Programming for Adherence: The Initiation and Maintenance of an Exercise Program with Obese Adolescents

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© David V. Ness

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Abstract

The tenets of a theory proposed by Lees and Dygdon (1988) were used to initiate and maintain increased amounts of aerobic activity in 6 obese adolescents. Each of the 6 subjects received a multicomponent treatment package comprised of: (1) a graduated aerobic exercise regime, (2) behavioral techniques aimed at developing scheduling and self-monitoring skills, and (3) cognitive techniques aimed at tacting the immediate side-effects of exercise to later improvements. A multiple baseline across subjects design was used to assess the changes in each subjects activity level. Five of the 6 subjects demonstrated very low levels of aerobic activity during baseline: a sixth subject exercised once a week during baseline. Implementation of the multicomponent treatment package elicited increased levels of aerobic activity from each subject. By the end of the intervention phase, each of the 6 subjects had attained his or her aerobic point goal. In addition, each of the 6 subjects maintained or increased his or her aerobic activity during the maintenance phase. The present experiment was different from past exercise and obesity research because: (1) in-person compliance checks were performed during the intervention phase, and (2) the experimental procedures were tailored to each of the subjects. Each of the 6 subjects was allowed to select his or her exercise behavior, exercise time, and final exercise goal. Adherence data indicated that each of the 6 subjects complied with the exercise and behavioral instructions. Adherence to the cognitive component was more difficult to determine: Subjects complied to the written assignments but adherence to

the covert cognitive homework could not be assessed. In addition to becoming more aerobicly active, each of the 6 subjects incurred decreased girth measurements, decreased percents overweight, and increased aerobic fitness. Although the present experiment attempted to assess Lees's and Dygdon's (1988) theory, an extraneous variable (attention) may have been responsible for the results. The present experiment appears to lend support to Lees's and Dygdon's (1988) theory, however, future research will need to conduct a component analysis to determine the effect of the therapist contact on the results.

Programming for Adherence: The Initiation and Maintenance of an Exercise Program with Obese Adolescents

Obesity is a serious disorder which appears to be reaching epidemic proportions. Prevalence estimates of obesity range from 15% to 50% (Stunkard, 1984; Wilson & Brownell, 1980) and appear to be increasing (Foreyt, 1987). A recent survey of the United States by the National Health and Nutrition Examination Survey (NHANES) (in Van Itallie, 1985) finds that 26% of all United States adults, or about 34 million people between the ages of 20 - 75, are overweight. Data from the United States Department of Health and Human Services (1985, in Foreyt, 1987) indicate that the percentage of overweight individuals, aged 20 -74 years, was 27.4 in 1960-1962, 27.9 in 1971-1974, and 28.4 for 1976-1980. Prevalence estimates of childhood obesity indicate that between 10% and 40% of all children are overweight (Abraham, Collins, & Nordsieck, 1971; Garn, Clark, & Guire, 1975; Khan, 1981). The Manitoba Department of Education Survey (1978) indicates that over 20% of students were overweight by the age of 11.

The high prevalence of obesity is especially critical because of obesity's association with numerous conditions that are detrimental to health and longevity (Van Itallie, 1979). As the severity of obesity increases the incidence rates of gallbladder disease, pulmonary function impairment, endocrine abnormalities, obstetric complications, trauma to weight bearing joints, gout, cutaneous disease (Bray, 1985), cardiovascular disease (CVD), non-insulin-dependent diabetes mellitus, diabetes mellitus,

liver disorders, and renal disease (Van Itallie, 1979) also increase. For example, the National Health and Nutrition Examination Survey (NHANES-II) (in Foreyt, 1987) finds that the prevalence of hypertension is 2.9 times higher for overweight persons than non-overweight persons and 5.6 times higher if the overweight person is 20-44 years old. Furthermore, the prevalence of diabetes was 2.9 times higher in the obese than the non-obese (NHANES-II in Foreyt, 1987).

Despite not occuring with greater frequency in the obese, anxiety and depression have also been found to result from obesity (Wadden, Foster, Brownell, & Finley, 1984). Obesity may affect an individual's level of self-confidence and contribute to a sense of isolation due to difficulties encountered while attempting to lose and maintain weight. This may be exacerbated by a lack of understanding from non-obese significant others and peers (Wadden & Stunkard, 1985).

Obese individuals have been found to suffer greater social prejudice and discrimination than non-obese individuals (Allon, 1979, 1982). For example, obese students are accepted at lower rates than normal-weight students into higher ranking colleges, even though they do not differ in qualifications or rate of applications (Canning & Mayer, 1966), and 16% of employers report that they would not hire an obese woman under any circumstance (Larkin & Pines, 1979).

The prevalence and seriousness of obesity has elicited an abundance of research which has attempted to identify effective treatment packages. Despite this, If we define a "cure" as a reduction to ideal weight and

maintenance of that weight for 5 years, a person is more likely to recover from most forms of cancer than from obesity (Brownell, 1982). One difficulty facing researchers who attempt to develop better treatment programs is determining the etiology of obesity for individual patients. There are a plethora of causes at the core of obesity with no single factor likely to be the sole reason for a single person's weight problem.

An individual's lifestyle (Smith & Fremouw, 1987; Van Itallie & Campbell, 1972), diet (Sclafani & Springer, 1976; Smith & Fremouw, 1987), and ancestry (e.g., Foch & McClearn, 1980; Hirsch & Knittle, 1970; Nisbett, 1972; Stunkard et al., 1986) have all been proposed as major determinants of obesity. Despite these theories, the primary cause of 95% of obesity (5% has been attributed to underlying physical disorders such as brain damage) has yet to be conclusively established (Smith & Fremouw, 1987; Van Itallie, 1979). It appears that a combination of factors are involved in the development of obesity, however, it is still commonly believed that obesity results from overeating (Smith & Fremouw, 1987). This viewpoint is reflected in the obesity literature as the majority of treatment programs focus exclusively on altering food consumption (Bennett, 1986; LeBow, 1977; Wilson & Brownell, 1980). Whether or not overeating is a cause of obesity, research has demonstrated that on average the obese eat no more than persons of normal weight (Garrow, 1974; Smith & Fremouw, 1987) and that obesity can certainly be maintained without overeating (Wooley & Wooley, 1984).

The Role of Exercise

Some reseachers believe that obesity may partially result from inactivity (Brownell & Stunkard, 1980; Van Itallie & Campbell, 1972; Smith & Fremouw, 1987). For example, Van Itallie (1979) found that although the daily caloric consumption of individuals in the United States has decreased 10% since 1900, there has been a two fold increase in the prevalence of obesity. He suggested that this increased prevalence of obesity was due to decreased physical activity levels (Van Itallie, 1979).

Regardless of its influence on the initiation of obesity, exercise, in combination with dieting, has been demonstrated to be a more effective treatment method than dieting alone (e.g., Dahlkoetter, Callahan, & Linton, 1979; Epstein, Wing, Koeske, & Valoski, 1985; Harris & Hallbauer, 1973; Stalonas, Johnson & Christ, 1978; see for reviews, Epstein & Wing, 1980). In addition, Bennett's (1986) review of 105 studies occurring before January 1985 found that exercise was an important variable in the success of weight loss programs.

Exercise, or increasing energy outgo, is thought to play a significant positive role in increasing weight loss during treatment (Perri, Lauer, McAdoo, McAllister, & Yancey, 1986) and maintaining the weight loss after treatment (Colvin & Olson, 1983; Dahlkoetter et al., 1979; Epstein et al., 1985; Epstein, Woodall, Goreczny, Wing, & Robertson, 1984; Hoiberg, Berard, Watten, & Caine, 1984; Marston & Criss, 1984; Stalonas et al., 1978, Stern & Lowney, 1986). In addition, obese patients have been found to value exercise as a component in their treatment. For example, Colvin and Olson

(1983) found that 85% of men and 78% of women who participated in an obesity treatment program reported that increased exercise was an important factor in maintaining their weight loss.

The Benefits of Exercise

There are five primary benefits of exercise which facilitate the increase and maintenance of weight loss in the obese (Wilson & Brownell, 1980). First, the obese can alter their ratio of lean to fat tissue with regular exercise (Bjorntorp, Sjostrom, & Sullivan, 1979). Exercise will facilitate the transition of fat tissue to lean tissue. Since lean tissue is more dense than the fat tissue it replaces, the obese individual may change his body composition without changing his weight (Wilson & Brownell, 1980). Furthermore, not only does exercise improve this transition, it also decreases the amount of lean tissue lost during diets (Wilson & Brownell, 1980). Weight loss through dieting alone typically consists of 75% fat tissue and 25% lean tissue (Brownell, 1982). When exercise is included in the dieter's treatment program the amount of lean tissue lost is reduced to 5% (Bray, 1976; Oscai & Holloszy, 1969, in Brownell, 1982; Zuti & Golding, 1976). Since lean tissue is more metabolically active than fat tissue, maintaining lean tissue will help maintain weight losses (Scheuer & Tipton, 1977).

Second, regular exercise can have favorable effects on the resting metabolic rate (RMR) (Donahoe, Daria, Kirschenbaum, & Keesey, 1984). As the obese patient sheds kilograms the RMR decreases thereby causing a reduction in the rate of weight loss (review by Apfelbaum, 1978). The RMR

has been shown to be lowered almost double what one would expect on the basis of weight loss alone (Donahoe et al., 1984). Donahoe and associates (1984) found that they could attenuate this decreased RMR by programming regular exercise for their patients. Exercise caused the RMR to rise to a level appropriate to a dieter's prevailing body weight. Numerous other studies also indicate that exercise may raise RMR's (e.g., Bray, 1969; Mayer, 1968; Scheuer & Tipton, 1977).

Third, contrary to most individual's perceptions, exercise does not increase hunger. Increased activity in animals has been shown to decrease appetite and lower body weight (Brownell, 1982). Despite little research with humans, available evidence suggests that moderate exercise does decrease appetite (Durrant, Royston, & Wloch, 1982; Epstein, Masek, & Marshall, 1978; Holm, Bjorntorp, & Jagenburg, 1978).

Fourth, exercise can produce positive changes in many of the physical side-effects of obesity (Wilson & Brownell, 1980). For example, exercise has been shown to improve blood pressure, coronary efficiency, and insulin sensitivity, even in the absence of weight loss (Bjorntorp, 1978; Bray, 1976; Brownell & Stunkard, 1980; Scheuer & Tipton, 1977).

Finally, exercise can improve the negative pyschological consequences of being obese (Wilson & Brownell, 1980). Although a limited amount of research has been conducted, results indicate that exercise can improve body image and can therefore decrease the anxiety and depression sometimes associated with obesity (Folkins & Sime, 1981; Greist, Klein, Eischens, Gurman, & Morgan, 1979).

Despite the obvious benefits of including an activity component in treatment packages for the obese, research has often ignored the contributions of energy expenditure to weight control (Donahoe et al., 1984). For example, LeBow (1977) found that 80% of 105 reviewed reports taught eating changes but no activity changes. Bennett (1986) reviewed 105 studies involving the behavioral treatment of the obese and found that only 5% actively programmed for exercise. The majority of the studies either had no exercise recommendations (38%) or gave only advice on how to exercise (57%) (Bennett, 1986). As Coates and Thoresen (1980) lament more people focus on reducing input than increasing outgo.

Adherence to Exercise Programs

When exercise has been included in treatment packages for the obese, researchers often find that adherence is poor (Martin & Dubbert, 1982). Dropout rates from physical training programs are typically greater than 30% (Bjorntorp, Holm, & Jacobsson, 1977 in Brownell, 1982). For example, Gwinup (1975) found that 68% of obese women dropped out of a 1-year exercise program which involved only modest activity (walking). High dropout rates are not isolated to the obese. In healthy populations the dropout rate from exercise programs is rarely less than 50% (Brownell & Stunkard, 1980). For example, Cooper (1970) found that his jogging programs typically had dropout rates of 30%-60%. Furthermore, 25% of the prisoners involved in another jogging program dropped out for reasons other than physical injury (Pollock et al., 1977). Even in highly motivated patients such as individuals with myocardial infarction, dropout rates can

sometimes approach 80% (Brownell & Stunkard, 1980).

Although adherence to exercise programs is poor, the majority of research examining exercise with the obese has focused on weight loss. For example, numerous studies compare the effects of exercise alone, exercise with diet, and diet alone on the initiation and maintenance of weight loss (e.g., Dahlkoetter et al., 1979; Epstein et al., 1984; Harris & Hallbauer, 1973; Perri et al., 1986). Few studies investigate methods to improve the adherence of the obese to exercise programs alone. The author, in a review of the literature, did not find any studies that investigated different techniques to enhance the adherence of obese individuals to exercise regimes. However, research which investigates methods to improve exercise adherence of normal weight nondieting people does exist (e.g., Epstein et al., 1984).

Improving Exercise Adherence

Wysocki, Hall, Iwata, and Riordan (1979) assessed the use of behavioral contracting to encourage physical exercise with undergraduate college students. Four subjects dropped out during baseline. Of the remaining 8 subjects, 7 demonstrated increased levels of physical activity at the end of treatment and at the end of a 12 month followup period (Wysocki et al., 1979). Despite the success of the subjects who remained in the study, Wysocki and his associates (1979) still obtained an overall dropout rate of 33%.

Martin and his associates (1984) performed six studies with apparently healthy sedentary adults in order to identify behavioral and cognitive

procedures that would enhance adherence to a 3-day-per-week exercise (walking/jogging) program. The experimenters evaluated a number of different procedures: feedback and praise during exercise, various goal-setting strategies, lottery reinforcement, cognitive strategies during the exercise, and relapse prevention training. The adherence measures were class attendance, exercise program adherence, and fitness data. Each study lasted 3 months and was followed by a 3 month self-reported followup period. Results showed that social support, flexible goal setting and training in distraction based cognitive strategies were the best methods for improving adherence. Contrary to the researchers' expectations, the attendance lottery and the relapse prevention training were not associated with superior exercise adherence (Martin et al., 1984).

Atkins, Kaplan, Timms, Reinsch and Lofback (1984) attempted to improve the exercise adherence of 76 chronic obstructive pulmonary disease patients (COPD). The subjects in this study were divided into five groups: behavior modification, cognitive-behavior modification, cognitive modification, attention control, and no-treatment control. The behavior modification group was presented with strategies aimed at developing self-control. The cognitive modification group received training in replacing maladaptive thoughts with more positive cognitions. The cognitive-behavior modification group received a combination of the two previous treatments. The attention control group was told about the merits of exercise and had exercise monitored by an experimenter. The no-treatment control group was given an exercise prescription and advised

to exercise. Atkins and her associates (1984) found a significant difference between the three treated groups and the control groups: The cognitive-modification group demonstrated the greatest increase in physical activity, followed by the cognitive group, and then the behavior modification group. Unfortunately, these results, and those found by other researchers (e.g., Martin et al., 1984; Wysocki et al., 1979), may not be generalizable to the obese because they have been conducted with normal weight, nondieting people (Epstein et al., 1984).

A Learning Conceptualization of Exercise Behavior

A theory by Lees and Dygdon (1988) appears to be applicable to the exercise adherence difficulties of the obese. Lees and Dygdon (1988) offer a learning theory conceptualization on the initiation and maintenance of exercise behavior. They begin by stating that an operant model is initially most appealing when attempting to explain the development of regular exercise: Exercise behaviors are present in an individual's behavioral repertoire because they have been reinforced. A person likely initiates exercise behavior because of learning through the observation of models or through verbal representations of the positive events which follow exercise. New exercise behavior is unlikely to continue without response contingent reinforcement, therfore, the first step in developing an operant explanation of exercise behavior is to identify the reinforcers delivered to the new exerciser. It is the identification of possible reinforcers that first presents a problem for an operant explanation of exercise behavior (Lees & Dygdon, 1988).

What stimuli can serve as potential "exercise reinforcing stimuli" in the new exerciser's situation? Verbal praise is unlikely because it does not occur with great frequency. Physical health and body appearance improvements are unlikely reinforcers because they are too far removed in time from the performance of the behavior. One way to identify the possible reinforcers is to examine which stimuli typically follow exercise behavior (Lees & Dygdon, 1988).

Proprioceptive feedback from the muscles, tendons, and joints involved in the exercise is the set of stimuli which typically follow physical activity. In the case of exercise, this feedback is likely perceived as pain, discomfort, or at least fatigue. Despite being aversive, these stimuli do not suppress new exercise behavior for all individuals. Lees and Dygdon (1988) suggest that individuals who continue to exercise see these aversive stimuli as conditioned reinforcers: The relationship between mild muscle fatigue and later improvements in physical conditioning is tacted for these people.

Research has demonstrated that aversive stimuli can act as conditioned reinforcers. For example, Dulany (1968) told subjects that the receipt of a mild aversive stimulus would indicate the correct completion of a task. Under these circumstances, a behavior which elicited this aversive consequence was performed with increased frequency by the subjects. Bandura (1977) interpreted these results as indicating that the information a stimulus carries over-rides its reinforcing or punishing value.

Lees and Dygdon (1988) state that the only problem with this

explanation occurs when the physical side-effects of exercise are very extreme: It is unlikely that anyone would accept the notion that a very strong aversive stimulus can act as a conditioned reinforcer. Thus, Lees and Dygdon (1988) stress the importance of using a graduated exercise program to minimize the physical side-effects of exercising (Lees & Dygdon, 1988). Other researchers have also noted the importance of gradually introducing exercise to the new exerciser (e.g., Martin & Dubbert, 1984).

Finally, Lees and Dygdon (1988) stress the importance of developing scheduling skills in the new exerciser. It is likely that the conditioned reinforcement supplied by an aversive stimulus will lose in the pull for behavior when competing against a stronger reinforcer. Therefore, it is important to schedule exercise at times which do not conflict with other highly reinforcing behaviors. Lees and Dygdon (1988) suggest that individuals who maintain new exercise behavior have enhanced scheduling skills which allow them to perform their exercises at optimal times.

This experiment attempted to evaluate Lees's and Dygdon's (1988) theory. A cognitive-behavior modification package was used to initiate and maintain aerobic exercise with sedentary obese individuals. The treatment package was comprised of three main components: cognitive modification, behavior modification, and graduated exercise.

The cognitive modification component focused on tacting the physical side-effects of exercise with later physical improvements. Subjects were taught to replace negative, non-goal oriented statements with positive goal oriented statements.

The behavior modification component taught subjects self-monitoring and scheduling skills. The scheduling skills focused on planning times for physical activity such that the exercise would not compete with other more highly valued behaviors.

Aerobic Exercise

The exercise component consisted of a graduated aerobic exercise regime (Cooper, 1980). Aerobic exercises consist of moderate, sustained activities which produce elevated levels of oxygen consumption over an extended period of time. This form of exercise was used for a number of reasons. First, aerobic exercise is associated with a greater rate of caloric expenditure than other types of exercise (Brownell & Stunkard, 1980). Second, research indicates that aerobic exercise is the most optimal form of activity for improving blood pressure and cardiovascular efficiency (Martin et al., 1984). For example, when advising individuals on exercise selection the American College of Sports Medicine (ACSM) (1978) recommends activity that "can be maintained continuously and is rhythmical and aerobic in nature" (p. 7). Third, aerobic exercise emphasizes the duration of the activity, not just the intensity of the activity. In fact, duration is a more pertinent measure for the obese. Finally, aerobic exercise has a quantifiable measure associated with it: the aerobic point.

Cooper (1970) developed the aerobic point from aerobic conditioning research with 15 thousand Air Force cadets. Cooper (1970) measured the amount of oxygen consumed by the body for each of a variety of aerobic activities. Each aerobic activity was assessed at various combinations of

intensity and duration. Cooper (1970) then reduced the oxygen consumption data to a single quantitative dimension: the aerobic point. An aerobic point is equivalent to an oxygen consumption rate of 7.0 ml/kg/min. In simplest terms, the aerobic point is a measure of the amount of oxygen consumed by the body during a given activity. Aerobic points can be earned by taking part in activities that can be maintained continuously and involve the expenditure of oxygen (e.g., jogging and swimming). Those exercises that cause one to expend more oxygen per minute earn more points per minute. The aerobic point allows the comparison of the cardiovascular benefits of various physical activities (Cooper, 1970).

Adolescent Obesity

The subjects in this experiment were obese adolescents (ages 13-16). The prevalence of obesity in high school has been estimated to be approximately 10%-35% depending upon the criteria used to define obesity (e.g., Huse, Branes, Colligan, Nelson, & Palumbo, 1982; Lauer, Connor, Leaverton, Reiter, & Clarke, 1975; Zakus, Chin, Cooper, Makovsky, & Merrill, 1981).

Research indicates that most obese children and adolescents become obese adults (Abraham et al., 1971; Brownell, 1982). For example, assessments of obese American children indicate that 80% are destined to become obese adults (Brownell, 1982; Brownell & Stunkard, 1980; Rowe, 1980; Ward, 1982, in Plimpton, 1987). In an early study, Stunkard and Burt (1967) found that if an obese eighth grader had not reduced his weight by the end of adolescence, the odds against him doing so were 28 - 1.

Researchers have identified numerous potential causes for adolescent obesity. These include eating habits, environmental factors, and biological factors. In addition, physical inactivity is often identified as a causal agent in the developement of adolescent obesity. Research indicates that obese adolescents appear to be less active than their non-obese peers (Foreyt, 1987). For example, Bullen, Reed, and Mayer (1964) assessed the activities of non-obese and obese adolescent girls at a summer camp. They observed the girls' behavior in three different sports: swimming, volleyball, and tennis. Bullen and his associates (1964) found that the obese were far less active than the non-obese, even during supervised sports periods. More recently, Dietz and Gortmaker (1985) found that the prevalence of obesity among 12 - 17 year olds increased by 2% for each additional hour of television watched.

Despite an apparent connection between inactivity and adolescent obesity, there has been little research which focuses on increasing the energy output of the obese adolescent. Like the adult literature, most studies utilizing exercise as a treatment component do so only in conjunction with other components, such as diet control or nutrition training (e.g., Harris, Sutton, Kaufman, & Carmichael, 1980; Coates, 1977). Even when exercise is included, it is not actively programmed (e.g., Weiss, 1977).

The lack of attention paid to exercise as a treatment for obese adolescents is ironic given Rosen's and Gross's (1987) survey results from 1373 high school children. Their data indicated that exercise with moderate

reductions in caloric intake was the favored and most used method to lose weight (Rosen & Gross, 1987).

There are no data available on the attrition rates of obese adolescents due mostly to the lack of studies investigating this issue. Most attrition data surrounds dropout rates from multicomponent weight reduction programs (e.g., Harris et al., 1980). Adherence data is absent even in those studies which do include an exercise component. Despite this lack of research, obese adolescents likely have the same poor levels of exercise adherence as obese adults have (Brownell, 1982).

Adherence Measures

The primary adherence measures taken during this experiment were: random visits by the experimenter to the subject's exercising location during scheduled exercise times, and telephone calls to the subject's parents during scheduled exercise times. The in-person and telephone compliance checks attempted to validate that each subject was exercising during his or her scheduled time.

Secondary adherence assessments were also conducted during the present experiment. Compliance to the cognitive component was inferred from each subject's written cognitive homework. In addition, compliance to the exercise program was inferred from: decreased circumference measurements of the thighs, hips, waist, and upper arms; smaller skinfold measurements; decreased percentage overweight; and increased distances covered during the 12 minute walk/run fitness tests or decreased times during the 3 mile walk fitness tests.

Researchers have established that the 12 minute walk/run is a highly reliable and valid indicator of maximum oxygen uptake (e.g., Biddle, 1986; Cooper, 1968, 1982; Doolittle & Bigbee, 1968; Maksud & Coutts, 1971). For example, Cooper (1980) states that the results from two 12 minute fitness tests, run 4 days apart, were almost identical. In addition, maximum oxygen consumption studies show a very good correlation with the 12 minute fitness test.

Some experimenters have used the 12 minute fitness test as a dependent measure when studying exercise (Cooper, 1980). For example, Keefe and Blumenthal (1980) used the 12 minute fitness test to assess physical fitness improvements caused by a walking program. Martin and his associates (1984) also used the 12 minute fitness test to gauge improvements in fitness resulting from exercise programs. The 3 mile walk fitness test has also been identified as a reliable indicator of maximum oxygen uptake (Cooper, 1980).

Predictions

Subjects were expected to initiate and maintain an aerobic exercise regime due to the gradual development of individual exercise programs and the learning of behavioral and cognitive skills. In addition, the subjects were expected to increase their respective baseline levels of aerobic activity by a minimum of 50%.

As a result of adhering to the exercise program, subjects were expected to increase their level of aerobic fitness as assessed by either the 12 minute walk/run or 3 mile walk fitness tests. Subjects' percents

overweight, circumference measurements, and skinfold measurements should decrease from participation in their respective exercise regimes.

Method

Subjects

Seven adolescents (6 females and 1 male), whose parents and physicians consented to their participation in an experiment involving physical activity, were chosen. The specific criteria for inclusion in the experiment included: (a) being 13-18 years of age (Vicki was 13 years old; Karen, Susan, and Nancy were 14 years old; Lisa was 15 years old; and Rob was 16 years old.), (b) being at least 25% above desirable body weight (norms taken from Food and Nutrition Board, National Academy of Sciences-National Research Council, 1980, in LeBow, 1984), (c) being currently active at a rate of 10 aerobic points per week or less during baseline, and (d) having no medical problems that would preclude participation in an exercise program (e.g., a broken leg). One female subject dropped out of the present experiment during baseline. The reason behind her dropping out could not be obtained as she had moved out of her parent's house and had not left a forwarding address or telephone number.

The subjects were recruited by placing an advertisement in one of the daily newspapers in Winnipeg, Manitoba (Appendix A). All subjects who responded to the newspaper advertisement were invited to the Manitoba Obesity Control Centre for a pre-baseline interview.

Experimental Design

This experiment utilized a multiple baseline across subjects design

which was replicated across two sets of subjects. Six subjects underwent three phases during the experiment: baseline, intervention, and maintenance. A relapse intervention phase was included in the design of the study but was not implemented due to the performance of the subjects during maintenance.

Each subject remained in the baseline phase until two criteria were met. First, baseline continued until each subject had a minimum of 2 consecutive weeks where his or her level of aerobic activity differed by no more than 3 aerobic points. Second, the length of the baseline phase was determined by each subject's placement in the multiple baseline design: the first 2 subjects to meet the first criteria began intervention immediately; the second 2 subjects to meet the first criteria began intervention at least 2 weeks after the first 2 subjects; and the final 2 subjects to meet the first criteria began intervention at least 2 weeks after the second pair of subjects. Consequently, 2 subjects were in baseline for 2 weeks, 2 subjects were in baseline for 4 weeks, and 2 subjects were in baseline for 6 weeks.

Each subject was seen weekly during the intervention phase. The length of the intervention phase was determined by three factors: (1) the subject's initial fitness level, (2) the time required for the subject to learn the behavioral and cognitive material, and (3) the subject's progress through his or her exercise program. The intervention phase was terminated once the subject had: (1) learned the behavioral and cognitive material and (2) attained his or her weekly aerobic point goal and maintained that point total

for a minimum of 2 consecutive weeks.

The weekly intervention sessions were approximately 1 hour in duration and involved the teaching of the various components comprising the intervention phase. In addition, each subject was telephoned weekly to check on assigned homework and to identify trouble points as soon as possible.

Each subject completed a 12 week maintenance phase during which aerobic point totals were monitored weekly. A relapse intervention phase would have been instituted if any subject's weekly aerobic point totals fell below a predetermined adherence quota. No subject required the relapse intervention phase.

Procedure

Experimenter

The experimenter was a male graduate student in clinical psychology at the University of Manitoba. The experimenter was knowledgeable in three specific areas: aerobic exercise, behavior modification, and cognitive modification. Each subject was seen by the same experimenter throughout the experiment.

A female undergraduate student assisted the experimenter with the circumference measurements. The same female assistant performed all of the circumference measurements on the female subjects throughtout this experiment.

Baseline

The subjects began baseline once they had participated in a

pre-baseline interview session with the experimenter. During this interview session the experimenter briefly explained that the experiment involved the initiation and maintenance of an aerobic exercise program: Aerobic exercise was defined and contrasted with anaerobic, isometric, and isotonic exercises. The subjects were also told that they would learn planning, monitoring, and graphing skills and would practice cognitive techniques aimed at improving exercise adherence.

Each subject was then informed of the entrance criteria and asked to take part in the experiment. The criterion assessment began if the subject agreed to take part in the experiment.

The experimenter obtained demographic information, height and weight data, and inquired about each subject's past and present exercise and medical history. This information was used in the development of each subject's exercise program. In addition, each subject was asked if he or she had any physical injury which would preclude participation in sustained physical activity. Circumference measurements of the thighs, hips, waist, and upper arms were then taken. These measurements were retaken at subsequent times during the research (Appendix B).

Each subject was given a letter of permission (Appendix C) which had to be signed by his or her parent(s) and physician. The latter's signature indicated that there were no medical contraindications with respect to participation in the experiment. No subject began intervention until the letter of permission had been returned.

At the end of the the pre-baseline interview each subject was given a

recording sheet (Appendix D). This sheet asked each subject to detail his or her daily physical activity, excepting exercise which took place during physical education classes at school. Specifically, the subjects were asked to describe all physical activities, their intensity and duration, and their time of occurrence. The subjects were given stamped envelopes with which to return the activity sheets to the experimenter. If a subject failed to return the self-monitoring forms, the experimenter would have telephoned and prompted him or her to do so. No subject required the telephone prompt during this phase. The experimenter calculated the aerobic points that the subjects were earning from the returned self-monitoring sheets.

Six of the 7 initial subjects met the entrance criteria. One female subject was active at a rate of 12 aerobic points per week during baseline, however, since she met the rest of the entrance criteria she was included in the experiment.

Intervention

The intervention phase consisted of three main components: aerobic exercise, behavior modification, and cognitive modification. The length of the intervention phase was approximately 10 weeks.

Exercise component. The exercise component consisted of a graduated aerobic exercise regime (Appendix B). Aerobic exercise was defined and contrasted with isometric, isotonic, anaerobic, and aerobic exercises: The experimenter placed extra emphasis on the benefits of aerobic exercise for the obese. The experimenter then explained the aerobic point. Each subject was shown how to use the aerobic point to compare the benefits of various

physical activities.

Each subject's respective exercise program was developed from baseline data and aerobic fitness data. A 12 minute walk/run aerobic fitness test or a 3 mile walk aerobic fitness test was used to determine each subject's aerobic fitness level. Ideally, all subjects would have taken the same fitness test during this experiment, however, 2 subjects did not want to participate in the 12 minute walk/run fitness test. Both of these subjects reported that they felt very uncomfortable running and would prefer any other fitness test. Consequently, the 3 mile walk fitness test was added to the experiment. Each subject was asked to choose one of these two fitness tests as his or her measure of aerobic efficiency. Four subjects chose the 12 minute walk/run fitness and 2 subjects chose the 3 mile walk fitness test.

The 12 minute walk/run fitness test required the subject to walk or run as far as possible for a duration of 12 minutes. The variable measured during this test was the distance covered by the subject over the 12 minutes. The 3 mile walk fitness test required the subject to walk 3 miles as fast as he or she was able. Both fitness tests were given at the indoor track at the University of Manitoba.

Each subject was placed into one of five fitness categories based on his or her baseline and aerobic fitness data. The categories ranged from Very Poor to Superior. Each category was associated with an average weekly aerobic point total. For example, for male adolescents the Poor fitness classification is associated with 10-20 aerobic points per week.

The fitness classification was then used to determine a starting point for each subject's exercise program. For example, a male adolescent initially in the Poor fitness classification would be required to earn approximately 10 aerobic points during the first week of intervention.

The subjects were allowed to choose the primary activity that would comprise their respective exercise programs. The choices offered were: walking, running, stationary cycling, cycling, swimming, rope skipping, and rowing. Once each subject had attained 10 aerobic points in 1 week, he or she was taught to incorporate other physical activities into his or her exercise program.

The amount of aerobic exercise required of each subject was gradually increased on a weekly basis. Each subject's final weekly aerobic point goal was determined by both the experimenter and the subject. The experimenter required each subject's weekly aerobic point goal to be at least 50% greater than his or her average weekly baseline aerobic point total.

Behavioral Component. The subset of behavior modification principles aimed at scheduling, self-monitoring, and generalization skills were utilized to help subjects follow their respective exercise programs. Early in the first intervention session, subjects were given a daily behavior diary (Appendix E) asking them to detail their behaviors for the upcoming week. Specifically, each subject was asked to record the time, duration, and enjoyment level of each daily behavior. During the second intervention session the experimenter used this daily behavior diary to identify time periods which did not contain highly reinforcing activities. The subjects

were required to schedule their exercises during these times such that exercise behavior did not compete with other, incompatible, highly reinforcing behaviors.

Each subject scheduled his or her upcoming week of exercise during the session prior to that week. A planning and self-monitoring sheet (Appendix F) was used by each subject to plan and record his or her exercise. A weekly progress sheet (Appendix G) was provided to enable the subjects to follow their progress towards their final weekly aerobic point goal.

Subjects were also taught to incorporate various exercises into their respective exercise regimes once they had attained 10 aerobic points per week (Appendix B). This was done to enhance enjoyment and to increase the probability of each subject maintaining his or her increased activity level. For example, instead of earning 24 aerobic points by jogging alone, a subject could skate for 60 minutes (4 points), ski for 120 minutes (12 points), and jog for 4 miles (8 points).

Cognitive component. The cognitive component was comprised of two subcomponents: (1) subjects were taught to tact immediate fatigue and muscle soreness, and later more intense muscle soreness, with improvements in physical conditioning, weight loss, activity levels, and self-concept; and (2) subjects were taught to become aware of and identify negative and maladaptive self-statements and replace each with positive statements (Appendix B).

The double column technique (Appendix H, Burns, 1980) was used to tact fatigue and muscle soreness with later improvements in physical

conditioning. In the first column, subjects were asked to record any muscle soreness or fatigue felt from exercising. In the second column, subjects were asked to relate the side-effects of exercising to later positive gain (e.g., "I am sore right now but this just shows that I am progressing towards my goal of being in better shape").

The triple column technique (Burns, 1980) was used to teach the subjects to replace negative and maladaptive self-statements (e.g., "This is so boring") with positive goal-oriented statements (e.g., "I am getting better at jogging this distance"). In the first column, subjects were instructed to identify negative maladaptive cognitions (e.g., "I can't learn to become active because I never do anything right"). In the second column, subjects had to label the negative maladaptive cognitions with 1 of 10 cognitive distortions (Appendix I) (e.g., "Overgeneralization"). In the third column, subjects were asked to produce rational responses to the negative maladaptive cognitions (e.g., "Nonsense, I do a lot of things right and I will become more active"). Both the double and triple column techniques were taught with the aid of example sheets (Appendices J & K).

Maintenance

Each subject completed a 12 week maintenance phase. The maintenance phase began once each subject had (1) been taught the behavioral and cognitive skills and (2) reached and maintained his or her weekly aerobic point goal for a minimum of 2 consecutive weeks.

There were no in-person contacts between the subjects and the experimenter during the maintenance phase. Each subject was supplied with

self-monitoring forms with which to monitor weekly aerobic activity. In addition, each subject was given stamped envelopes with which to return the self-monitoring data. If the weekly activity level of any subject dropped by 25% or more for 2 consecutive weeks a relapse intervention package would have been instituted. Each subject maintained his or her level of aerobic activity, consequently, the relapse intervention package was not used (Appendix B).

The experimenter telephoned each subject bi-weekly during maintenance. The telephone calls served as prompts for the subjects to return their self-monitoring forms. The telephone call was also used to casually inquire on the progress of each subject (e.g., "How is the exercise program going?").

The experimenter re-administered either the 12 minute walk/run or 3 mile walk fitness test to each subject at the conclusion of the maintenance phase. In addition, each subject's weight, height, skinfold, and circumference measurements were re-taken at the end of maintenance.

General Structure of Sessions

The experimenter met with each subject individually throughout the experiment, except when the female assistant was present to measure the female subjects. The sessions took place in one of two locations: the Manitoba Obesity Control Centre or an indoor track at the University of Manitoba.

There was only one session for each subject during baseline: the pre-baseline interview. During this session, subjects were introduced to

the experiment and assessed for entrance into the study. The experimenter asked each subject to record his or her daily physical activity for "the next few weeks". Each subject was provided with self-monitoring forms and stamped envelopes for the recording and returning of baseline data.

During the intervention sessions, three topics were discussed: aerobic exercise, behavior modification, and cognitive modification. In addition, the experimenter collected and discussed the subjects' self-monitoring sheets.

During the maintenance phase the experimenter had one in-person session with each subject: the final 12 minute walk/run or 3 mile walk fitness test. During the rest of this phase, subjects mailed in their self-monitoring forms. Each subject completed a 12 week maintenance phase (See Appendix L for a summary of the sessions).

Outcome Measures

Aerobic efficiency measures. Each subject was given either a 12 minute walk/run or 3 mile walk fitness test on three different occasions: (1) during the first session of intervention, (2) at the end of the intervention phase, and (3) at the end of the maintenance phase. The variables measured were (1) the distance covered in 12 minutes or (2) the time required to walk 3 miles. Both fitness tests were given at an indoor track at the University of Manitoba. The subjects were not permitted to participate in both fitness tests: They were initially permitted to pick one fitness test but had to re-take that same test on the two remaining assessment times.

Circumference, skinfold, height and weight measures. The subject's height, circumference, and skinfold measurements were taken: (a) during the pre-baseline interview; (b) during the first, last, and every fourth intervention session; and (c) at the end of the maintenance phase. The circumference measurements were taken on the thighs, hips, waist, and upper arms. The experimenter or the female assistant performed the circumference measurements on each subject. In addition, the subjects were also instructed to measure themselves. The subjects' measures were then compared to the experimenter's or female assistant's and retaken until they were within 1 cm of each other.

The skinfold measurement was taken using a John Bull caliper on the nondominant tricep of each subject. The procedure followed while making this assessment was taken from Seltzer and Mayer (1965) and Grimes and Franzini (1977) (Appendix B).

Each subject's weight was taken (1) during the pre-baseline interview, (2) every week during intervention, and (3) at the end of the maintenance phase. The weight and height assessments were taken on a Health o Meter balance scale.

Adherence Measures.

Adherence to the experimental procedures was assessed with four different measures. First, the experimenter performed in-person compliance checks on each subject once every 2 weeks during intervention. The visits were conducted during scheduled exercise times and without prior warning to the subjects. If a subject was exercising when the

experimenter visited, the experimenter praised his or her efforts and asked if there were any difficulties. If a subject was not exercising, the experimenter asked why and discussed it further at the next weekly session.

Second, the experimenter also performed telephone compliance checks during the intervention phase. Each subject was telephoned weekly during scheduled exercise times. If the subject answered the telephone, the experimenter asked whether or not he or she had been exercising. If another family member answered the telephone, the experiment asked if the subject was presently exercising. Each subject was told that the telephone calls were a necessary component of the experiment and not related to his or her performance.

Third, the 12 minute walk/run fitness test or 3 mile walk fitness test also served as a measure of adherence to the exercise program. Adherence was inferred from increased aerobic fitness ratings from the two fitness tests. If the subjects adhered to their respective exercise programs, their performances on the fitness tests should have improved.

Finally, the written cognitive homework served as a measure of adherence to the overt cognitive techniques. Adherence to the covert cognitive techniques cannot be established because there is no way to objectively measure covert behavior.

Experimenter Reliability

After each session, the experimenter completed a reliability checklist (Appendix M) detailing the material covered. This checklist data was then used in two ways to assess experimenter reliability. First, an independent

observer analyzed each checklist for adherence to the prescribed procedures. Second, the independent observer used the checklists to assess audiotapes of the intervention sessions. The observer randomly chose 25% of the audiotaped sessions for comparison with the checklists. After listening to the audiotape of a session, the observer completed a reliability checklist and compared her data to that obtained by the experimenter.

Results

The dependent measures were: (1) the weekly total of aerobic points earned by each subject, (2), the weight of each subject, (3) the change in percent overweight of each subject, (4) the fitness data obtained from the 12 minute walk/run or 3 mile walk fitness test, (5) the circumference and skinfold measurements, and (6) the adherence checks.

Aerobic Point Data

Figure 1 shows the weekly aerobic point totals of each of the subjects. It can be seen that during baseline there was very little exercising by the subjects except for Vicki. Four of the 6 subjects did not obtain any aerobic points during baseline and John obtained an average of 2.25 aerobic points per week during baseline. Vicki obtained 12 aerobic points per week during baseline from participation in a weekly aerobic dance class.

All subjects, excepting Vicki and John, demonstrated gradual increases in physical activity during the intervention phase. Vicki showed a dramatic increase in physical activity during week 6 of intervention. She had chosen swimming as her physical activity and decided to increase her weekly aerobic point goal 30 to 100. John also demonstrated a large increase in

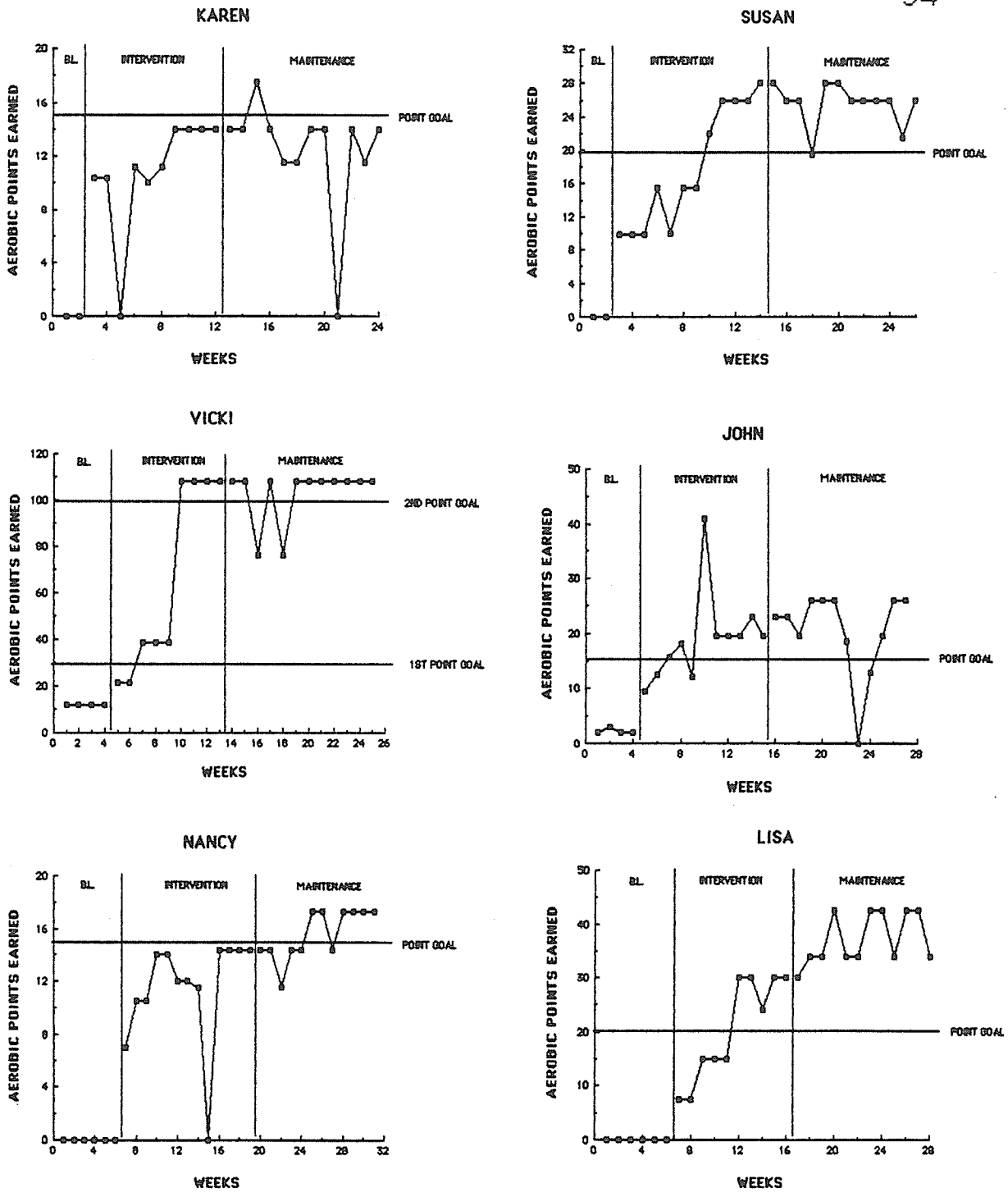

Figure 1. The weekly aerobic points earned by each subject during baseline, intervention, and maintenance. Note: B.L. = Baseline.

physical activity during week 6 of intervention. During weeks 5 and 6 of intervention, John was on vacation with his family. The vacation allowed him to spend more time exercising. He said "I had lots of time on my hands so I exercised more". John's vacation also affected his physical activity during week 5 of intervention. Due to vacation travelling time, John was unable to obtain his previous weeks aerobic point total.

Two subjects did not earn any aerobic points during 1 week of intervention. Karen and Nancy were ill during these weeks and unable to exercise. In addition, Nancy changed exercises during week 6 of intervention and consequently obtained fewer aerobic points during the next 3 weeks. Her time spent exercising remained the same but her new exercise earned less aerobic points per minute than her first exercise.

Each subject had different final weekly aerobic point goals during the intervention phase. The weekly aerobic point goals of the subjects were: 15 for Karen; 20 for Susan; 30 for Vicki; 15 for John; 15 for Nancy; and 20 for Lisa. Only Vicki changed her final goal. All subjects either achieved their aerobic point goal by the end of intervention or were within 1 point of doing so: Karen and Nancy obtained 14 and 14.4. aerobic points per week during the final 4 weeks of intervention and decided to maintain this total during maintenance.

Each subject either maintained or increased his or her weekly aerobic point goal during maintenance. Karen and John each had 1 week of aerobic inactivity during maintenance: Karen was ill during week 9 of maintenance while John sustained an ankle injury during week 7 of maintenance. In

addition, due to his ankle injury John demonstrated decreased levels of activity during weeks 8 and 9 of maintenance.

Figure 1 also shows the number of weeks each of the 6 subjects spent in the intervention phase: Karen was in intervention for 10 weeks; Susan for 12 weeks; Vicki for 9 weeks; John for 11 weeks; Nancy for 13 weeks; and Lisa for 10 weeks. The amount of time spent in the intervention phase was determined by two factors: (1) the progress of each subject towards his or her final weekly aerobic point goal, and (2) how quickly each subject learned the behavioral and cognitive techniques.

Only John, Nancy, and Lisa incorporated different exercises into their weekly physical activity regime. John incorporated four different activities: stationary cycling, cycling, rowing, and jogging. Nancy and Lisa participated in three different exercises: Nancy rode a stationary cycle, rowed, and walked; and Lisa skipped, cycled, and swam.

Weight Data

Figure 2 shows the weights of each of the subjects across the three phases of this experiment. It can be seen that each of the 6 subjects either maintained or increased his or her weight during baseline. In contrast, each of the 6 subjects attained weight losses during intervention and maintenance. Susan, John, and Nancy demonstrated gradual weight losses during intervention and Karen, Vicki, and Lisa demonstrated intermittent weight losses during intervention. John and Nancy are missing 1 data point during intervention because both did not attend a weekly session: John was on vacation for 1 week and Nancy was ill for 1 week.

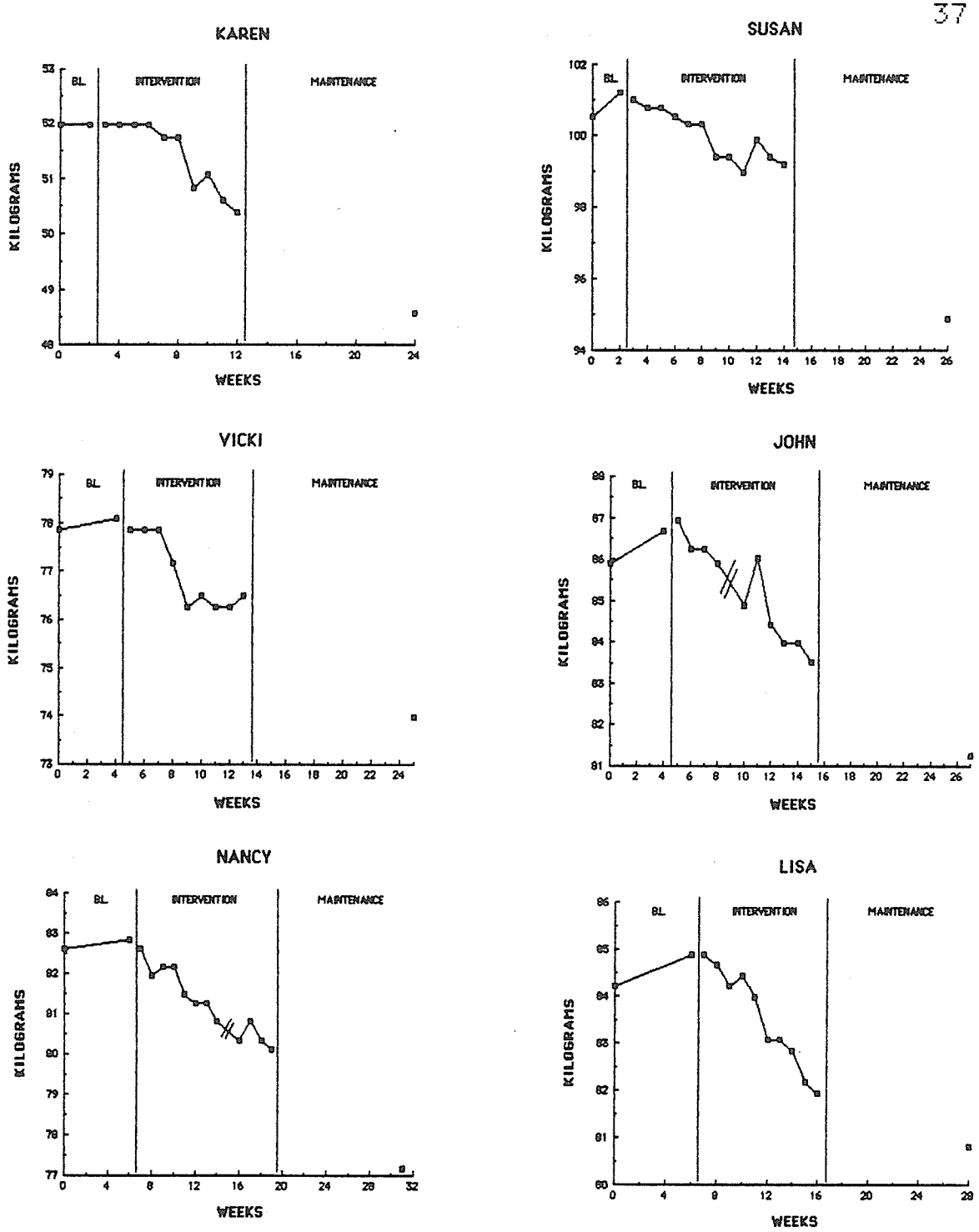

Figure 2. Each of the 6 subjects' weights during baseline, intervention, and maintenance phases. Note: B.L. = Baseline.

Figure 3 shows each of the subjects' percent overweight at the end of baseline, intervention and maintenance. It can be seen that each of the 6 subjects reduced his or her percent overweight across the three phases of this experiment. Initial percents overweight ranged from 26.7 to 98.5. By the end of the experiment, Karen had reduced her percent overweight by 8.3%, Susan by 12.8%, Vicki by 19.6%, John by 14.7%, Nancy by 32.8%, and Lisa by 9.6%. Each of the 6 subjects demonstrated reductions in percent overweight during intervention and during maintenance. In addition, 3 subjects reduced their percent overweight to <20 by the end of maintenance.

Aerobic Fitness Data

Each of the 6 subjects demonstrated improvements in aerobic fitness during this experiment. Figure 4 shows each of the subject's performance on the two physical fitness measures. Susan, Vicki, John, and Nancy chose the 12 minute walk/run fitness test while Karen and Lisa chose the 3 mile walk fitness test. Susan and Nancy demonstrated continual increases in the distances covered across their 3 fitness tests. Karen and Lisa also demonstrated continual increases in aerobic fitness: Both subjects needed progressively less time to complete the 3 mile walk. In contrast, Vicki and John only improved from baseline to intervention: Vicki's and John's performances during the maintenance fitness tests were nearly identical to their performances during the intervention fitness tests.

Table 1 shows the fitness classification of each subject based on his or her performance on either fitness test. It can be seen that each of the 6 subjects improved their level of aerobic conditioning during this

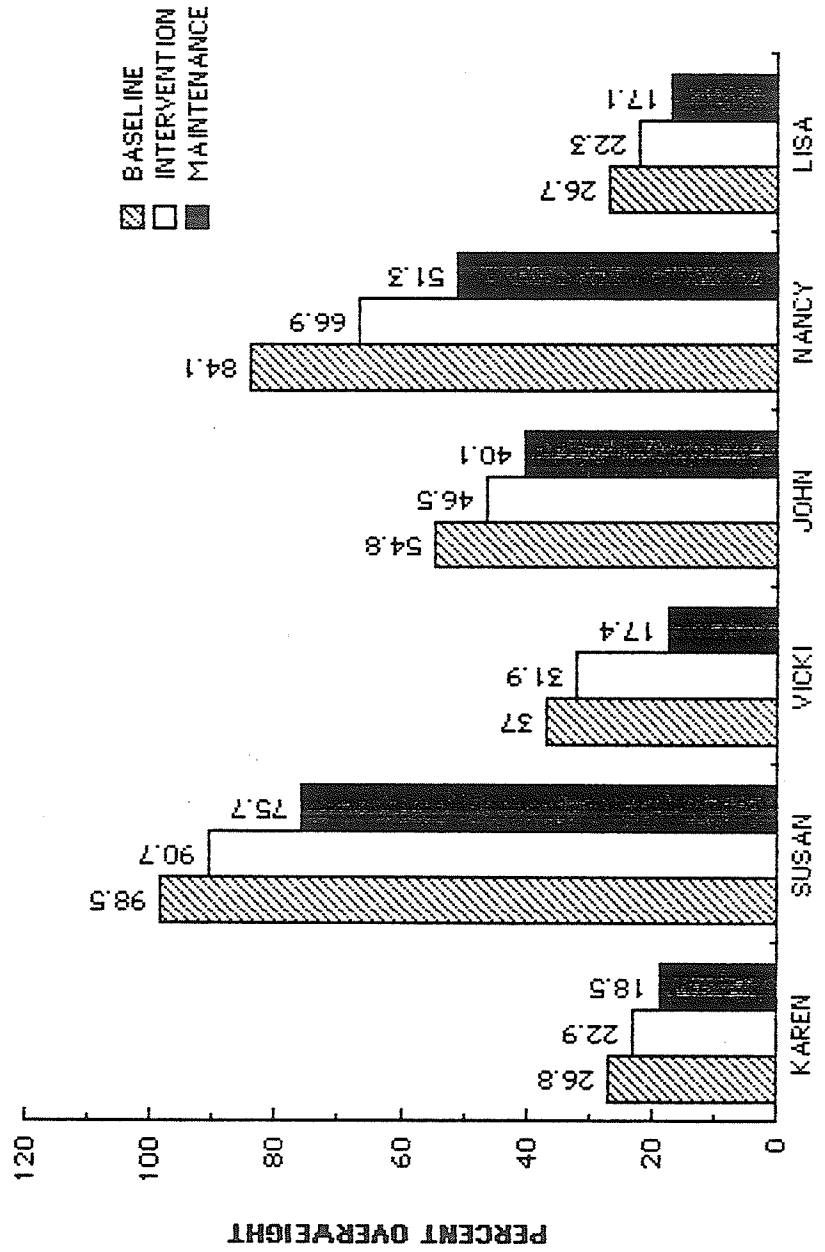

Figure 3. The percent overweight for each of the 6 subjects at the end of each phase of the present experiment.

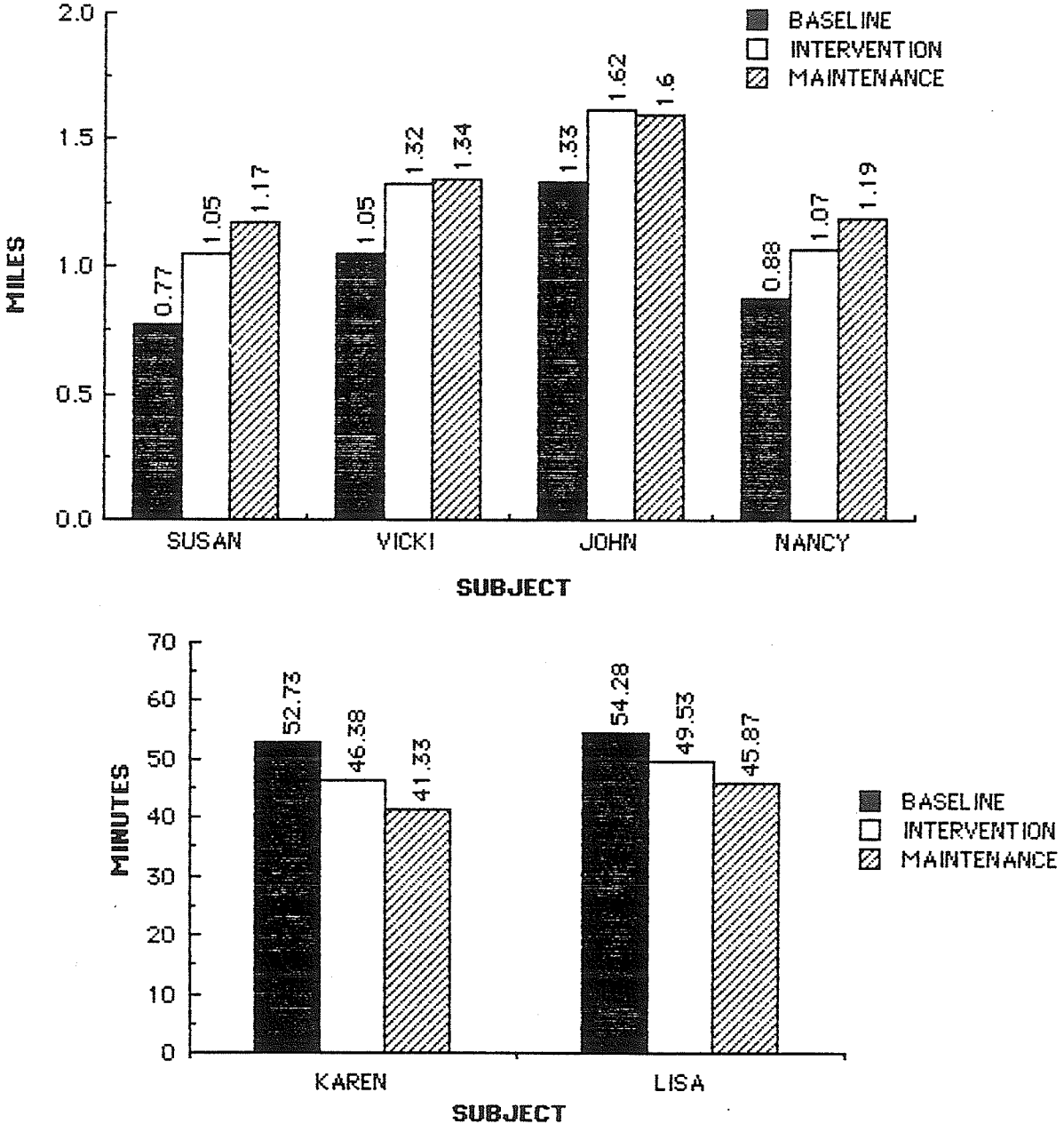

Figure 4. The distances covered by 4 subjects during the 12 minute walk/run fitness tests and the amount of time required for 2 subjects to complete the 3 mile walk fitness tests.

Table 1.

The Fitness Classification* of Each Subject Based on His or Her Performance on the 12 Minute Walk/Run or 3 Mile Walk Aerobic Fitness Tests.

	Fitness Classification		
Subject	Baseline	Intervention	Maintenance
Karen	Very Poor	Poor	Fair
Susan	Very Poor	Poor	Poor
Vicki	Poor	Good	Good
John	Poor	Good	Good
Nancy	Very Poor	Poor	Fair
Lisa	Very Poor	Very Poor	Poor

*The fitness classifications are an indication of aerobic efficiency. Each classification is associated with an average weekly amount of aerobic activity. For men: Very Poor is associated with <10 weekly aerobic points; Poor is associated with 10-20 weekly aerobic points; Fair is associated with 21-31 weekly aerobic points; and Good is associated with 32-50 weekly aerobic points. For women: Very Poor is associated with <8 weekly aerobic points; Poor is associated with 8-15 weekly aerobic points; Fair is associated with 16-26 weekly aerobic points; and Good is associated with 27-40 weekly aerobic points (Cooper, 1982).

experiment: Karen, Vicki, John, and Nancy improved by two classification levels while Susan and Lisa improved by one classification level.

Circumference and Skinfold Data

Table 2 shows the circumference and skinfold measures taken at the end of baseline, intervention, and maintenance. It can be seen that each of the 6 subjects demonstrated gradual decreases in his or her circumference measurments. In addition, each subject's skinfold measurement also decreased. Karen's tricep skinfold percentile was approximately 39 during baseline but had reduced to the 10th percentile by the end of maintenance. The reduction in skinfold percentiles for each of the remaining 5 subjects was: from >95 to ~92 for Susan, from ~92 to ~78 for Vicki, from ~94 to ~82 for John, from >95 to ~59 for Nancy,and from ~83 to ~41 for Lisa (Smoothed percentile tables from Johnson, Fulwood, Abraham, & Bryner 1981, in LeBow, 1984).

Adherence Data

Table 3 shows the adherence data obtained from the in-person and telephone compliance checks. It can be seen that each of the 6 subjects was usually exercising during his or her scheduled times. Only Nancy demonstrated a compliance percentage of less than 70 during the in-person experimenter checks. The percentage data on the in-person compliance checks should be viewed with caution due to the small number of checks performed on each subject: A single instance of non-compliance could drastically affect the final percentage. For example, Nancy was not exercising during two separate in-person experimenter checks. Because

Table 2.
The Skinfold and Circumference Measurements of each of the Six Subjects At the End of Each Phase.

Karen

MEASURE	BASELINE	INTER.#	MAIN.*
RIGHT ARM (cm)	27.2	26.9	26.4
LEFT ARM (cm)	26.2	25.6	24.9
WAIST (cm)	77.2	73.6	70.3
HIPS (cm)	99.6	95.4	92.4
RIGHT THIGH (cm)	59.4	57.1	55.4
LEFT THIGH (cm)	58.5	56.0	54.2
SKINFOLD (mm)	12.6	10.2	8.3

Susan

MEASURE	BASELINE	INTER.	MAIN.
RIGHT ARM (cm)	36.6	35.0	33.3
LEFT ARM (cm)	36.9	35.0	33.4
WAIST (cm)	112.0	104.5	97.0
HIPS (cm)	130.0	130.5	127.2
RIGHT THIGH (cm)	73.7	66.5	62.3
LEFT THIGH (cm)	75.1	69.5	65.1
SKINFOLD (mm)	34.4	30.8	26.8

Vicki

MEASURE	BASELINE	INTER.	MAIN.
RIGHT ARM (cm)	33.2	31.8	29.2
LEFT ARM (cm)	33.1	32.0	29.0
WAIST (cm)	101.6	96.7	90.2
HIPS (cm)	113.2	108.2	102.3
RIGHT THIGH (cm)	67.5	64.8	61.0
LEFT THIGH (cm)	64.2	62.3	57.8
SKINFOLD (mm)	24.5	22.1	19.8

John

MEASURE	BASELINE	INTER.	MAIN.
RIGHT ARM (cm)	32.6	30.8	29.7
LEFT ARM (cm)	31.2	29.5	28.9
WAIST (cm)	103.0	99.0	96.0
HIPS (cm)	108.5	103.0	98.0
RIGHT THIGH (cm)	60.3	57.6	55.7
LEFT THIGH (cm)	61.1	58.9	57.1
SKINFOLD (mm)	21.0	16.0	13.0

Nancy

MEASURE	BASELINE	INTER.	MAIN.
RIGHT ARM (cm)	32.5	30.5	27.8
LEFT ARM (cm)	33.0	31.0	28.5
WAIST (cm)	90.5	86.5	82.1
HIPS (cm)	113.5	109.7	105.4
RIGHT THIGH (cm)	70.0	66.0	62.3
LEFT THIGH (cm)	69.0	63.5	60.9
SKINFOLD (mm)	29.8	21.5	16.2

Lisa

MEASURE	BASELINE	INTER.	MAIN.
RIGHT ARM (cm)	30.7	29.6	28.9
LEFT ARM (cm)	31.2	29.7	29.2
WAIST (cm)	88.5	86.6	82.1
HIPS (cm)	108.6	106.8	102.8
RIGHT THIGH (cm)	66.5	64.2	61.2
LEFT THIGH (cm)	65.5	63.7	59.7
SKINFOLD (mm)	22.8	16.4	14.1

#INTER.: Intervention
*MAIN.: Maintenance

Table 3.

The In-Person and Telephone Adherence Checks Performed During Intervention.

	In-Person Checks			Telephone Checks		
Subject	No. of Visits	Exer-cising	Compliance Percentage	No. of Calls	Exer-cising	Compliance Percentage
Karen	5	4	80.0	10	7	70.0
Susan	6	5	83.3	12	11	91.7
Vicki	5	5	100.0	9	9	100.0
John	4	4	100.0	10	7	70.0
Nancy	6	4	66.7	13	10	76.9
Lisa	4	4	100.0	10	8	80.0

only 6 in-person checks were performed on Nancy, her final compliance percentage was just 66.7.

The telephone checks can be interpreted with more certainty due to the greater number of checks performed. However, caution is still required when interpreting the telephone data due to their secondary nature: The experimenter had to rely on each subject's respective parent or family member for correct information. Notwithstanding the aforementioned cautions, adherence levels indicated that each subject was exercising during planned activity times. In addition, an informal assessment of the subjects at the end of maintenance indicated that all subjects had continued to schedule their activity. The common reason given for continuing this technique was "It becomes more of a habit this way and is just easier".

Cognitive Data

The cognitive component was assessed in two ways: (1) the total number of sessions required to complete the cognitive component and (2) the total number of statements overtly practiced during weekly homework. As it can be seen from Table 4, the subjects needed varying numbers of sessions to complete the prescribed cognitive material: Vicki and John needed the fewest sessions and Nancy and Lisa needed the most sessions. Table 4 also contains the total number of statements that each of the 6 subjects practiced on as weekly homework. It can be seen that different amounts of written cognitive homework were completed by each subject: Nancy and Lisa performed the most overt cognitive homework; and Susan, Vicki, and John performed the least amount of overt cognitive homework.

Table 4.

The Number of Sessions Required by Each of the 6 Subjects to Complete the Cognitive Component and the Number of Statements He or She Overtly Practiced During Weekly Homework.

Subject	Number of Sessions	Number of Statements	
		Exercise Side-Effects	Maladaptive Cognitions
Karen	6	7	10
Susan	5	4	4
Vicki	4	3	6
John	4	5	4
Nancy	8	10	22
Lisa	7	11	17

Experimenter Reliability

An independent observer conducted a reliability assessment on 25% of the intervention and maintenance sessions. Data indicated that the experimenter delivered the procedure as stated: The observer and experimenter obtained 100% agreement.

Discussion

The results of the present experiment lend support to Lees's and Dygdon's (1988) contention that the gradual implementation of an exercise program, in conjunction with appropriate scheduling and tacting of proprioceptive feedback to later physiological improvements, can initiate and maintain increased levels of physical activity in formerly non-active individuals. At the start of this experiment 6 obese adolescents were either completely or nearly aerobically inactive. By the end of the intervention phase, each of the 6 subjects had increased his or her aerobic activity and had reaped the benefits of this increased activity level: each of the 6 subjects demonstrated improved aerobic fitness, decreased percents overweight, and decreased girth measurments. In addition, each of the 6 subjects maintained or increased these gains during a 12 week maintenance period.

Baseline assessments of physical activity indicated that: Karen, Susan, Nancy, and Lisa earned zero aerobic points per week; John earned just 2.25 aerobic points per week; and Vicki earned 12 aerobic points per week. Vicki earned her weekly points from participation in a weekly aerobic dance class: She was aerobically inactive during the rest of the week. Consequently,

Vicki did not accrue many physiological benefits from this amount of exercise. Inactive periods of 3 or more days between exercise sessions will diminish the total benefits of aerobic activity (Cooper, 1980). Cooper (1980) and the ACSM (1978) recommend at least 3 days of activity per week to enhance the training effect of aerobic exercise. Exercising 3 or 4 times a week allows the effects of aerobic activity to accumulate and fitness to be increased to levels which cannot be reached by the weekend warrior (those individuals who are sedentary during weekdays but are very active during the 2 weekend days) (Cooper, 1970).

Each of the 6 subjects had different reasons for his or her inactivity: Susan and John enjoyed sports and wanted to become more involved in physical activity, however, both said "I never seem to get around to doing anything"; Karen, Nancy, and Lisa had participated in group activities in the past, but had not participated in individual activities; Vicki enjoyed walking, swimming, and jogging, but had stopped engaging in these activities due to breathing problems and a past foot injury which necessitated the removal of cartilage and several months of physiotherapy. Although the injury only occasionally flared up, Vicki said that she avoided physical activity for fear of re-injuring herself.

By the end of the intervention phase, each of the 6 subjects demonstrated increased levels of physical activity. The most dramatic increase occurred with Vicki: she was earning 108 weekly aerobic points by the end of the intervention phase compared to just 12 weekly aerobic points during baseline. Vicki earned this large number of points by swimming 1

hour three times per week and by continuing to participate in her aerobic dance class. Swimming was an ideal activity for Vicki because it did not put any sustained pressure on her previously injured left foot and did not cause any breathing difficulties.

Differing Weekly Aerobic Point Totals

The 6 subjects attained different levels of activity during this experiment: Vicki was earning 108 weekly aerobic points by the end of intervention; Susan and Lisa were earning 28 and 30 weekly aerobic points by the end of intervention; John was earning 20 weekly aerobic points by the end of intervention; and Karen and Nancy were earning 14 and 14.4 weekly aerobic points by the end of intervention. These differences were maintained during the 12 week maintenance period. The differing final aerobic point totals do not indicate that this experiment had varying degrees of success as each of the 6 subjects was able to attain his or her weekly aerobic point goal.

The differences in final weekly aerobic point totals may be attributable to differing achievement levels. During intervention, Susan, Vicki, John, and Lisa continually asked to increase their weekly aerobic point requirement. In contrast, Karen and Lisa never asked to increase their respective weekly aerobic point requirement: They had to be asked to increase their weekly exercise total.

The subjects initial motivation for entering the experiment may also have caused the differences in final activity levels. Each of the 6 subjects was asked "What do you hope to gain by taking part in this exercise

program?". Susan, Vicki, John, and Lisa said that they enjoyed sports and wanted to participate in them more often. In fact, each of these subjects frequently emitted behaviors which appeared to indicate that he or she was enjoying exercising. For example, during an in-person compliance check, Susan told the experimenter that she loved walking and meeting people. Susan, Vicki, John, and Lisa also said that another goal was to become more fit and healthy. Weight loss appeared to be a secondary concern for these subjects. In contrast, Karen and Nancy said that losing weight was their sole reason for participating in this experiment. Consequently, Karen and Nancy may have seen this experiment as an aversive experience with participation necessary in order to reduce weight.

Although motivation and achievement levels may be responsible for the differences in final weekly aerobic point totals, difficulties incurred while practicing the cognitive exercises do not appear to be associated with the differing activity levels. For example, Nancy and Lisa appeared to have the most difficulty with the cognitive exercises as both needed more sessions to complete the cognitive component than the other subjects. Nancy and Lisa also appeared to be least interested in the cognitive exercises. For example, Nancy said "I don't think this will help me much", and Lisa frequently said that the cognitive exercises were boring. Despite her apparent trouble with and disdain for the cognitive component, Lisa attained the second highest weekly aerobic point total during intervention and maintenance. In contrast, Nancy attained the second lowest weekly aerobic point total during intervention and maintenance.

Did The Present Experiment Accurately Assess Lees's and Dygdon's (1988) Theory?

Although this experiment succeeded in stimulating 6 obese adolescents to become more aerobically active, was it an accurate assessment of Lees's and Dygdon's (1988) theory? The theory has three tenets. First, the institution of an exercise regime should be gradual in order to minimize the negative physiological side-effects incurred by new exercisers. Second, the scheduling of exercise plays a critical role in the maintenance of an exercise regime: Exercise should be scheduled during times which do not compete with other highly reinforcing behaviors. Third, the tacting of exercise's negative physiological side-effects (e.g., muscle soreness) to later positive improvements may help individuals to maintain new exercise behavior. Individuals who do not maintain new exercise behavior may not make this association (Lees & Dygdon, 1988).

Clearly, this experiment employed techniques in accordance with the first tenet of Lees's and Dygdon's (1988) theory: Each of the 6 subjects gradually increased his or her weekly aerobic point total up to a final weekly goal. In addition, an aerobic fitness test and baseline assessment were conducted to ensure that each subject's exercise program started at a level consistent with his or her bodily capabilities. These procedures appeared to have succeeded as no subject identified any serious negative physiological consequences from exercising.

The present experiment also employed techniques in accordance with the second tenet of Lees's and Dygdon's (1988) theory: The subjects were

taught to monitor their daily behavior and to select exercise periods which did not conflict with other highly valued behaviors. For example, Nancy went to a friend's home immediately after school every Friday. She would stay the entire evening and come home the next day. Nancy exercised at home with either a rowing machine or a stationary bicycle, consequently, she could not exercise on Fridays. Scheduling Nancy to exercise Friday evenings would have insured her noncompliance. Similarly, John would sometimes nap immediately after school. This behavior was not consistent but was highly valued. Consequently, John did not schedule his exercise immediately after school. He said, "If I'm tired, I'll just take a nap. I won't exercise."

Finally, this experiment also employed techniques in accordance with the third tenet of Lees's and Dygdon's (1988) theory. Each subject was taught: (1) to associate the negative physiological side-effects of exercise to later improvements, and (2) to substitute maladative non-goal oriented statements with positive goal oriented statments. The double and triple column techniques (Burns, 1980) were used to teach both of these cognitive skills.

Adherence to the Prescribed Techniques

Although the procedures of the present experiment are consistent with the tenets proposed by Lees and Dygdon (1988), an analysis of their theory cannot be performed without evidence that each of the 6 subjects complied with the prescribed techniques.

Adherence to the experimental procedures was assessed by: (1)

in-person compliance checks, (2) telephone compliance checks, (3) inferences made from outcome measures, and (4) written cognitive homework records.

In-Person Compliance Checks

The experimenter visited each subject during scheduled exercise periods to check on (1) compliance with the exercise regime and (2) compliance to the scheduling component. Past research has typically only inferred compliance from outcome measures (if an obese individual loses weight then he or she is assumed to have exercised) or self-monitoring records (e.g., Dahlkoetter et al, 1979; Keefe & Blumenthal, 1980; Perri et al., 1984). These secondary compliance assessment techniques can not absolutely confirm adherence.

The in-person compliance visits during intervention indicated that the subjects were exercising as planned. However, data from the checks need to be viewed with caution because of the low number of visits made. There were two reasons for the low number of in-person compliance checks. First, because of scheduling difficulties, the experimenter could not conduct weekly checks on each subject: Some subjects were scheduled to exercise at the same time during the same day. Second, more frequent in-person checks could have elicited negative emotions from the subjects. As it was, no subject expressed negative thoughts regarding the in-person checks and some subjects appeared to enjoy them. For example, Susan often asked the experimenter when his next visit was. She said "I like walking with you". John appeared to enjoy showing me the mileage on his stationary bicycle

during the in-person checks. He would say "Look how much I've done now!". Incidently, the mileage on John's stationary bicycle correlated perfectly with the mileage on his self-monitoring sheets.

Telephone Compliance Checks

The telephone compliance checks also indicated that each of the 6 subjects was usually exercising during his or her scheduled times. When the subject was not exercising during either the telephone or in-person compliance check, he or she had typically become involved in an unforseen behavior. For example, Susan's family unexpectedly went out for dinner during one of her scheduled exercise times. Consequently, she was not exercising when the experimenter telephoned.

Both the in-person and telephone compliance checks occurred only during the intervention phase because the experimenter did not have access to each subject's exercise schedule during maintenance.

Inferences From Outcome Measures

Exercise compliance during intervention and maintenance can be inferred from outcome measures taken during this experiment. During intervention and maintenance, each of the 6 subjects demonstrated: (1) decreased percents overweight, (2) decreased girth and skinfold measurements (inferences from the girth and skinfold measurements need to be viewed with caution as they may have resulted from individual development), and (3) increased aerobic fitness. In addition, each of the 6 subjects' aerobic point records showed that he or she had become more aerobically active.

Continued use of scheduling skills during maintenance cannot be inferred from the outcome measures. However, each of the 6 subjects did report that he or she continued to schedule exercise behavior during the maintenance phase.

Written Cognitive Homework

Each of the 6 subjects completed all of his or her prescribed written cognitive homework during the experiment. Consequently, each subject complied with this part of the cognitive component. Adherence to the covert cognitive exercises was more difficult to establish because there is no way to accurately assess covert behavior. Despite this problem, it appears that the subjects did comply with the covert practice instructions: Each of the 6 subject reported that he or she had covertly practiced the cognitive techniques during intervention.

Do the Results Support Lees's and Dygdon's (1988) Theory?

It appears that the results of the present experiment lend support to Lees's and Dygdon's (1988) theory. However, this conclusion may not be accurate because an extraneous variable may have enhanced the results: Each of the 6 subjects received a large amount of experimenter attention during this experiment.

Each subject had weekly meetings and telephone calls from the experimenter and bi-weekly in-person visits from the experimenter. Research has demonstrated that the amount of therapist contact can influence the results of experiments (e.g., Patterson & Forgatch, 1985), most likely by creating greater adherence (Perri et al., 1987). For example,

Bennett (1986) reviewed 105 behavioral weight control studies and found that the time spent with the patient was an important variable in determining the success of that experiment.

If the amount of therapist contact was an important variable during this experiment, it could have affected the data in three ways. First, the large amount of therapist contact may have elicited greater adherence to the prescribed techniques: Each of the subjects may have practiced and used the behavioral and cognitive techniques to a greater extent than he or she would have if less therapist contact existed during this experiment. If attention increased adherence to the behavioral and cognitive techniques, then Lees's and Dygdon's theory would still be supported by the present experiment: each of the 6 subjects' exercise behavior would have been initiated and maintained by the variables suggested by Lees and Dygdon (1988). Second, the large amount of therapist contact may have elicited the increased levels of physical activity demonstrated by each subject. If attention caused each subject to adhere to his or her exercise regime, then the behavioral and cognitive components may not be necessary for maintenance of new exercise behavior. Finally, the large amount of therpist contact may have enhanced the obtained results: The behavioral and cognitive components are still necessary, however, large amounts of attention may enhance the effectiveness of these variables.

Summary

Despite the inclusion of an attention variable, the results of the present experiment lend support to Lees's and Dygdon's (1988) theory. The

aerobic activity level of 6 obese adolescents was increased and maintained using a multicomponent treatment package comprised of graduated exercise, scheduling skills, and the tacting of exercise side-effects to later gains. A component analysis of this treatment package is necessary to assess the value of each component in determining the final outcome. In addition, any component analysis will need to manipulate an attention variable to determine its effect on the results of this experiment: The large amount of therapist contact during the present experiment may have enhanced the obtained results.

The present experiment was different from past obesity and exercise research in three ways: (1) in-person compliance checks were performed, (2) the subjects were obese adolescents (very little research has been conducted on the exercise behavior of obese adolescents), and (3) the experimental procedures were "tailored" to each subject: Each of the 6 subjects were allowed to chose exercise behaviors, exercise times and exercise goals. Tailoring refers to the process of fitting the prescribed treatment techniques to the individual subject. Although little research has been conducted, it appears that tailoring can only help improve adherence to different treatment regimes (Dunbar, Marshall, & Hovell, 1979).

Research attempting to identify methods to improve adherence to exercise programs is particularly guilty of not being designed to meet individual subject needs. For example, exercise research usually requires subjects to participate in one or two physical activities (e.g., Epstein et al., 1980; Long & Haney, 1988). One study by Martin and his associates (1984)

used only walking and jogging as the exercise behavior when attempting to shape greater activity in 160 people! It is doubtful that walking or jogging, or any single activity, would have been the activity of choice for all 160 people in Martin's and associates's (1984) study.

Each of the 6 subjects in the present experiment received many positive consequences from becoming more aerobicly active. First, each subject reduced his or her percent overweight during the experiment. In fact, Karen, Vicki, and Lisa each reduced to <20% overweight by its end. Second, each of the 6 subjects improved his or her aerobic fitness level. Initially, all subjects were in either the Poor or Very Poor fitness classification. By the end of the experiment, no subject was in the Very Poor classification and 2 subjects were in the Good classification. Third, each of the 6 subjects sustained reductions in his or her girth measurements.

In addition to realizing positive consequences from becoming more active, each of the 6 subjects also said that he or she enjoyed participating in the present experiment and were happy with the results. For example, Susan was overjoyed when her new volleyball uniform came in and it was much too large for her. Vicki said that she is going to join a swimming club because she's in better shape. John was planning on trying out for his school football team because he felt more confident. Only Nancy was not totally happy with the results: She was happy that she had lost some weight but would have liked to lose even more.

Although the results of the present experiment are encouraging,

further research in the area of adolescent obesity is necessary. Too frequently child or adult treatment packages are generalized to the obese adolescent. Research needs to reverse this trend and identify effective treatment packages for the obese adolescent. Perhaps then, more positive results will be obtained for this neglected population.

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Appendix A

The Advertisement that will be Placed in the Newspaper to Recruit Subjects.

A researcher at the University of Manitoba is looking for teenagers to take part in a physical activity program. Individuals who are overweight, aged 13 to 17 years, and do not suffer from any medical or physical problems, that would preclude them from taking part in research, are invited to contact David Ness for more information (837 8964, evenings after 6 p.m.) (Supervisor, Dr. M.D. LeBow).

Appendix B

Manual to be Used by the Experimenter

This manual is comprised of four sections: pre-baseline interview, intervention, maintenance, and relapse intervention. Each section will contain the procedures that will be implemented during this experiment.

Pre-Baseline Interview

The first in-person contact between the experimenter and the subject will be a pre-baseline interview. During this session, the experimenter will introduce the experiment and perform the entrance criteria assessment. The experimenter will begin by telling the subject that he or she will be taking part in a research program involving aerobic exercise. The experimenter will then compare and contrast four types of physical activity: aerobic, anaerobic, isometric, and isotonic. The following information will be given to each subject:

> Isometric exercise involves exercising muscles without producing movement or using large amounts of oxygen. Such exercises usually involve moving one set of muscles against another set or against an immovable object. For example, pushing against opposite sides of a doorjam, or pulling up on the chair you're sitting on (The experimenter will demonstrate an isometric exercise)(Cooper, 1980).
>
> Isometric exercises can increase the size and strength of individual muscles. Nonetheless, such exercises have no significant effect on overall health, expecially that of the heart, lungs, and blood system. Since there is no increase in oxygen used, there is no training effect. "Isometrics appear to be only good for one thing: Developing muscles to do isometric exercises" (Cooper, 1980).

Appendix B (cont.)

Isotonic exercises move muscles and therefore make you move. Calisthenics, weight lifting, shuffleboard, archery, and horseshoes are all examples of isotonic exercises. Like isometrics, isotonics are aimed almost entirely at muscles and not the heart or lungs. Thus, they do not enhance the heart, lungs, or blood system (Cooper, 1980).

The main reasons that these exercises do not affect the heart, lungs, or blood system are: they are either all muscle exercises, which do not cause you to increase your oxygen intake (e.g., weight lifting); or they are too-short in duration to do you any good (e.g., calisthenics). Isotonic exercises are better than isometric exercises but should not be the main exercise for anyone although they are ideal as building blocks for other exercises (e.g., use calisthenics to warm up before jogging; Cooper, 1980).

The word "anaerobic" means "without oxygen." Anaerobic exercises fall into two categories: Those exercises which demand reasonable amounts of oxygen but which you cut short on purpose, and those exercises which demand high amounts of oxygen but which you stop doing because your body can't take anymore. An example of the first would be running for a short distance, cycling a few blocks, swimming a few laps, or walking a few blocks. An example of the second would be wind sprints, interval training, a 100 meter dash, swimming sprints, and bicycle sprints (Cooper, 1980).

Anaerobic exercise needs lots of oxygen and is used by competitive athletes to build up speed. These exercises should not be used as a main exercise: They end too soon and do not change your body (Cooper, 1980).

Aerobic exercise means with oxygen. Aerobic exercises demand oxygen without making your body too short of oxygen. This is the type of exercise which every exercise program should use. Aerobic exercise improves the strength of your heart and lungs. For example, as your level of aerobic exercise increases your lungs will

Appendix B (cont.)

begin processing more air with less effort. Your heart will also grow stronger and will pump more blood, with fewer strokes. Consequently, the blood supply to your muscles will improve and the total amount of blood in your body will increase. Your body will become better at using oxygen and you will have better endurance (Cooper, 1980).

Regular aerobic exercise can also reduce the amount of fat in your body and increase the amount of muscle. Increased aerobic exercise may also cause your body to use more calories every hour. Thus, you will need more calories to maintain your weight or you will lose weight (Mayer, 1968). There is also evidence that aerobic exercise will decrease your appetite (Epstein, Masek, & Marshall, 1978).

Aerobic exercise can also help you because you can do low-intensity exercise. This allows you to burn more calories because you can do the exercise for a longer period of time.

Changing your body and improving your physical fitness does not take an enormous amount of exercise nor does it involve very hard exercise. For example, you can jog two miles twice a week or three miles five times a week. You can take part in other exercises as well, such as swimming, rowing, cycling, or squash. The amount of time spent exercising will depend on the exercise that you choose (Cooper, 1980).

After explaining the differences between the four types of exercise, the experiment will tell the subject that the goal of the experiment is to develop a long-term aerobic exercise program. The subject will then be told that there is an entrance criterion which he or she may not meet. Each subject will then be asked if he or she would like to participate. If yes, the pre-baseline interview will continue. If not, the experimenter will thank the

Appendix B (cont.)

subject for meeting with him and terminate the session.

The next step of the pre-baseline interview will be to acquire demographic and qualitative information on each subject. Each subject will be asked the following questions:

1. What is your birthdate?
2. What grade are you in?
3. Do you exercise regularly?
4. Do you purposely set times aside to exercise?
5. Do you participate in any sports? How often? Where? With whom?
6. Do you like exercising?
7. If you do not exercise, why not?
8. Are there any situations in which you exercise more than usual?
9. Are there any situations in which you exercise less than usual?
10. What has been your past pattern of exercise and sports participation?
11. Have you ever been involved in an exercise program? How did you like it?
12. Have you ever had an injury or illness which would affect your participation in an exercise program?
13. What do you hope to gain by taking part in an exercise program?
14. What types of exercises would you like to engage in?

Once this information has been acquired, the experimenter will perform the entrance criterion assessment. First, each subject's height and weight will be taken on a Health o Meter balance scale. For this measurement, the subject will be asked to remove any shoes and jackets that are being worn. The height and weight measurements will be taken during the pre-baseline

Appendix B (cont.)

interview, each session of intervention, and the session at the end of the maintenance phase.

The experimenter will then take circumference measurements of the thighs, hips, waist, and upper arms. If the subject is female, a female assistant will conduct the measurements. During these measures, the experimenter will ask the subject to stand upright with his or her legs together. For the thigh measurement, a tape measure will be placed around each thigh at a point approximately midway between the knee and waist. For the hip measurement a tape measure will be placed around the hips at a point approximately at the hip bone. The waist measurement will be taken at a point which includes the subject's navel. Finally, the circumference of each upper arm will be taken at a point 1/2 the distance between the elbow and the top of the shoulder. Once the experimenter or the female assistant has taken these measures, the subjects will be instructed to make these measurements themselves. The experimenter will explain that the purpose of this is to ensure that the measurements are accurate. The experimenter will re-take the circumference measurements during: the first, last, and every fourth intervention session; and during the session at the end of the maintenance phase.

A skinfold measurement will then be taken using a John Bull caliper on the nondominant tricep of the subject. The following procedure will be used when taking this measure:

"The skinfold measurement to be obtained is the (doubled)

Appendix B (cont.)

> thickness of the pinched "folded" skin plus the attached subcutaneous adipose tissue. The person making the measurement pinches up a full fold of skin and subcutaneous tissue with the thumb and forefinger of his left hand at a distance about 1 cm from the site at which the calipers are to be placed, pulling the fold away from the underlying muscle. The fold is pinched up firmly and held while the measurement is being taken. The calipers are applied to the fold about 1 cm below the fingers, so that the pressure on the fold at the point measured is exerted by the faces of the caliper and not by the fingers. The handle of the caliper is released to permit the full force of the caliper arm pressure, and the dial is read to the nearest 0.5 mm. Caliper application should be made at least twice for stable readings. If the folds are extremely thick, dial readings should be made three seconds after applying the caliper pressure." (Seltzer & Mayer, 1965). "The Triceps Measurement. Taken over the mid-point of the muscle belly, midway between the olecranon (elbow) and the tip of the acromion (the highest point of the shoulder), with the upper arm hanging vertically (Edwards et al., 1955). Note: If the examiner suspects that the triceps muscle has been pinched up with the fatfold, the subject should stiffen the arm (to define the muscle) and then relax it for the measurement. The mid-point of the site should be measured and marked with a felt pen, since subcutaneous fat varies considerably in this area." (Grimes & Franzini, 1977).

The experimenter will take this measure twice each time he assesses the skinfold thickness of a subject. The skinfold assessment will be performed during: the first, last, and every fourth session of the intervention phase; and during the session at the end of the maintenance phase.

The experimenter will then give each subject a letter of permission

Appendix B (cont.)

(Appendix C) which will have to be signed by his or her parent(s) and physician. The latters signature will indicate that there are no medical contraindications to participation in the experiment. No subject will be allowed to begin the intervention phase until the letter of permission has been returned.

At the end of the pre-baeline interview, each subject will be given a recording sheet (Appendix D). This sheet will ask each subject to detail his or her daily physical activity, excepting exercise which took place during physical education classes at school. The experimenter will tell the subject that these sheets will help determine a starting point for his or her exercise program. The subject will be asked to monitor his or her physical activity for up to 6 weeks. The experimenter will explain that the delayed start of the program is necessary to help determine a starting point for the subject. Each subject will be given 6 stamped envelopes with which to return their baseline data. The experimenter will ask each subject to return his or her data weekly.

Intervention

Session One. The first session of the intervention phase will take place at the indoor track at the University of Manitoba and at the Manitoba Obesity Control Center. During a telephone call, the experimenter will explain that the subject is required to take an aerobic fitness test. Each subject will be told that this is necessary for the determination of his or her aerobic fitness level. The experimenter will ask the subject to come to the indoor track at the University of Manitoba and wear appropriate clothing for a short walk or jog (e.g., running shoes, shorts, and a t-shirt). The subject will also be asked to

Appendix B (cont.)

return the signed consent form during this meeting, otherwise, the exercise program will not begin. Once at the indoor track, the subject will be introduced to the 12 minute walk/run fitness test and the 3 mile walk fitness test. Each subject will be told that the 12 minute walk/run requires him or her to walk or run as fast as possible for 12 minutes. The subjects will be told that the 3 mile walk requires them to walk 3 miles as quickly as they are able. Before making their selection, the subjects will be told that they will be required to re-take the same fitness on two other occasions. Consequently, no subject will be allowed to take both fitness tests: they must take the same fitness test on all three occasions.

If the subject chooses the 12 minute walk/run, he or she will be told: start out running, walk if your breath gets short and until it comes back, and then run some more. The subject will be told to keep going for the full 12 minutes and to not be embarrassed if he or she has to walk most of the time. If the subject chooses the 3 mile walk fitness test, he or she will be told to walk 3 miles as fast as possible. The experimenter and the subject will then go to the Manitoba Obesity Control Center for the remainder of this first intervention session.

At the Manitoba Obesity Control Center, the experimenter will begin by re-stating the information regarding the different types of exercise. Next, the experimenter will explain the aerobic point. Each subject will be told that the aerobic point allows him or her to compare the benefits of different exercises. For example, "it allows you to compare hockey to cycling, and jogging to

Appendix B (cont.)

squash". Using Appendix N, the experimenter will show each subject how various physical activities can be compared.

The experimenter will then tell each subject that he or she will be required to participate in a single form of exercise for the first few weeks of the experiment. The seven alternatives will be walking, running, cycling, stationary, cycling, rowing, skipping, and swimming. The experimenter will explain that each subject is to use only one exercise to help develop aerobic fitness before attempting other exercises. Once each subject has earned 10 aerobic points during a week, the experimenter will show how to incorporate other activities into his or her weekly exercise program. The experimenter will provide the subject with a list (Appendix N) detailing the aerobic point value of various physical activities. The subjects will not be required to incorporate other physical activities into their weekly exercise plan.

For the first week of intervention each subject will be instructed to exercise at a rate equal to the midway point for their fitness classification. The fitness classification will be derived from each subject's performance on either of the two fitness tests. For example, if a male subject took 49 minutes to complete the 3 mile walk he would be in the Very Poor fitness classification for his age. For males this fitness classification is associated with an average of less than 10 aerobic points per week (See Appendix O). Thus, this subject would be instructed to start at 5 aerobic points for the first week.

After providing the exercise instructions for the first week, each subject will be given a daily behavior diary (Appendix E). The experimenter

Appendix B (cont.)

will instruct the subject to record each daily behavior for the next week. In addition, the subjects will be asked to record the time, duration, and enjoyment level of each daily behavior. The experimenter and subject will rehearse the recording of a single day. Subjects will be told that the daily behavior diary will help them to schedule their exercises.

The final task of the first session will be to re-take the circumference measurements, skinfold measurements, and height and weight measurements. These measurements will be taken as outlined during the pre-baseline interview session. The weight measurement will be taken during every session of the intervention phase. The height, circumference, and skinfold measurements will be taken every fourth session. For female subjects, a female assistant will take the circumference measurements. The experimenter and subject will then set a time for the next session.

Session Two. At the beginning of the second session, the final weekly aerobic point goal will be determined. The subject will be encouraged to select a final goal which is within reach. The subject will be told that it is desirable to set small attainable goals and then set further goals if necessary. The weekly aerobic point goals must be at least 50% greater than baseline levels

Once the weekly aerobic point goal has been determined, the experimenter will emphasize the importance of a gradual increase in physical activity: The gradual increase in physical activity will minimize the amount of fatigue and muscle soreness that may be experienced when a person starts to exercise. The subjects will be required to exercise during at least 3 separate

Appendix B (cont.)

days of each week.

Next, the experimenter will ask the subject to produce his or her daily behavior diary. The experimenter will reiterate that the daily behavior diary will be used to find optimal times for exercising. The experimenter and the subject will examine the diary and identify time periods which are not currently occupied by highly reinforcing behaviors. The subjects will be told to pick exercise times which do not conflict with activities which are highly valued. The subjects will then be given a planning and self-monitoring sheet (Appendix F) for planning and recording their weekly physical activity. Initially, the experimenter will help each subject plan his or her upcoming week of exercise. Starting with the fifth intervention session, the subject will be asked to fill out the planning sheet independently.

Finally, the experimenter will inform each subject about the in-person checks and telephone checks. The subjects will be told: "I will occasionally visit you at home to see how things are going, and, I will phone you each week to see if you are having any difficulties". The experimenter will visit or telephone during scheduled exercise times.

The experimenter will telephone each subject during the upcoming week of intervention. If the subject is exercising as scheduled, another person should answer the telephone call. This person will be asked "Is John (the subject) exercising right now? If he is, I'll phone back later". If the subject is not exercising during this check, the experimenter will ask why and then stress the importance of following the schedule. If the subject is exercising, the

Appendix B (cont.)

experimenter will praise his or her efforts.

The experimenter will also conduct an in-person check during the second week of intervention. If the subject is exercising as planned, praise will be delivered. If the subject is not exercising at the planned time, the noncompliance will be discussed at the next session: The experimenter will ask the reason(s) for the noncompliance and will attempt to offer a solution. For example, if a highly desirable behavior was interrupted by the scheduled exercise the subject will be asked to find another time to exercise. This procedure will be followed whenever a subject is found not to be exercising during either the in-person check or the telephone check. The experimenter will conduct bi-weekly in-person visits and weekly telephone calls.

Session Three. The experimenter will begin session three as he did during session two. Next, the experimenter will introduce the cognitive component of the intervention phase. Cognitions will be defined as "thoughts in your head". The experimenter will say, " the cognitive section will give you skills to help exercise when things get tough". Each subject will then be given a list of ten common cognitive distortions (Appendix J). The experimenter will read this list over with each subject. Each subject will then be required to read the list on his or her own during the upcoming week.

Session Four. The beginning of this session will be identical to the beginning of the previous two sessions. Next, the experimenter will explain the relationship between muscle fatigue and soreness and later improvements in physical conditioning. The subject will be told that immediate muscle

Appendix B (cont.)

fatique and soreness, and later muscle fatigue and soreness, are indications of progress towards a final weekly aerobic point goal.

The double column technique (Burns, 1980) will be used to associate fatigue and muscle soreness with later improvement in physical conditioning. Each subject will be given a sheet comprised of different examples of the double column technique (Appendix I). This sheet contains: examples of the negative physical side-effects of exercises and positive statements connecting these side-effects with later physical improvements.; and examples of negative physical side-effects but no positive statements. The experimenter will go through this list and ask each subject to produce positive self-statements to these latter negative physical side-effects. During the upcoming week, each subject will be asked to practice this technique immediately after exercising: The subject will be told to write down a single negative physical side-effect after each exercise session and supply a positive interpretation. The location of the exercise may make it awkward to practice this technique immediately after exercising (e.g., swimming pool). If so, the subject will be told to complete the practice as soon as possible.

Session Five. At the beginning of session five, the subject will be required to plan the next week of activity without the aid of the experimenter. The experimenter will provide help if needed, however, the experimenter will attempt to separate himself from this task. Next, the height, circumference, and skinfold measures will be retaken. The rest of this session will be devoted to the cognitive component.

Appendix B (cont.)

The experimenter will check each subject's prescribed homework and again practice associating the physical side-effects of exercising to later physical improvements. During the next week, the subject will be asked to covertly practice this technique while exercising and after exercising.

The experimenter will then begin to teach each subject to replace any maladaptive and negative self statements related to exercise. Subjects will be told that they are going to learn a method of thinking which may help make it easier to exercise. The triple column technique (Burns, 1980) will be used to replace negative non-goal-oriented statements with positive goal-oriented statements. The triple column technique will then be demonstrated and rehearsed with the subject. An example sheet comprised of maladaptive cognitions will be supplied to each subject (Appendix K). This sheet contains: maladaptive cognitions, their related cognitive distortion labels, and positive statements. The experimenter will go through this practice sheet with each subject. The final half of the practice sheet contains maladaptive cognitions but no distortion label and no positive statements. The subject will be asked to supply appropriate cognitive distortion labels and positive statements to the maladaptive statements.

Each subject will be asked to practice this technique immediately after exercising (The experimenter will proved practice sheets to each subject). If practicing this technique is awkward at the exercise site, subjects will be told to complete the task at home. The subjects will be asked to work on two negative cognitions after each exercise period for the next week. If the

Appendix B (cont.)

subject does not experience any exercise related maladaptive cognitions, he or she will be instructed to practice on any maladaptive cognitions (e.g., I'll never finish this essay"). If the subject has no negative cognitions during an exercise day, he or she will be told to re-do the practice sheet.

Session Six. The subject will now have two forms of cognitive homework: one focusing on tacting muscle fatigue and soreness to later improvement; and one focusing on cognitive restructuring. The experimenter will check the homework of the subject and correct difficulties where necessary. If difficulties are occurring, the experimenter will again practice the appropriate technique with the subject. If no difficulties are encountered, the subject will then be asked to practice the triple column technique on every exercise related maladaptive cognition.

Session Seven. The experimenter will check each subject's record regarding: physcial activity, tacting of the side-effects to later gain, and cognitive restructuring. If any difficulties are being encountered, the experimenter will practice the appropriate technique with the subject. If no difficulties are being encountered, the experimenter will ask the subject to start covertly practicing all of the cognitive restructuring procedures.

The experimenter will tell each subject to: write down the side-effects of exercising or the maladaptive self-statements, and produce positive statements covertly. The experimenter will then practice this technique with each subject. For example, the experimenter will say "You just finished exercising and your thinking: I did really lousy today". The subject will then

Appendix B (cont.)

be asked to produce replace this practice cognition with a positive statement.

Session Eight. All weekly work will be checked during the beginning of this session and the remaining intervention sessions. If the subject has completed all of the cognitive practice correctly, he or she will be told to continue to practice covertly. If the covert practicing of the cognitive techniques proves too difficult for any subject, the experimenter will instruct the subject to re-start writing down either the muscle symptom or negative self-statement and covertly practice just the positive substitution. If a difficulty is occurring with one part of the cognitive component, the experimenter will not procede until the subject has overcome this problem.

The rest of the intervention sessions will follow this same format: The experimenter will check all homework, have the subject plan the next week of activity, and practice some of the cognitive techniques.

Final Intervention Session. The final intervention session will occur once (1) the subject has reached and maintained his or her final weekly aerobic point goal for at least 2 consecutive weeks, and (2) once the subject has learned the cognitive skills. The experimenter will then tell each subject to continue to exercise for the next 12 weeks using the skills learned in this experiment. Each subject will be asked to maintain or increase his or her final weekly level of activity. In addition, the subject will be told that the experimenter will phone each week to check progress. This telephone call will also serve as a prompt to return the data every week. The experimenter will supply each subject with stamped envelopes with which to return weekly data.

Appendix B (cont.)

The final task of this last session will be to re-take each subject's height, weight, skinfold, and circumference measurements. The subject and experimenter will then set up a time to re-take either the 12 minute walk/run or 3 mile walk fitness test.

Maintenance. There will be no in-person contact between the subject and the experimenter during maintenance. The subject will be provided with self-monitoring forms and stamped envelopes with which to return the forms to the experimenter. The experimenter will analyze the returned data and monitor weekly aerobic point totals. If any subject reduces activity by 25% or more for three consecutive weeks, a relapse intervention phase will be instituted.

The experimenter will conduct weekly telephone calls to each subject during maintenance. During this telephone call, the experimenter will casually inquire as to the progress of the subject (e.g., "How is the exercise program going?"). The purpose of the telephone call is to prompt subjects to return their self-monitoring forms.

At the end of 12 weeks the experimenter will re-administer either the 12 minute walk/run or 3 mile walk fitness test to the subject. In addition, height, weight, skinfold, and circumference measurements will also be retaken.

Relapse Intervention Phase. The relapse intervention phase will be instituted if the subject has reduced his or her final intervention activity level by 25% or more. If this occurs, the experimenter will telephone the subject and inquire about the reduced weekly aerobic point total. If the subject was ill

Appendix B (cont.)

during this time, the relapse intervention program will not be instituted. If the subject is having difficulties maintaining his or her activity level, the relapse intervention program will be started.

During the first relapse intervention session, the subject will be given another daily behavior diary. As during the first intervention session, the subject will be required to record each of his or her daily behaviors during the upcoming week. Next, the experimenter will practice the cognitive exercises with the subject. The experimenter will produce the two cognitive practice sheets: one for tacting the negative physical side-effects to later improvement and one outlining the substitution of positive goal oriented statements for negative non-goal oriented statements. These techniques will be practiced as they were during the intervention phase. The experimenter will then ask the subject to overtly practice these procedures immediately after exercising.

The next relapse intervention session will begin with the experimenter and subject analyzing the daily behavior diary. Appropriate times for exercising will be identified and utilized when planning the subject's next week of exercise. The subject and experimenter will plan the next week of activity with the aerobic point total being equal to the subject's final weekly aerobic point total during intervention.

The cognitive homework will then be examined and practiced with the subject. For the next week the subject will be required to write down just his or her negative thoughts or negative side-effects of exercising. The subject

Appendix B (cont.)

will then be instructed to covertly practice substituting positive statments to these two negative stimuli.

During the third relapse intervention session, the subject will independently plan his or her upcoming week of activity and covertly practice the cognitive techniques. The maintenance phase will be re-started when the subject has re-attained his or her weekly aerobic point goal and learned the cognitive techniques. The relapse intervention phase will continue until the subject has met this criterion.

Appendix C

A Copy of the Letter of Permission Given to Each Subject

I am aware that my patient, _____ is participating in a behavioral exercise program at the University of Manitoba. According to my knowledge, there is no medical reason that would prevent _____ from participating in this programme.

Physician's signature_____

Date _____

I am aware that my offspring, _____ is participating in a behavioral exercise program at the University of Manitoba. I hereby give my consent allowing _____ to participate in this programme.

Parents' signature_____

_____

Date _____

Appendix D

A Copy of the Physical Activity Recording Sheet Used During Baseline.

DATE	TIME OF DAY	TYPE OF ACTIVITY	TOTAL TIME SPENT DOING THE ACTIVITY	INTENSITY OR AMOUNT OF ACTIVITY

Appendix E
The Daily Behavior Diary Used During Intervention

WHAT WAS THE DATE AND TIME OF DAY OF THE BEHAVIOR	WHAT DID YOU DO AND HOW LONG DID YOU DO IT	HOW MUCH FUN WAS THE BEHAVIOR

* 0 NOT FUN AT ALL 1 2 SOMEWHAT FUN 3 4 VERY FUN

Appendix F

The Physcial Activity Planning and Self-Monitoring Sheet.

Name:_____ Week:_____

	Scheduled Activity	Scheduled Time of Activity	Scheduled Amount of Activity	Activity Completed	Time of Completed Activity	Amount of Activity Completed	Aerobic Points
Mon.							
Tues.							
Wed.							
Thurs.							
Fri.							
Sat.							
Sun.							

Appendix G
The Weekly Progress Recording Sheet

WEEK	AEROBIC PT. GOAL	AEROBIC PT. OBTAINED
1		
2		
3		
4		
5		
6		
7		
8		
9		

Appendix H
An Example of the Double Column Technique

Negative Physical Side-Effect of Physical Activity	Positive Statement Relating Side-Effects to Later Physical Improvements
Muscles in legs cramping	"I am sore right now but this just shows that I am progressing towards my goal of being in better shape".

Appendix I

A Copy of The Ten Cognitive Distortions.

1. **ALL-OR-NOTHING THINKING**: You see things in black and white categories. Either you do everything perfect or you are no good. For example, you only exercised 5 times this week instead of 6 and you think you are a failure
2. **OVERGENERALIZATION**: Every time you do bad you see it as a never ending pattern. "No matter what I do, it always ends up lousy" or "I don't know why I bother, I never win".
3. **MENTAL FILTER**: You only see the bad things that happen. You think about these bad things over and over. For example, you didn't lose weight in the last week even though you exercised. You think about this over and over and feel lousy.
4. **DISQUALIFYING THE POSITIVE**: You don't count positive things. They just don't matter. "The bike is easy to ride now, but so what? I'm not losing much weight".
5. **JUMPING TO CONCLUSIONS**: You jump to conclusions without knowing for sure. For example, if a person looks at you, you think they are making fun of you.
6. **MAGNIFICATION (CATASTROPHIZING) OR MINIMIZATION**: You make bad things really huge and good things really small. If one person tells you that you are doing bad, you feel lousy even though 30 people told you that you are doing good.
7. **EMOTIONAL REASONING**: Because you feel bad then things must really be bad. Everything is lousy if you feel bad for the moment.
8. **SHOULD STATEMENTS**: You often say that you SHOULD or MUST do something. I SHOULD exercise everyday or I MUST do more.
9. **LABELING AND MISLABELING**: You call yourself a name because of one thing that you did. If you did not exercise one day you call yourself worthless. You describe you entire self based on one thing that you did.
10. **PERSONALIZATION**: You blame yourself for things that happen even when they are not you fault. "I'm bad because I can't lose weight even though I'm exercising". "It's my fault that my mother is not happy".

* From Burns (1980)

Appendix J

The Double Column Technique Used in Teaching the Tacting of the Side-Effects of Exercise to Later Physical Improvement

BAD THINGS THAT HAPPEN FROM EXERCISE	POSITIVE WAY OF LOOKING AT THE BAD SIDE-EFFECT
MY LEGS ARE SORE	"YES, MY LEGS ARE SORE, BUT IF I KEEP WORKING THEY WON'T BE THIS SORE LATER".
MY STOMACH IS UPSET	"SURE, MY STOMACH IS SORE, BUT THIS IS JUST FOR NOW. IT WILL GO AWAY. I MUST BE WORKING HARD".
I FEEL REALLY TIRED	
AGGH, I'VE GOT BLISTERS	
MY FEET SURE ARE TENDER AND SORE	
MY LEGS FEEL LIKE JELLO	

Appendix K

The Triple Column Practice Guide Used During Intervention.

NEGATIVE THOUGHT	TYPE OF MISTAKE	POSITIVE THOUGHT
I'm already tired. I'll never get into shape	Jumping to Conclusions	I know I'm tired right now but as I exercise more I will get into better shape
I can't exercise right because I never do anything right	Overgeneralization	That's dumb, I do a lot of things right and I will keep exercising.
That person is probably thinking that I'm fat and no good	Mind reading Fortune teller error	I don't know what that person is thinking. If he is thinking that then he's a jerk. I'm doing my best.
I'm fat because I deserve to be.		
Doing this exercise doesn't give me time to do anything else		
Exercise won't work for me.		

Appendix L

A Summary of the Experimenter's Manual

PRE-BASELINE INTERVIEW

-Discuss the four types of exercise.

-Present the goal of the research program.

-Obtain Demographic and qualitative information.

-Take circumference, skinfold, height, and weight measurements.

-Request physician and parental clearance.

-Give and explain the daily activity recording sheet (Appendix D).

INTERVENTION

Session One

-Conduct 12 minute walk/run or 3 mile walk fitness test.

-Explain aerobic point system.

-Explain the exercise program.

-Give and explain the daily behavior diary (Appendix E)

Session Two

-Take measurements as during interview session.

-Prescribe an exercise program.

-Briefly explain the components of the treatment package.

-Give and explain the Physical Activity Planning and Self-Monitoring Sheet (Appendix G).

-Begin scheduling phase.

Appendix L (cont.)

Session Three

-Take measurements.

-Collect data.

-Introduce the cognitive component.

-Give and explain ten common cognitive distortions (Appendix I).

Session Four

-Take measurments

-Collect data.

-Begin tacting side-effects of exercise with later physical improvement.

-Practice triple column technique and assign homework.

Session Five

-Take measurements.

-Collect data.

-Begin replacing negative non-goal oriented cognitions with positive goal oriented cognitions.

-Practice cognitive techniques.

-Have subject plan next week of physical activity.

Session Six to Final

-Take measurements.

-Collect data.

-Practice and monitor cognitive restructuring.

Appendix L (cont.)

Final Intervention Session

-Take circumference, skinfold, height, and weight measurements

-Give self-monitoring sheets and planning sheets for maintenance (Appendices F and G).

-Make appointment for 12 minute walk/run or 3 mile walk fitness test.

Maintenance

-Collect data.

-Telephone subjects.

-Monitor weekly aerobic point totals.

-After 12 weeks, take circumference, skinfold, height, and weight measurements.

-Give 12 minute walk/run or 3 mile walk fitness test.

RELAPSE INTERVENTION

-Collect data.

-Re-introduce scheduling and planning of activity.

-Practice cognitive techniques.

-Re-introduce into maintenance once activity is back up to post intervention level.

Appendix M

A Copy of the Experimenter and Reliability Checklist

Date:_____ Subject:_____

Phase:_____ Session no._____

Length of Session:_____ Parents present:_____

Reliability: Y N

Check off which of the following were done during the session.

COLLECT DATA FROM SUBJECT. _____

PRAISE SUBJECT FOR COMPLETED HOMEWORK. _____

INQUIRE ABOUT POSSIBLE DIFFICULTIES WITH PAST WEEK'S WORK. _____

DISCUSS IMPORTANCE OF SCHEDULING. _____

PLAN NEXT WEEKS ACTIVITIES. _____

CHECK ON PROGRESS OF SUBJECT TOWARD EXERCISE GOAL. _____

DISCUSS AND PRACTICE COGNITIVE TECHNIQUES. _____

GO OVER PAST WEEK'S COMPLETED HOMEWORK WITH SUBJECT. _____

WERE HEIGHT AND WEIGHT TAKEN? _____

WERE CIRCUMFERENCE MEASURES TAKEN? _____

WAS SKINFOLD THICKNESS TAKEN? _____

Appendix N

The Aerobic Point Values of Some Physical Activities#

SPORT	TIME	POINTS	SPORT	TIME	POINTS
FENCING	10 MIN	1	SKATING	15 MIN	1
	20 MIN	2	(ICE OR	30 MIN	2
	30 MIN	3	ROLLER)	60 MIN	4
FOOTBALL*	30 MIN	3	SKIING**	30 MIN	3
	60 MIN	6	(SNOW OR	60 MIN	6
	90 MIN	9	WATER)	90 MIN	9
GOLF	9 HOLES	1.5	SOCCER +	30 MIN	3
(WALKING)	18 HOLES	3	LACROSSE	60 MIN	6
				90 MIN	9
HOCKEY	20 MIN	3			
	40 MIN	6	TENNIS	1 SET	1.5
	60 MIN	9	(SINGLES)	2 SETS	3
	80 MIN	12		3 SETS	4.5
ROPE	5 MIN	1.5	VOLLEYBALL	15 MIN	1
SKIPPING	10 MIN	3		30 MIN	2
	15 MIN	4.5		60 MIN	3
ROWING***	6 MIN	1	WRESTLING	5 MIN	2
	18 MIN	3		10 MIN	4
	36 MIN	6		15 MIN	6

* Count only the time in which you are actively participating.
**Count only the time in which you are actively skiing.
***2 oars, 20 strokes/minute.

#From Cooper (1980)

Appendix O.

The average number of aerobic points earned per week by individuals in different fitness classifications*.

	Average Points Per Week	
Fitness Classification	Men	Women
Very Poor	<10	<8
Poor	10-20	8-15
Fair	21-31	16-26
Good	32-50	27-40
Excellent	51-74	41-64
Superior	75+	65+

* From Cooper (1982)