix= Effect Size for each Measure.

time periods. Based on previous reviews of the obesity treatment literature, one would expect to see the greatest weight loss during the first period with weight loss steadily eroding over time. This is in fact the trend observed with the exception of the period 18-23 months after treatment onset. This temporary jump is unexplainable. There is no obvious reason for a sudden and short-lived improvement in outcome.

For the three longer-term periods (12-17 months, 18-23 months, and over 24 months) studies showing weight losses greater than the mean weight loss for that period were examined. There was no clear trend with regard to treatment types accounting for these superior results. This was due perhaps to the small number of studies reporting outcome for these extended periods.

Outcome Measure Correlations

It is evident that obesity researchers need to adopt a common metric for their work. Hopefully more of them will become aware of the advantages of adipose-based measures. Abandonment of pounds lost and similar measures is not necessary since these do provide useful data. Adipose measures will hopefully emerge as the outcome measure of choice. This becomes progressively more important as studies more consistently incorporate exercise into a previously diet-dominated treatment field.

In Table 25 is found a correlation matrix for the most commonly used outcome measures. This provides some insight into the relationships among these measures. Although few of these coefficients are significant at or above the 0.1 level, a trend is evident. With only one exception, those coefficients which are significant at or above the 0.1 level are those which represent correlations among pound-based measures (pounds, pounds e.s., percent overweight, percent overweight e.s.) OR, correlations among body-fat based measures (percent body fat, percent body fat e.s., skinfold thickness, skinfold thickness e.s.).

Table 25

Outcome Measures: Correlations

Msr.	LBS	LBSES	POW	POWES	PBF	PBFES	SKTK	SKTKES
LBS		.87!	.39^	.22	.18	-.21	-.05	.72*
LBSES			.25	.25	.49	.48	-.32	.31
POW				.91!	-	-	-	-
POWES					-	-	-	-
PBF						.72	.97^	.92^
PBFES							.80	1.0!
SKTK								.42

Significance Level: (^= .1, *= .05, != .01)

LBS= Pounds, POW= Percent Overweight, PBF= Percent Body Fat, SKTK= Skinfold Thickness, ES Suffix= Respective Effect Size

By collecting a variety of outcome measures on a large number of subjects, tables could be developed, like that found in Table 25, which could be used to more clearly establish concurrent validity of different obesity measures.

CHAPTER V

CONCLUSIONS

A total of 44 studies of obesity treatments were reviewed using meta-analytical procedures. These articles represent the studies considered in fifteen previous reviews. As far as it is known, this meta-analysis is the most comprehensive review of this literature to date. The findings of 85 unique treatment trials are integrated and evaluated. These trials represent 1,916 individual subjects.

On average, subjects in the studies analyzed were 34 years old, 46% were male. On average, subjects weighed 193 pounds and were 45% overweight. The majority became involved in studies by volunteering in response to public notices. Most subjects had no physical complaints other than obesity.

One of the biggest threats to internal validity of these studies is experimental mortality. On average, one-third of the subjects were unavailable for assessment at the time of the first outcome measure beyond 6 months. This suggests that researchers should plan to expend considerable effort to ensure continued client contact, even if clients are no longer adhering to treatment. Otherwise, it cannot be determined if subjects dropping out have done so because they have met personal treatment goals, because they have not, or if other factors have prevented their continuation.

A careful analysis of those dropping out of treatment could provide valuable insight into the causes of nonadherence.

Behavioral procedures are the most frequently evaluated treatment components. They provide relatively reliable outcomes of practical significance. They involve explicit procedures that lend themselves nicely to incorporation into bibliotherapy or didactic training. Specific behavioral treatments showing promise are contingency procedures, modeling, and reinforcement by significant others. Surprisingly, the latter treatment has been found to have considerably more impact than reinforcement by therapists. This corroborates the suggestion of some other researchers that significant others can play major roles in promoting treatment adherence.

The popularity of behavioral procedures seems to be eclipsing the emergence of their younger cousins: cognitive behavioral procedures. This study provides sufficient evidence to suggest that these methods may be as powerful or more powerful than standard behavioral procedures. It behooves researchers in this field to focus more attention on this family of interventions. Cognitive interventions showing considerable promise are covert sensitization, imagery, and problem solving.

Social and educational interventions have not yet been shown to make a practically significant impact on obesity. This may be the result of the fact that much less attention has been devoted to development and refinement of these

procedures. The fact that reinforcement by significant others has a strong impact on outcome suggests that social procedures in particular should be further explored.

A breakdown of results by obesity level provided no evidence that behavioral, cognitive, social, or educational treatments interact with the degree of subject obesity. However, small cell numbers necessitate further exploration of this issue.

Three-quarters of the studies presented treatment to subjects in groups. However, results from 14 studies using individual administration of treatment indicate that tailoring treatment to individual subjects yields outcomes nearly three times as large as those of group-administered treatments. This suggests that the key to successful obesity treatment may lie in tailoring interventions to individuals' unique characteristics and circumstances. Treatment designers would do well to incorporate as much of an individual element as possible into their programs.

This study suggests, contrary to cognitive dissonance theory, that there is no correlation between the amount of financial investment subjects make to treatment and the weight they lose.

Contrary to what most therapists would like to believe, the total time subjects spend in direct treatment does not correlate significantly with any of the outcome measures analyzed. This suggests that treatment developers should

focus more upon the quality of treatment than upon the sheer quantity.

It would be easy to suppose that studies of poor methodological quality would produce results of greater magnitude than studies of better quality. Just the opposite is true for the studies reviewed. Studies of poor quality produced about half as much weight loss as studies of good quality. It appears that the threats to internal validity of the studies reviewed herein systematically suppress outcome magnitude.

Diets that are based on improving the nutritional quality of subjects' consumption appear to produce the best results. Reduced calorie diets produce the weakest results, in spite of the fact that they are the most frequently used. Treatment designers must disabuse themselves of the idea that simple caloric reduction is the key to weight loss. Nutritional quality shows itself to be a more salient factor.

The idea that the best exercise requires sweating in unison with a drill sergeant calisthenics director is not supported by this study. In fact, just the opposite may be true for the obese subject. It appears that the more freedom of choice regarding exercise selection, the better the outcome. Self-selected exercise produces the best improvement, with lifestyle exercise coming in second. Aerobics/calisthenics and jogging/walking came in last in terms of outcome. It may be that the obese subject finds

structured public exercise aversive for reasons of difficulty and/or embarrassment. Further study is needed to clarify the factors that produce this effect. Treatment designers must keep in mind that subjects must be helped to develop a natural enjoyment of exercise if they are to continue with it when not under the treatment implementor's watchful eye.

The long-term efficacy of treatment remains a major problem. When all treatment types are averaged, weight losses are not well maintained over time. On average, after 24 months, subjects weigh one pound more than they did upon entering treatment. This finding may not be so bleak if data were available for comparable subjects who did not enter treatment. If they were to gain significantly more, a mere one-pound gain among treated subjects would be a considerable success.

Regardless of the relative significance of the one-pound gain, this finding should serve as a warning to program designers that if success is to be maintained, careful attention to maintenance strategies is crucial. Initial success is only that. An equal if not greater challenge lies in maintaining those successes over the long run.

The vast majority of the studies used outcome measures based on weight loss. Although these measures provide some idea of treatment efficacy, they should be used only as secondary measures. Measures based on adipose loss are

superior. They provide the best index of improvement, especially when exercise is included in the treatment regimen.

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APPENDICES

Appendix A

Conventions

ARTICLE CODING CONVENTIONS

Below is found a summary of the coding conventions used in this meta-analysis. These guidelines provide the basis for quantitatively capturing the different variables of interest in each study. When an article did not provide information relative to a given variable, a code of -1 was given for that variable. In cases where the information for a variable was unapplicable, a score of -2 was given. An example of the latter would be found in coding an article which assessed the impact of a particular exercise program. Such an article would receive a code of -2 for the variable "diet type" since none was involved.

The conventions are presented in the same sequence as that used in the coding instrument.

IDENTIFYING INFORMATION

A. Study ID #. Each article is assigned a two-digit ID number.

B. Authors. This includes the last names of the article authors.

C. Year. This code indicates the year of publication of the source from which a case is drawn.

D. Treatment Group Number. Within any given study, a number of treatment groups may be found. A treatment group

is any unit of subjects which receives a unique treatment relative to other groups in the study. To be coded as such, outcome measures for that group must be available.

E. Time. For any given treatment group, outcomes may be provided across a wide range of times. The "time 1" coding indicates that the outcome measures recorded represent the first available after the minimum period of 6 months from onset of treatment. Separate data records are made for each set of outcomes available every 6 months after the "time 1" codings. This permits assessment of the ongoing status of treatment efficacy.

F. Treatment Type. After all articles had been coded, the various treatment components (described in the Treatment Components section below) were recategorized into 5 general treatment types. A computer printout of these new codings was used to categorize each composite treatment into one of the five general categories below:

1. Behavioral Treatment.
2. Educational Treatment.
3. Cognitive Treatment.
4. Social Treatment.
5. Other Treatment.

TREATMENT VARIABLES

The following variables describe the characteristics of the treatment(s) employed within a given case.

A. Treatment Components Treatment components are the specific methods, techniques, or procedures used to affect a change in the dependent variable. For each case, up to ten treatment components were coded. Where possible, treatment components were entered into the ten data fields in order of descending importance. For example, if self-monitoring was the chief treatment component used in a study, it would be coded first. If the authors gave any indication of the relative emphasis given to treatment components, this is used to rank-order codings. Otherwise, codings are entered sequentially according to the coder's judgement of relative importance.

Following is an alphabetical listing of the treatment components which occurred in this study. With each is provided a brief description and/or example:

1. Access to Facilities: Providing enhanced access or availability of the facilities necessary for treatment. Commonly, this involved providing such things as a worksite gym and locker facility for employees.

2. Aversive Conditioning: A behavioral method which pairs undesirable behaviors with a noxious stimulus. For example, subjects might be asked to bring in samples of their favorite high-calorie foods. Using a mask, the smell of these foods is alternately paired with aversive odors such as skunk oil, butyric acid, etc.

3. Bibliotherapy: The use of books, pamphlets, manuals, or other written materials as an integral part of therapeutic self-instruction.

4. Booster sessions: The provision of explicit therapeutic interaction between subjects and treatment implementors after the initial therapy/training is complete. Such sessions have the explicit purpose of reiterating and enhancing the original treatment(s).

5. Chaining Procedures: This behavioral strategy involves teaching the individual components of a complex activity one at a time. Subjects are then taught to link these components together into the overall pattern of desired behavior. For example subjects may be taught how to cook low-calorie foods, how to identify low calorie foods, and where to locate low-calorie foods in supermarkets. Once these individual components are learned they may be "chained" together to create the complete sequence of behaviors.

6. Buddy System: Involves structuring a treatment group into small units (usually two individuals per group). Such programs typically encourage members of each "buddy" group to develop increased rapport and comradery so as to better support each other in adhering to treatment regimens.

7. Cognitive Behavior Modification: This family of treatments involves teaching subjects to modify specific cognitive behaviors that serve as the eliciting cues for affective and overt behavioral responses. Such methods include negative thought stoppage, self-instructional training, counteracting irrational beliefs, and adopting alternate interpretations of situations.

8. Commitment-Verbal: An example of this treatment would include having subjects verbally commit themselves to treatment adherence. Such a commitment would be given to the treatment implementor and/or the other members of the treatment group.

9. Commitment-Written: This treatment is similar to that above with the exception that the commitments elicited from the subjects are put in writing.

10. Contracting Procedures: These procedures go beyond a simple written commitment in that they specify a reciprocal contractual arrangement between the treatment implementors and subjects. Usually stipulations are made as to specific contingencies that will attend adherence or nonadherence to the regimen. Deposits of money or other valuables are often involved.

11. Coverant Sensitization: This procedure, developed by Joseph Cautela, requires that the subject relax and imagine that he is about to engage in an inappropriate behavior (e.g. procrastinating exercise). At this point the subject imagines the occurrence of an aversive event (e.g., having to undergo heart bypass surgery). The term "coverant" derives from the combination of the terms covert and operant.

12. Discussion-General: Discussions used to help subjects share their concerns, failures, and successes. Such discussions are designed to foster self-expression and build group cohesion.

13. Education-Exercise: Explicit instructions concerning exercise, including such topics as: its role in weight reduction, injury prevention, adherence strategies, basic demonstrations, and methods for selecting appropriate exercise.

14. Education-General: Didactic presentation of information concerning general obesity-related issues such as: etiology of obesity, the role of social and emotional factors, and the medical consequences of prolonged obesity.

15. Education-Nutrition: Didactic instruction in which subjects are taught basic principles of sound nutrition. This often includes information concerning the role of fats, proteins and carbohydrates, estimation of one's caloric consumption, physiological/metabolic effects of specific foods, how to shop for appropriate foods, and information regarding basic nutritional requirements for those losing weight.

16. Goal-Setting: This procedure usually involves teaching subjects basic goal-setting techniques such as making explicit, written, concrete, and realistic goals, use of short and long-term goals, how to monitor progress, etc.

17. Group Reinforcement: This reinforcement procedure involves making reinforcement for an entire group contingent upon group achievement of a given criterion. Reinforcements might consist of points, praise, or award of prizes. Criteria might include achievement of a certain percent of the group being adherent, loosing an average number of pounds for a given week, etc.

18. Hypnotherapy: Such methods include any hypnotic procedures designed to elicit treatment adherence or its outcome. For example, a subject in a hypnotic state might be given a post-hypnotic suggestion that she will find previously tempting foods less desireable.

19. Imagery: Subjects are taught to visualize any of a number of scenes involving such things as engaging happily in exercise or diet behaviors, seeing themselves reaching their goals, or successfully coping with problems that have previously elicited overeating.

20. Individualization of Treatment: This method requires that other treatment methods employed be individually tailored to subjects. For example, instead of simply teaching the principles of cognitive behavior modification to a group, the treatment implementors work with subjects individually to help them adjust these methods to their unique abilities and circumstances.

21. Induced Anxiety Training: With their eyes closed, subjects are encouraged to allow feelings of anxiety to increase. When these reach a peak, subjects are directed to use Wolpean relaxation procedures to bring their anxiety down. Induced Anxiety Training is based on the assumption that subjects overeat in response to anxiety. Hence, if they are taught how to systematically reduce anxiety, they can reduce their motivation to overeat.

22. Insight Therapy: Treatment implementors using this method encourage subjects to become aware of the inner psychological dynamics that promote behaviors contributing to obesity. For example, a subject may come to discover that she "unconsciously" seeks to maintain her corpulent stature in order to insulate herself from the unwanted advances of the opposite sex.

23. Modeling: The objective of this treatment is to provide a model of appropriate behavior which can be imitated by the subject. For example, parents can be trained to model appropriate eating and exercise behaviors for their children.

24. Monitoring- By Self: Self-monitoring is a simple procedure in which the subject is taught to record the frequency or duration or quantity of a particular behavior. This may involve jotting notes on cards, creating a bar or line graph, or simply summing the behaviors observed. No particular reinforcement or punishment is involved, only record keeping.

25. Monitoring- By Other: This procedure is identical to that outlined above with the exception that the behavior recorder is someone other than the subject. Monitoring by others is especially indicated with children or psychiatric patients who lack self-monitoring skills.

26. Photographed- T.V. Picture: Involves the use of video images of the subject which can be used both as a record of treatment progress as well as an incentive to adhere to treatment.

27. Problem Solving: Includes any of several systems which teach subjects how to: clearly conceptualize the problem situation, refine the problem definition, generate a variety of problem solutions, select a course of action, and implement the selected course of action.

28. Reinforcement- By Other: Reinforcement consists of the contingent administration of anything intended to increase the frequency of a desired behavior. "Reinforcement- by other" was coded if the one administering the reinforcement to the subject was someone other than self, a peer, family member or therapist.

29. Reinforcement- By Peer: This category was coded if the reinforcement administor was a peer of the subject. For example, if a fellow treatment group member was primarily responsible for administering praise and/or other rewards to the subject for appropriate behavior.

30. Reinforcement- By Self: In this case the subject is primarily responsible for the administration of his own reinforcement for target behaviors.

31. Reinforcement- By Family Member: Here, the reinforcement administor is someone within the subject's own family. This would include a parent, guardian, or spouse.

32. Reinforcement- By Treatment Implementor: This item was coded if the treatment implementor was primarily responsible for reinforcement delivery.

33. Relaxation- Any procedure where the focal objective was to teach subjects how to relax themselves. Such procedures include Jacobsonian relaxation, deep breathing, and autogenics. For example, if it is hypothesized that overeating is a response to anxiety, subjects may be trained to deeply relax themselves when feeling the onset of anxiety, so as to circumvent inappropriate eating.

34. Self-Motivation/Management: Involves teaching subjects a variety of behavioral principles (e.g., the Premack principle, stimulus control, self-reinforcement/ punishment, etc.). An emphasis is placed on personal responsibility for success. This is contrasted with methods which emphasize the role of the treatment implementor as an authority and the major agent of improvement.

35. Self-Punishment: Punishment is defined as anything applied as a consequence of behavior which is intended to decrease the frequency of that behavior. Self-punishment treatments typically involve teaching the subject to self-administer punishment whenever an inappropriate behavior is performed. For example, a subject might be taught to snap a rubber band against his wrist whenever he approaches the refrigerator door between meals.

36. Shaping: The goal of this behavioral strategy is to slowly build complex responses through reinforcing their successive approximations. For example, a subject might be reinforced for buying exercise clothes one week, for walking 10 minutes a day the next week, until finally, the subject must engage in 30 minutes a day of jogging to receive his reinforcement.

37. Slowed Eating Rate: Subjects are taught to slow the pace of food consumption. This may be achieved through having them count to 10 between spoonsful, setting their utensil down between bites, or any other procedure that similarly slows eating pace.

38. Stimulus Control: This family of behavioral strategies involves the identification of the environmental cues that trigger appropriate and/or inappropriate behaviors. Once these are identified, the subject is taught to restructure her environment to increase cues for appropriate behavior (e.g., putting her walking clothes out on her bed) and/or decrease cues for inappropriate behavior (e.g., choosing a walking route that avoids bakeries, candy machines, etc.).

39. Supervised Exercise Sessions: This technique is designed specifically to promote exercise behavior by having someone supervise exercise sessions. The director can provide instruction, encouragement, and social facilitation not available to the solitary exerciser.

40. Token Economies: This procedure provides concrete objects (e.g., poker chips, play money, tickets, etc.) as reinforcers for appropriate behavior. Such objects are reinforcing since they may be exchanged for rewards or privileges subjects find attractive.

B. Treatment Mode This variable represents the level at which treatment was administered. The following codes are used:

1. Individual Administration: Treatment was administered predominantly on a one-to-one basis. This is especially characteristic of single subject designs.

2. Group Administration: Treatment was administered on a group level.

3. Combined Administration: Although treatment was administered on a group level an effort is also made to tailor the intervention to individual subjects on a one-on-one level.

C. Treatment Duration. This is a measure of the number of weeks treatment lasted. For treatment to be considered in progress, subjects had to be seen at least every other

week and the purpose of contact with subjects had to be primarily the administration of treatment (as opposed to simple follow-up visits).

D. Treatment Intensity. This variable indicates the actual number of hours (to the nearest tenth of an hour) that subjects were in contact with the treatment implementors.

E. Treatment Setting This provides a record of where the treatment was administered. Following are the possible codes:

1. Clinic.
2. Doctor's office.
3. Home.
4. Recreation facility.
5. Hospital.
6. Work site.
7. Other.

F. Treatment Cost. This provides the treatment cost in dollars for the subject. In situations where deposits were employed, the deposit amount is recorded as the cost.

G. Diet Type. For each case, the types of diets employed were recorded. They are coded as follows:

1. Avoidance of Selected Foods: Such diets require subjects to limit or eliminate from their diet classes of foods that are thought to promote obesity. Such foods may be specific items such as candy, pastries, or processed meats, or they may be general types such as refined carbohydrate foods or fatty foods.

2. Improved Nutritional Quality: These diets involve teaching subjects to improve the general nutritional quality of their dietary intake. Typically an emphasis is placed upon maximizing the ratio of nutrients to calories. This ratio is often called the index of nutritional quality (INQ) and is calculated as a decimal figure.

3. Reduced Calorie: This diet emphasizes reducing the subject's overall daily caloric intake. Typically, subjects are given calorie charts and asked to calculate the caloric equivalent of whatever they eat. They are usually asked to maintain a daily intake below a given threshold.

4. Target or Traffic Light Diet: These diets provide subjects with information concerning the nutritional value of various basic food groups. Subjects may be allowed unlimited consumption of some food groups (e.g., green vegetables), limited allowances of others (e.g., breads) and no allowances of some (e.g., butter, cream, etc.).

5. Counting Mouthfuls: This diet requires subjects to keep records of how many mouthfuls of food are eaten. Specific number limits may be imposed on some food types.

H. Exercise Type. This variable describes the type of exercise(s) employed in the subject's treatment regimen. Up to three types were coded. The types are:

1. Aerobics: This includes activities which were carried out at an aerobic level and which did not fall into any other category. Examples would include aerobic dance, cycling, rowing, and so forth.

2. Calisthenics: This includes any prescribed routine of calisthenic-type exercises.

3. Jogging: Although full scale "running" was rarely prescribed, it is also included in this category.

4. Lifestyle Exercise: Such exercises involve increasing the intensity and/or duration of exercise found in the daily routine. For example subjects may be encouraged to steadily increase the distance they walk from their car to work (by parking progressively further away). They might also be asked to begin taking stairs instead of elevators.

5. Swimming: Includes swimming in any body of water.

6. Walking: Includes walking of all types; on tracks, treadmills, or city streets.

7. Other: Any type of exercise not categorizable elsewhere.

8. Games: Exercises which take the form of games. Examples include basketball, volleyball, racquetball, and so forth.

9. Self-Selected: Such programs encourage subjects to design their own regimens. Hence, they may consist of a combination of several exercise types.

I. Exercise Intensity. This figure represents an estimate of the total hours per week that subjects were to engage in exercise. If measures of actual hours per week are available, these were used.

J. Follow-Up Frequency. This record provides the mean number of contacts per month made with subjects after the main treatment had come to a close. For follow-up cases, this figure corresponds to the period since the previously recorded case period.

K. Follow-Up Quality. This variable indicates the nature of follow-up contacts made with subjects. The following codes were used:

1. Measurement: The primary purpose of the follow-up contact was to repeat outcome measures.

2. Treatment: Though the contact may have included measurements, the main purpose was to reiterate and extend the treatment program.

STUDY CHARACTERISTICS

The following section includes variables which describe the characteristics and design of the study itself.

A. Period. This indicates the number of months since the onset of treatment. Outcomes are taken no less than 6 months after the onset of treatment and no sooner than every 6 months thereafter. After the first year, outcomes are recorded only once per year.

B. Validity Threats. Each case was coded relative to the types and intensity of various threats to internal validity of the study. Following is a listing of potential codes for each threat:

0= Not a plausible threat to internal validity.

1= Potential minor problem in attributing the observed effect to treatment; by itself, not likely to account for a substantial amount of the observed results.

4= Very plausible alternative explanation which could account for a substantial amount of the observed results. Requires evidence rather than simple suspicion of threat.

9= Very plausible alternative explanation which could explain most or all of the observed results. The evidence of this threat is clear and substantial.

The following threats to internal validity were coded using the system outlined above.

1. Selection. Subjects are selected for membership in the experimental and control groups in a fashion that resulted in their being unequal with regard to variables that are causally related to the outcome variables.

2. Mortality. In experimental studies this relates to the differential loss of subjects from the control and experimental groups. Such loss can bias outcome. A similar bias can occur in pre-post studies of obesity, where it is common for subjects who make the least progress to drop out of treatment. When their data are lost, remaining data yield statistics biased in favor of the treatment. For pre-post studies the following guidelines were used for the mortality threat:

0= 0-10% loss of subjects.
1= 10-25% loss of subjects.
4= 25-50% loss of subjects.
9= > 50% loss of subjects.

3. History. This threat entails any factors or events that came to bear differently on subjects in the experimental and control groups and that have plausible impact on the outcome variable. In pre-post analyses, history threats include factors, other than the treatment, which could influence the outcome. For example, if it is evident that most or all of the subjects in a treatment group were concurrently attending the meetings of a weight-reduction group (e.g., TOPS), it is conceivable that much of the outcome could have been due to such participation.

4. John Henry Effect. Typically, this effect is seen when a control group performs better than expected when placed in competition with an experimental group that employs a treatment threatening to replace the control treatment. However, the phenomenon can be expected to occur among treatment groups within a study when they perceive themselves in competition with each other. The plausibility of this threat increases as the groups involved come into closer proximity of each other and/or as their ongoing outcome data are more readily accessible to each other. For example, the John Henry Effect could be very pronounced if members of group A are losing weight by learning a diet modification program and have their weekly meetings in the YMCA building where they interact with members of group B who are using exercise to reduce weight. The problem is exacerbated if the weekly group weight losses for both groups are posted on a public bulletin board.

5. Statistical Regression. This threat arises when a test-retest procedure is used to assess the impact of treatment. The effect can be especially pronounced when subjects have been selected based upon their extreme scores on one test and are then post-tested with a similar measure. For example, if only very obese subjects are accepted for inclusion in a study, chances are, a significant amount of weight loss would occur over a period of time with no treatment at all.

6. Diffusion of Treatment. This threatens validity when the treatments different groups of subjects receive can diffuse among groups. The threat becomes more pronounced as the opportunity for subject interaction rises and as the "absorbability" of the alternate treatments rises. For example, if the alternate treatments are injected drugs administered by physicians, the inter-group absorbability would be very low. However, in obesity studies, where many treatments are of an informational nature, and hence, lend themselves to verbal sharing, potential absorbability is relatively high. The "YMCA" scenario cited in the John Henry Effect example above would provide an opportunity for treatment diffusion.

After each validity threat was rated, the individual ratings are then summed to provide a single overall index of threat to internal validity.

C. Design of Study. After coding a sample of articles in this study it became apparent that the most frequently available index of outcome was the pre-post measure. Hence, even though situations occurred where other comparisons were made (e.g., treatment A vs. treatment B), the basic pre-post measure was used for uniformity of comparison across all studies. It should also be noted that even when "control" groups were used for comparison, these groups were usually receiving frequent obesity measurements. Given that such measures are typically quite reactive, the use of such groups for comparison also introduces a number of problems (i.e., such "control" groups function more as a social facilitation treatment group). Hence, pre-post measures were also taken in preference to experimental versus "control" measures.

D. Number of Subjects. This number represents the number of subjects on which the recorded outcome measure is based, not the number which started treatment.

E. Percent of Original Sample. This percentage is calculated by dividing the number of subjects represented in the outcome measure (from #4 above) by the number of subjects starting treatment. It provides the percentage used in rating the mortality threat to internal validity.

F. Mean Age. This represents the mean age of subjects in the group at the onset of treatment.

G. Obesity Level. This is a measure of the relative level of obesity among subjects at the beginning of treatment. The measures reported in Table 1 were those reported within the studies in this meta-analysis. All reported data regarding initial obesity level were coded. These data were then tabulated for all studies and used to develop the following criteria for placing subjects into

Table 26

Criteria for Obesity Level

Variable	Low	A	Medium	B	High
Weight in Pounds		179 lbs.		192 lbs.	
Pounds Overweight		TFC		TFC	
Percent Overweight		40%		52%	
Percent Body Fat		TFC		TFC	
Minimum Lbs. Overweight		TFC		TFC	
Minimum Percent Overweight		10%		20%	

three general categories. On the left are the measures which were used in the various studies for describing initial level of obesity. To the right, criteria A and B, are the figures used to categorize subjects into low, medium, and high levels of obesity. The abbreviation TFC indicates that too few cases were available to use the measure as a criterion.

When more than one measure was provided for a given set of subjects, preference was given first to weight in pounds, then percent overweight, and lastly minimum percent overweight. The levels for the above criteria were chosen such that they would break the frequency distribution for each measure into three groups of roughly equal size.

H. Percent Male. Indicates the percent of subjects in the group which were male.

I. Selection Method. This variable identifies the source of subjects in the sample. Up to two codes per article are recorded. Following are the codes used:

1. Hospital Inpatients: These include subjects who were hospitalized at the onset of treatment. Usually these subjects were hospitalized for chronic and/or severe obesity and its complications.

2. Respondents to Advertisement: Subjects were selected from those responding to newspaper or bulletin-type advertisement.

3. Employee Response to Offer: Subjects in this category accepted offers of services by their employers.

4. Physician Referral: Subjects were obtained by the researcher as a result of direct referrals from physicians.

5. Treatment Seekers: These subjects became involved in studies as a result of self-initiated requests for services.

6. Volunteers: This category includes subjects described simply as "volunteers." This category would include students offered extra credit for research participation or those solicited in similar fashions.

J. Health Status. This measure describes subject health status at the onset of treatment. Up to two codes per article are made. Following are the codes used:

1. Psychiatric patients: Subjects were clinically diagnosed as having a specific mental disorder.

2. Metabolic Disturbances: Subjects had thyroid or other diagnosed metabolic disorders.

3. Cardiac Patients: Subjects had experienced previous myocardial infarction or other diagnosed cardiac problems prior to treatment onset.

4. Medically Screened: Article authors simply indicated that subjects had been medically screened. No indication was given as to the results of screening.

5. No Problems: Article authors stated specifically that subjects were found to have no medical problems affecting their participation in the study.

K. Percent Adherent. This figure represents the percent of subjects still basically adherent to the treatment regimen at the time of outcome measurement.

L. Outcome Measurement. All obesity-related outcomes reported by the article authors are coded. This allows cross-comparisons to be made. Wherever the reported statistics permit, a standardized mean-difference effect

size is calculated. This permits evaluation of the magnitude of treatment effect in terms of the control group (or pretreatment) standard deviation. The following outcomes were coded.

Pounds Lost,	Effect Size for Pounds Lost.
Percent Overweight,	Effect Size for Percent Overweight.
Percent Body Fat,	Effect Size for Percent Body Fat.
Skinfold Thickness	Effect Size for Skinfold Thickness.
Perc. Body Weight	Effect Size for Perc. Bdy. Wght.
Perc. Excess Weight	Effect Size for Perc. Excess Wght.
Weight Reduction Index	Effect Size for Wght. Red. Index
Body Mass Index	Effect Size for Body Mass Index
Body Density	Effect Size for Body Density

Effect sizes are calculated by dividing the difference between experimental and control groups (or pre-post differences) by the standard deviation of the control group (or the pre-treatment group). Where standard deviations are not available, standard formulas for deriving effect size from F, t, and other statistics are used.

Appendix B

Articles Used In Meta-Analysis

ARTICLES INCLUDED IN META-ANALYSIS

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Appendix C

Coding Instrument

CODING INSTRUMENT: OBESITY META-ANALYSIS

ID- _____ AUTHORS- _____ YR. ____

Group # _____ Time # _____ Tx Type _____

TX COMPNTS ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

TX MODE ____ F-U TX FREQ ____ ____ ____ ____

TX DURATION ____ F-U TX QUAL ____ ____ ____ ____

TX INTENSITY ____

TX SETTING ____

TX COST ____

DIET TYPE ____ ____ ____

EXERCISE TYPE ____ ____ ____

EXER. INTENS. ____

PERIOD ____ ____ ____ ____ N Ss ____ ____ ____ ____

VLDTY THRTS S____M____H____J____R____D____I____T____= _____

DESIGN ____ % OS ____ ____ ____ ____

AGE MEAN ____

OBESITY LVL ____ LBS_____ LBOW_____ POW_____

PERCENT MALE ____ PFAT_____ MINLBOW_____ MINPOW_____

SELECT METHOD ____ ____

HEALTH STATUS ____ ____

PERC ADHERENT ____ ____ ____ ____

OTCM MSR T1 _____ _____ _____ _____ _____

T2 _____ _____ _____ _____ _____

T3 _____ _____ _____ _____ _____

T4 _____ _____ _____ _____ _____

T5 _____ _____ _____ _____ _____