THE IMPACT OF A SCHOOL HEALTH PROMOTION PROGRAM ON ADIPOSITY AND WEIGHT, FITNESS AND NUTRITION HABITS AND FITNESS AND NUTRITION KNOWLEDGE

BY

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Abstract

The purpose of the study was to evaluate the impact of a school health promotion program on three dependent variables: (a) students' adiposity and weight, (b) students' fitness habits and nutrition habits and (c) students' fitness knowledge and nutrition knowledge. The program was comprised of three instructional components for grade 6 students from nine treatment schools: (a) an in-class module for overweight and non-overweight students, (b) a night school module for overweight students and (c) a night school module for parents of the overweight students. The three dependent variables were measured by the O-Scale System, Habit Inventory and Knowledge Test respectively on three testing occasions.

Analyses of covariance and analyses of variance followed by Scheffe's post-hoc procedure revealed that: (a) The program activities had no statistically significant impact on decreasing students' adiposity and weight scores, although positive trends suggesting program impact did appear; and (b) The program activities had a statistically significant impact on improving students' fitness habits and nutrition habits, and on fitness knowledge and nutrition knowledge for selected sex combinations and at specific testing occasions.

The findings of the study suggest that a short-term school health promotion program had a short-term impact for both overweight and

non-overweight students. Achieving statistically significant reductions in adiposity and weight is difficult, particularly over the course of a limited duration program. Statistically significant improvements in knowledge and habits pertaining to fitness and nutrition can be achieved through an eight-week program. Maintenance of these changes likely requires on-going follow-up sessions.

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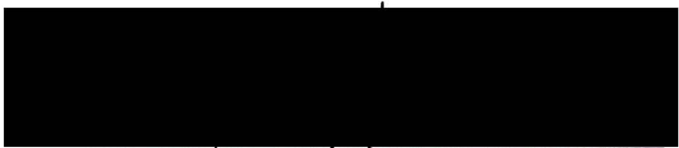

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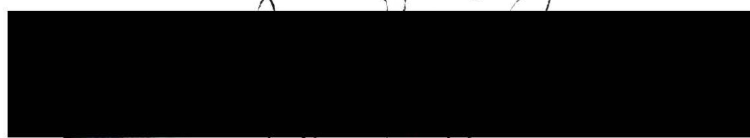

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Table of Contents

Page

Abstract i

Tables of Contents iii

List of Tables v

List of Figures viii

Acknowledgements ix

Chapter I - Introduction 1

Context of the Problem 1

Purpose of the Study 2

Characteristics of the Study 3

Limitations of the Study 4

Chapter II - Review of the Literature 5

Health Implications of Obesity in Children 5

Obesity - A Contemporary Health Problem 6

The School As a Setting for Weight Management 7

The Point of Intervention for School-Based Weight Management Programs 9

The Behavioral Approach to Weight Management 13

The Comprehensive Health Promotion Approach to Weight Management 14

The Management and Prevention of Obesity: Limited Program Successes 14

Summary 18

Chapter III - Rationale for Study, Definition of Terms and Statement of Hypotheses 19

Rationale 19

Definition of Terms 20

Identification of Treatment and Non-Treatment Conditions ... 21

Hypotheses 22

Statement of Hypotheses 22

Chapter IV - Research Methods 24
Planning and Development of Program Activities 24
Sampling Procedures and Considerations 25
Implementation of Program Activities 27
Philosophy of Program Activities 28
Measurement of Dependent Variable A - Fatness and Weight 31
Measurement of Dependent Variables B and C - Habits and Knowledge 34
Evaluation of Procedure for Identifying Overweight and Non-Overweight Students 36
Data Collection Procedures 37
Data Analyses 38

Chapter V - Results and Discussion 48
Dependent Variable A - Adiposity and Weight Scores 48
Dependent Variable B - Habit Inventory Scores 53
Dependent Variable C - Knowledge Test Scores 58
Evaluation of Method for Identifying Overweight and Non-Overweight Students 61
Impact of Gender on Program Impact 63

Chapter VI - Summary, Conclusions and Recommendations 103
Summary 103
Conclusions 105
Recommendations 106

Bibliography 108

Appendix A - Lesson Topics, Program Overviews and Program Goals for Study Curricula 112

Appendix B - O-Scale System Anthropometric Proforma 129

Appendix C - Habit Inventory 131

Appendix D - Knowledge Test 138

Appendix E - Summary Information on Habit Inventory and Knowledge Test Results, Tables 39-48 153

List of Tables

Table Page

1 Adiposity and Weight Mean Scores of Males on the Post-Test by Group 65

2 Adiposity and Weight Mean Scores of Females on the Post-Test by Group by Group 66

3 Adiposity and Weight Mean Scores of Males and Females Combined on the Post-Test by Group 67

4 Adiposity and Weight Mean Scores of Males on the Retention Test by Group 68

5 Adiposity and Weight Mean Scores of Females on the Retention Test by Group 69

6 Adiposity and Weight Mean Scores of Males and Females on the Retention Test by Group 70

7 Adiposity and Weight Mean Scores of Group 1 Males by Testing Occasion 71

8 Adiposity and Weight Mean Scores of Group 1 Females by Testing Occasion 72

9 Adiposity and Weight Mean Scores of Group 1 Males and Females Combined by Testing Occasion 73

10 Adiposity and Weight Mean Scores of Group 2 Males by Testing Occasion 74

11 Adiposity and Weight Mean Scores of Group 2 Females by Testing Occasion 75

12 Adiposity and Weight Mean Scores of Group 2 Males and Females Combined by Testing Occasion 76

13 Adiposity and Weight Mean Scores of Group 3 Males by Testing Occasion 77

14 Adiposity and Weight Mean Scores of Group 3 Females by Testing Occasion 78

15 Adiposity and Weight Mean Scores of Group 3 Males and Females Combined by Testing Occasion 79

16 Adiposity and Weight Mean Scores of Group 4 Males by Testing Occasion 80

17 Adiposity and Weight Mean Scores of Group 4 Females by Testing Occasion 81

18 Adiposity and Weight Mean Scores of Group 4 Males and Females Combined by Testing Occasion 82

19 Adiposity and Weight Mean Scores of Group 5 Males by Testing Occasion 83

20 Adiposity and Weight Mean Scores of Group 5 Females by Testing Occasion 84

21 Adiposity and Weight Mean Scores of Group 5 Males and Females Combined by Testing Occasion 85

22 Pairs of Significantly Different Habit Inventory Mean Scores on the Post-test by Group and Sex - Between Groups Comparisons 86

23 Pairs of Significantly Different Habit Inventory Mean Scores on the Retention Test by Group and Sex - Between Groups Comparisons 87

24 Pairs of Significantly Different Habit Inventory Mean Scores for Group 1 by Testing Occasion and Sex - Within Groups Comparisons 88

25 Pairs of Significantly Different Habit Inventory Mean Scores for Group 2 by Testing Occasion and Sex - Within Groups Comparisons 89

26 Pairs of Significantly Different Habit Inventory Mean Scores for Group 3 by Testing Occasion and Sex - Within Groups Comparisons 90

27 Pairs of Significantly Different Habit Inventory Mean Scores for Group 4 by Testing Occasion and Sex - Within Groups Comparisons 91

28 Pairs of Significantly Different Habit Inventory Mean Scores for Group 5 by Testing Occasion and Sex - Within Groups Comparisons 92

29 Pairs of Significantly Different Knowledge Test Mean Scores on the Post-test by Group and Sex - Between Groups Comparisons 93

30 Pairs of Significantly Different Knowledge Test Mean Scores on the Retention Test by Group and Sex - Between Groups Comparisons 94

31 Pairs of Significantly Different Knowledge Test Mean Scores for Group 1 by Testing Occasion and Sex - Within Groups Comparisons 95

32 Pairs of Significantly Different Knowledge Test Mean Scores for Group 2 by Testing Occasion and Sex - Within Groups Comparisons 96

33 Pairs of Significantly Different Knowledge Test Mean Scores for Group 3 by Testing Occasion and Sex - Within Groups Comparisons 97

34 Pairs of Significantly Different Knowledge Test Mean Scores for Group 4 by Testing Occasion and Sex - Within Groups Comparisons 98

35 Pairs of Significantly Different Knowledge Test Mean Scores for Group 5 by Testing Occasion and Sex - Within Groups Comparisons 99

36 Minimum, Median and Maximum Scores for Sum of Six Skinfolds by Group 100

37 Minimum, Median and Maximum Proportional Values for Proportional Sum of Six Skinfolds by Sex and Group 101

38 Percentage of Students With Overlap of Sum of Six Skinfolds and Proportional Sum of Six Skinfolds by Group and Sex 102

39 Habit Inventory Mean Scores of Males, Females, Males and Females Combined on the Post-test by Group 153

40 Habit Inventory Mean Scores of Males, Females, Males and Females Combined on the Retention Test by Group 154

41 Habit Inventory Mean Scores of Males, by Testing Occasion and Group 155

42 Habit Inventory Mean Scores of Females, by Testing Occasion and Group 156

43 Habit Inventory Mean Scores of Males and Females, by Testing Occasion and Group 157

44 Knowledge Test Mean Scores of Males, Females, Males and Females Combined on the Post-test by Group 158

45 Knowledge Test Mean Scores of Males, Females, Males and Females Combined on the Retention Test by Group 159

46 Knowledge Test Mean Scores of Males, by Testing Occasion and Group 160

47 Knowledge Test Mean Scores of Females, by Testing Occasion and Group 161

48 Knowledge Test Mean Scores of Males and Females, by Testing Occasion and Group 162

List of Figures

Figure		Page
1	Skinfold and Muscle Girth Sites for O-Scale System	33

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Chapter I

Introduction

Context of the Problem

Obesity is associated with a variety of health problems. Although they usually arise during adult life, the problems of the obese individual can begin at infancy and continue through childhood.

Obesity in school children may be the single most prevalent risk factor for the development of major chronic disease in adults (Williams, 1984). Most obese school-aged children, in the absence of significant modification in exercise and eating habits, become overweight adults (Abraham, Collins and Norsieck, 1971).

Health and education professionals do not dispute the desirability of preventing problems rather than treating them in the long term. However, few comprehensive programs exist in the school system to deal with the serious problem of obesity. Schools tend to mirror the orientation of contemporary medicine towards crisis management rather than prevention. As Williams (1984) indicated, a single case of hepatitis or meningitis will immediately mobilize health resources and concern in a school, while the everyday presence of 5% to 15% obesity in students is largely ignored.

The school setting provides tremendous potential for the development of

comprehensive obesity management and prevention programs. Schools provide the opportunity to generate support in the social environment for appropriate behavioral practices through the mobilization of peer and parental support. School programs can foster changes in normative standards relating to exercise and eating behaviors (Davis, Weener and Shute, 1977). Programs in the school environment can also produce significant savings in time and money compared with multiple single-student visits to physicians.

The impact of various approaches dealing with obesity has been limited. Coates and Thoresen (1978) reported that "most overweight people do not remain in a program; of those who remain, most will not lose weight; and of those who do lose weight, most will regain it" (p. 143).

Purpose of the Study

The purpose of the study was to investigate the impact of a comprehensive health promotion program on (a) adiposity and weight, (b) fitness habits and nutrition habits (c) fitness knowledge and nutrition knowledge. The following research questions were examined:

1. Will overweight students participating in the program demonstrate significantly greater decreases in fatness and weight scores than students in the non-treatment conditions?

2. Will overweight and non-overweight students participating in the program activities demonstrate significantly greater increases in fitness habits and nutrition habits, and in fitness knowledge and nutrition knowledge than students in the non-treatment conditions?

Characteristics of the Study

The program activities focussed on educating children about relevant weight management issues, providing the motivation and opportunity for small, yet significant, behavior changes, and stressing the influence of various social support systems. The program had three major components: (a) an in-class instructional module which addressed weight management issues for all grade 6 students, (b) a night school module designed specifically for overweight students, and (c) a night school module designed specifically for parents of overweight students.

The study investigated the impact of program activities on fatness (adiposity) scores and weight. The study also investigated the impact of the program activities on fitness and nutrition knowledge and fitness and nutrition habits. The study involved a sample of nine schools in the treatment conditions and seven schools in the non-treatment conditions, and involved three separate measurement occasions: (a) pre-test, prior to the initiation of the project activities; (b) post-test, following the intensive eight-week sessions; and (c) retention test, at nineteen weeks for examination of maintenance of change.

The impact of the program activities on the three groups of dependent variables was determined for overweight and non-overweight students and for males separately, females separately, and males and females combined.

Limitations of the Study

The limitations of this study were:

1) The study did not involve random assignment of schools into treatment and control conditions.
2) The duration of the program activities for the study was short - eight consecutive weekly sessions (in-class sessions and night school sessions) followed by three monthly maintenance sessions. The duration of the program, excluding the initial height and weight measurements prior to the initiation of the program activities, was nineteen weeks.
3) The procedure for identifying overweight students, prior to commencement of the program activities, did not provide a valid discrimination of students for fatness.

Chapter II

Review of the Literature

Obesity in adults is a serious health problem which carries with it increased risk of illness and death from heart disease, high blood pressure, stroke, kidney disease, gallstones, cirrhosis of the liver and diabetes (Bray, 1976). Obesity in children is a problem for several reasons.

Health Implications of Obesity in Children

Physiological Problems Associated With Childhood Obesity

The obese child is at risk for hypertension, decreased growth hormone release and hypercholesterolemia (Kannel and Dawber, 1972). An increased risk of developing heart disease is evident in many obese children as young as age five (Freedman, 1985). Overweight in children is correlated with higher than normal blood pressure (Court, Hill, Dunlop and Boulton, 1974), higher than normal triglyceride levels (Frerichs, Webber, Srinivasan and Berenson, 1978) and higher than normal very low density lipoprotein cholesterol elevations (Berenson, 1980).

Psycho-Social Problems Associated With Childhood Obesity

Obesity may have negative social and psychological consequences (Mayer, 1968). Overweight adolescents are more likely than normal weight adolescents to have problems related to poor self-image, low

self-esteem, social isolation, depression and feelings of rejection. Although a significant percentage of overweight children are not unhappy and participate unimpeded in normal childhood activities, many others suffer the censure of their peers, their parents and themselves. Often the psychological problems lie not only with the child but also within the family. Marital dissatisfaction, poor parent-child relationships and social isolation are common in the families of obese children (Hammar, Campbell, Campbell, Moores, Sareen, Gareis and Lucas, 1972).

Adult Problems Associated with Childhood Obesity

Most children do not "grow out" of their obesity; eighty percent of children who are obese in the eighth grade become obese adults (Abraham et al. 1971). The relative risk of an overweight 10 to 13 year old becoming an overweight adult is 18:1 for females and 5:1 for males. Eighty per cent of obese women and 15% of obese men were heavy as adolescents (Abraham et al. 1971). For obese 12-year-olds the odds against having normal weight as adults are 4:1 (Stunkard and Burt, 1967). Although the relationship is more apparent in women than in men, early obesity clearly puts a child at risk for being an overweight adult.

Obesity - A Contemporary Health Problem

Obesity is a serious problem in western society. It is estimated that approximately 10-35% of the adolescent population is obese (Zakus, Chin, Cooper, Makovsky and Merrill, 1981). Results of the 1980 B.C. Assessment of Physical Education indicate that the majority of students

of both sexes and for all grades studied (grades 3, 7 and 11) had body fat in excess of that judged to be acceptable. The mean percent body fat for grade 3 males and females was estimated to be 15.0% and 22.5% respectively, compared to the range of "acceptable performance" for body fat of 10.0%-13.0% for males and 16.0%-20.0% for females. The mean percent body fat for grade 7 students was 17.6% for males and 25.2% for females respectively, compared to the range of "acceptable performance" of 11%-14% for males and 18%-22% for females. For grade 11 students, the mean percent body fat was 17.0% for males and 26.6% for females, compared to range of "acceptable performance" of 12.0%-15.0% and 20.0%-24.0% for males and females respectively (B.C. Ministry of Education, 1980).

The School As A Setting For Weight Management

Professionals both within and outside the health and education systems see school programs as a vehicle for addressing the weight management issue and for improving health knowledge, attitudes, decision-making skills, health practices and health status of children. The school system provides a setting in which obesity in children may be addressed. The school offers many advantages: large numbers of children can be reached for long periods of time, guidance can be continuous and concentrated, costs to the family can be minimized, and the problem may be approached in an educational rather than a clinical setting (Seltzer and Mayer, 1970). As well, the children can be reached, in many cases, before the problem becomes severe.

In addition, the school is a logical setting in which to involve parents. Dietz (1983), and Epstein, Wing, Koeske, Andrasik and Ossip (1981) identified the family variable as an important correlate of childhood obesity. Parents may exacerbate problems related to obesity in their children in several ways. Some encourage overweight children to eat more than they should by using fattening foods as bribes and rewards for desired behavior and by leaving such foods around the house as a constant source of temptation. Other parents undermine their children's already shaky self-image and self-control by nagging them about bad eating habits and by registering disgust over the youngsters' size. Many such children express their unhappiness by eating even more food, or by using food as a means of controlling their parents. They defy their parents to stop them from eating, thereby perpetuating the vicious cycle (Dietz, 1983).

It is logical to involve parents in their children's weight management programs as familial relationships for obesity have been observed (Garn and Clark, 1976). They showed that the skinfold thickness of children having two heavy parents is three times the skinfold thickness of children having two lean parents. The risk of an overweight infant becoming obese increases from 1:5 if no parents are obese to 1:2 if at least one parent is obese (Charney, Goodman, McBride, Lyon and Pratt, 1976). Mayer (1965) reported that 80 percent of the offspring of two obese parents become obese, as compared with no more than 14 percent of the offspring of two parents of normal weight. Obese children come from families with obese parents (Hartz, Giefer and Rimm, 1977).

In a study examining the contribution of genetic factors to human fatness in a sample of adult Danish adoptees, Stunkard et al. (1986) found a strong relation between the weight class of the adoptees and the body mass index of their biologic parents. It was concluded that genetic influences had an important role in determining human fatness in adults, whereas the family environment alone had no apparent effect. However, in a study examining the factor of parental influence, Brownell, Kelman and Stunkard (1983) found that a program of behavior modification and parent involvement can lead to significant weight loss in children and that the nature of parent involvement may be important.

Van Itallie (1986) reported that although genetic factors may explain much of the individual variations in weight and fatness within a society whose members are exposed to a similar diet and pattern of physical activity, environmental influences account for differences that occur between societies whose diets, activity levels and attitudes concerning physical appearance differ.

Finally, the school also provides an educational context in which specific skills can be emphasized. Children who are only mildly obese can learn healthy eating and exercise habits before the obesity problem comes to the attention of medical professionals.

The Point of Intervention for School-Based Weight Management Programs

The period in which an intervention can take place within the school setting is an important consideration. Adolescence is a key period in a child's development when the problem of obesity may be addressed (Davis et al., 1977).

Adolescence is a period of great physical growth and emotional change. Most adolescents spend a great deal of time thinking about how they look, and how they "measure up" to others in their group. Height, weight, strength, agility and overall physical appearance are of great concern to youth (Saskatchewan Health, 1979). One of the important goals of adolescence is the achievement of self-identity and the path to this goal leads to the need for establishing increasing independence from parents, gaining acceptance by friends, and acquiring a self-satisfying personal image (Williams, 1984). One tangible means of establishing independence is for the adolescent to defy parental dictates regarding eating habits.

Another aspect of achieving independence is the pursuit of the numerous activities in which peers are involved. These activities place scheduling and time demands on the children and may make it difficult for them to mesh their meal schedules with the rest of the family (Williams, 1984). The increasing independence and mobility of adolescents may lead to significant modification in dietary patterns. The influences of parents and familiar family food patterns, although still significant, no longer completely dominate (Weiss, 1977).

During adolescence there is typically a strong need to be accepted by the peer group. Even when the interests of the group center upon activities far removed from eating, there is some snacking included as part of the socializing. When the group adopts certain foods or eating practices, individuals are strongly compelled to eat with the group regardless of their own personal preferences or appetite. Regular visits to the neighbourhood convenience store for "junk food" binges can be the norm for many adolescents.

Watching T.V. also appears to be a norm for many adolescents and this is linked to a likelihood of developing a serious weight problem. Dietz and Gortmaker (1985) examined the relationship between obesity and television watching and found that adolescents who watched the most daily T.V. were significantly more obese than peers who spent less time as viewers. They concluded that T.V. watching lowered the amount of calories used up and increased the number of calories ingested. Dietz and Gortmaker recommended that to help children who are overweight and to prevent obesity, children should be directed away from television and towards physical activities.

Exercise is a key issue during adolescence as it can provide a psychological boost. By enhancing self-image, physical activity helps adolescents persevere with quests to attain and maintain optimal body weight. Exercise provides positive feedback on personal accomplishments as well as giving people something to focus on besides food.

In addition the physiological benefits of exercise are clearly beneficial for weight management. Speaker (1983) found that increasing physical activity encourages a variety of beneficial effects, including improved feelings of control, improved musculature and prevention of overestimation of body size.

Nutrition and physical activity are closely linked to the self-image as an adolescent develops (Stunkard and Burt, 1967). A well-nourished and active adolescent will "ideally" have a well-developed and toned body, attributes that are important to self-image and are definitely enhanced by sensible eating habits and regular exercise patterns.

Developing activities prior to the child's major developmental years is a prudent approach. Fitness, nutrition and weight management programs during a later period are more likely to retard growth, development and sexual maturity and start the youngster on a "lifelong seesaw" of weight gain and loss, which can be more detrimental to physical and mental health than remaining overweight (Brody, 1985).

Bouchard, Savard, Despres, Tremblay and LeBlanc (1985) provided additional support for this point of intervention by reporting that identical twins remain remarkably close with respect to body fat until early puberty when environmental factors exert a stronger pull. Bray (1976) reported that one may not be a master of his or her own weight at age ten, but later in life one is certainly much more so.

The Behavioral Approach to Weight Management

The first generation of behavioral studies concerning the treatment and management of weight in children involved the application of principles derived from studies with adults. Weight losses ranged widely with great variability among subjects and little evidence of long term results (Aragona, Cassady & Drabman, 1975). The second generation of studies used multifaceted programs that included family involvement, exercise, nutrition and the traditional behavioral techniques (Brownell, Kelman and Stunkard, 1978). These programs were based on the premise that the key to the maintenance of an ideal body weight was regular physical activity patterns and sensible eating habits and that these were best established early in life.

Behavior modification offered new hope but whereas this approach has been used extensively with adults comparatively few studies have been done with children (Brownell et al. 1983). Unfortunately, many treatments for children suffer from limited losses, poor maintenance, negative emotional effects and large attrition rates (Brownell et al. 1978).

Weiss (1977) compared various approaches for the treatment of adolescent obesity. He found that the two treatment groups that included diet and/or behavior modification were more successful than the control group. The weight loss results of the two experimental conditions did not differ following the initial twelve week period. However, the twelve month follow-up revealed that only subjects from the group that included both diet and behaviour modification components were able to maintain weight losses and to further decrease weight.

Ikeda, Fujii, Fong and Hanson (1982) assessed the impact of two different, 14 week approaches on adolescent weight reduction. One approach involved a behavior modification program while the second involved an energy restriction program with minimal discussion of behavior modification techniques. Results indicated that there were no significant differences in the results of the two approaches pertaining to weight, but the participants in the behavioral approach had greater gains in cognitive weight control knowledge. A major limitation to this study was the fact that fifty percent of the initial participants dropped out of the program before its completion.

DeWolfe and Jack (1984) compared the effectiveness of three different types of weight control programs in assisting adolescent girls to achieve and maintain ideal body weight. Following the initial 8 week program, students in the three types of follow-up groups demonstrated similar percentage weight change, percentage change in excess weight and number of weight losers and gainers. However, twelve months later

students in the groups that received monthly follow-up sessions were more successful weight reducers than students who received no followup. The limitations of this study included the small sample size (only 15 students completed the study), and the lack of parental involvement (only one parent participated).

Brownell and Kaye (1982) reported that children who participated in a school-based program of behavior modification, nutrition education and physical activity had significantly better results when compared to children who did not receive the program. The children participating in this program showed significant decreases in percentage overweight and number of kilograms of body weight lost. However, there were serious limitations to this study. Firstly, students who were identified as controls were simply students who chose not to participate in the program. Secondly the study only examined the variable of weight and did not include measures for fatness. Thirdly, no attempt was made to examine the impact of the program on predisposing factors leading to weight and fatness loss such as knowledge and habits.

Botvin, Cantlon, Carter and Williams (1979) tested the impact of a school-based, multi-component behavioral weight reduction program. Comparison of the experimental and control groups revealed that a significantly greater proportion of students who participated in the program lost weight when compared with the control students. A significant decrease in the number of overweight students in the

experimental group was reported with no change reported among the control students. Limitations of the study included the fact that involvement in the program by students in the experimental group was the result of self-selection. The control students were students who decided not to participate. Attempts were made to measure behavior change but data were incomplete and were not reported. The study had no followup sessions and therefore had no indication of how reported weight losses were sustained past the initial ten week program.

Brownell et al. (1983) evaluated the impact of a comprehensive program of weight management on weight and blood pressure changes while comparing three methods of involving mothers in the program activities. The major finding indicated that the most significant weight losses in obese children resulted when both mother and child attended the weight management program but met concurrently in separate groups. This approach was significantly more successful than the mother-child together and child-alone groups.

Summary

The review of the literature reveals that (a) obesity is a serious and prevalent condition in children, (b) the school setting is a logical target setting for adolescent weight management programs, (c) early adolescence is a logical stage of the lifecycle in which weight management programs can be implemented, and (d) there are few demonstrations of comprehensive and effective weight management programs for adolescents. Reported limitations in existing studies include: (a) the lack of follow-up measures to assess sustained impact of program activities, (b) the lack of rigorous experimental design with respect to randomization of schools or students into treatment and control conditions, and (c) high rates of non-compliance to program regimens.

Other observable limitations to the reported studies are: (a) the lack of reported program approaches that address both the prevention and management of obesity; (b) the lack of measures that pertain to knowledge and behavioral practices of children as they relate to weight management; (c) an unsatisfactory focus on weight, weight-for-height and percentage overweight as measurements of weight management program success without consideration of skinfold thicknesses, (d) the lack of ability to discern the impact of programs on children according to sex; (e) limited sample sizes; and (f) the fact that the ages of target population are widely diverse in some studies, ranging from five to thirteen years.

Chapter III

Rationale for Study, Definition of Terms and Statement of Hypotheses

Rationale

The treatment of obesity in children has received limited attention from the research and evaluation community. It was evident from the review of literature that previous research studies had serious limitations. These limitations are far-ranging and are identified in the previous chapter. It is also evident from the review of literature that efforts to examine approaches for the prevention of obesity are extremely rare.

The present study involved evaluation research. The objective of the study was to evaluate the impact of a school health promotion program on three categories of dependent variables: (a) adiposity and weight, (b) fitness habits and nutrition habits, and (c) fitness knowledge and nutrition knowledge. While benefitting from the results of previous research, the present study added to the existing body of knowledge by investigating several key issues: (a) the impact of the program on fatness measures as well as weight; (b) the impact of the program on fitness habits and nutrition habits, and on fitness knowledge and nutrition knowledge; (c) the impact of the program on non-overweight students and on overweight students (prevention <u>and</u> treatment); and (d) the influence of gender on program impact. The present study evaluated the effectiveness of a practical school health promotion program.

The results of the study will have practical application for health and education professionals who attempt to prevent and treat a serious and prevalent condition in contemporary society - obesity in adolescents.

Definition of Terms

For the purposes of the study, the following operational definitions applied:

1. Obesity -- medical condition characterized by excessive accumulations of fat in the body. Obesity is present when body weight exceeds by 20 per cent the standard weight listed in the height-weight tables (Stunkard, 1978).
2. Overweight -- structural condition, identified when the 75th percentile of weight-for-height for appropriate age and sex is exceeded, according to National Centre for Health Statistics norms (Hamill, Drizd, Johnson, Reed, Roch and Moore, 1979).
3. Non-overweight -- structural condition, identified when the percentile of weight-for-height for appropriate age and sex is 75 or less.
4. Proportional weight (PWT) -- body weight, in kilograms, adjusted to standardized size while maintaining original body composition (Ross, Eiben, Ward, Martin, Drinkwater and Clarys, 1986).

5. Proportional sum of six skinfolds (PS6SF) -- sum of triceps, supraspinale, subscapular, medial calf, abdominal and front thigh skinfolds adjusted to standardized size; measured in millimetres of skinfold thickness.
6. Body mass index (BMI) - body weight, in kilograms, divided by height in metres squared; correlated with body fat.
7. Habit Inventory -- measurement instrument that assesses fitness habits and nutrition habits (Mellin, Slinkard and Irwin, 1982).
8. Knowledge Test -- measurement instrument that assesses fitness knowledge and nutrition knowledge (Silluzio, 1980).

Identification of Treatment and Non-Treatment Conditions

The research design allowed for an investigation of impact on the dependent variables for five distinct groups: three groups of students in the treatment condition and two groups of students in the non-treatment condition. The groups were:

1. Treatment Group 1: Overweight students participating in the in-class sessions and evening sessions.

2. Treatment Group 2: Overweight students participating in the in-class sessions only.

3. Treatment Group 3: Non-overweight students participating in the in-class sessions.

4. Non-Treatment Group 4: Overweight students, non-treatment schools.

5. Non-Treatment Group 5: Non-overweight students, non-treatment schools.

Hypotheses

In general terms, overweight students participating in the treatment conditions were expected to show significant decreases in adiposity when compared to overweight students in the non-treatment conditions. Students in the treatment conditions were expected to show significant improvements in fitness habits and nutrition habits and in fitness knowledge and nutrition knowledge when compared to students in the non-treatment conditions. Differential changes were expected between specific conditions (Groups 1, 2, 3, 4, 5) for each of the three variables.

Statement of Hypotheses

The following null hypotheses were tested:

H_1: No statistically significant differences in adiposity and weight scores (sum of six skinfolds, proportional sum of six skinfolds, weight, proportional weight, body mass index) will appear between groups 1 and 2, groups 1 and 4, and groups 2 and 4, on the post-test and on the retention test after controlling for any initial differences in scores on the pre-test.

H_2: No statistically significant differences in Habit Inventory scores will appear between groups 1 and 2, groups 1 and 4, groups 2 and 4 and groups 3 and 5, on the post-test and on the retention test after controlling for any initial differences in scores on the pre-test.

H_3: No statistically significant differences in Knowledge Test scores will appear between groups 1 and 2, groups 1 and 4, groups 1 and 3, groups 1 and 5, groups 2 and 3, groups 2 and 4, groups 2 and 5, groups 3 and 4, and groups 3 and 5 on the post-test and on the retention test after controlling for any initial differences in scores on the pre-test.

Chapter IV

Research Methods

The following chapter describes in detail how the present study was conducted. It includes a discussion of the planning and development activities, sampling procedures, implementation schedule for study activities, philosophy of program activities, instrumentation for the three categories of dependent variables, evaluation of the method for identifying overweight children, data collection procedures, and data analysis procedures.

Planning and Development of Program Activities

For the purposes of planning, developing and implementing the study a number of methodological steps were necessary. The study was supported by the Simon Fraser Health Unit, the Burnaby Health Department, the Coquitlam School District and the Burnaby School District. After discussions with health unit and school board officials the following steps were taken to organize the study:

1. Application made to, and funds received from B.C. Health Care Research Foundation.

2. Study coordinators hired.

3. Sixteen school principals volunteered to participate.

4. Grade 6 students measured for height and weight.

5. Schools assigned into treatment and non-treatment conditions.

6. Granting of certificate of ethical review

7. Communication of study activities to parents by principals and study coordinators.

8. Preparation, assessment and refinement of program content.

9. Preparation and distribution of physician consent forms.

10. Formal initiation of study activities and measurement procedures.

Sampling Procedures and Considerations

Eight elementary schools from the Coquitlam School District and eight elementary schools from the Burnaby School District volunteered, in early fall of 1984, to participate in the study. Principals of the schools interested in participating in the study indicated their commitment to the appropriate District Physical Education Co-ordinator

and to the study's principal investigator. The principal investigator and the study co-ordinators immediately established contact with the principals.

During early discussions with the principals and classroom teachers, it became evident that the level of commitment to the study varied greatly. While there was a demonstrated level of commitment and enthusiasm from key officials within several schools, it was evident that several other schools were not at an adequate state of readiness to participate in the special project. For instance, in several schools the grade 6 classroom teachers were not interested in the project, or were not willing to be flexible in their lesson planning to accommodate the classroom requirements of the study.

Following lengthy discussions between the principal investigator, the study coordinators and the school board officials, a decision was made not to randomly assign the sixteen schools to treatment and control conditions. Rather, five schools in the Coquitlam School District and four schools in the Burnaby School District were assigned to the treatment condition based on an assessment of study commitment and participation readiness. The remaining three schools in the Coquitlam School District and four schools in the Burnaby School District were assigned to the non-treatment condition. It was the unanimous opinion of the study Advisory Group (principal investigator, co-ordinators of physical education for Coquitlam and Burnaby School Districts) and the

study coordinators that the program activities would not be appropriately implemented in these schools because of the lack of administrator and/or teacher support.

It is acknowledged that this non-random experimental design may have limited the external validity of the research. However, it was the opinion of the Study Advisory Group that a special project of this nature should not be instituted in the school setting unless there was top level and wide-based support at the outset and throughout the duration of the study.

Implementation of Program Activities

The study was comprised of three major program components: (a) an instructional module for all students, integrated into the existing science 6 curriculum, (b) a night school module specifically designed for overweight students and (c) a night school module for the parents of the overweight students. The schedule for program activities in the treatment schools was as follows:

1. Instructional component on fitness and nutrition in grade 6 science class; once per week in each of nine treatment schools for eight weeks.

   February 4, 1985 to March 29, 1985.

2. Instructional components on fitness, nutrition, and weight

management in the evening for (a) overweight students and (b) parents; once per week in one of two sessions for eight weeks.

February 5, 1985 to March 28, 1985.

3. First follow-up sessions in the evening for (a) overweight students and (b) parents; one session for each of the two groups, choice of evening.

April 24, 25, 1985.

4. Second follow-up sessions in evening for (a) overweight students and (b) parents; one session for each of two groups.

May 15, 16, 1985.

5. Third follow-up sessions in evening for (a) overweight students and (b) parents; one session for each of two groups.

June 5, 6, 1985.

Philosophy of Program Activities

In-class Module. Many health education programs have been designed to disseminate information to children with the hope that well-informed students would make wise lifestyle choices. As failures have been common, the program activities of the present study addressed other factors that may have filled the gap between knowledge and application.

One of the factors examined in the in-class module was the commitment and attitudes of the students. The students evaluated whether or not they felt that improving their fitness and nutrition habits was a personal priority. Many of the activities were discussed in the context of the peer group and the family structure. It was emphasized that the child's social support network had a definitive effect on influencing habits and shaping attitudes.

Another feature of the program was the use of behavior modification techniques which provided guidance through the steps necessary for change. The assessment of current behaviors, the setting and re-setting of realistic and attainable goals, and the recording and evaluation of progress were all stressed. The guiding principle was that in order to be meaningful to the students the information and activities must be personalized and presented in a fun and activity oriented manner.

Night School Module for Overweight Students. Obesity and overweight can have deep and often long lasting psychological effects for the individual. Constant reminders of the current cultural ideal of thinness are common and these serve to ingrain negative self-concept for those who do not match the ideal.

The activities of the night school module for the overweight students were based on the belief that prior to changes in exercise and eating habits being made it is necessary for the overweight child to

strengthen his or her self-image. It is difficult to effect change when individuals feel that they have little or no control over their lives or have such little confidence that they feel that they will never succeed.

A primary objective of the night school module was the enhancement of self-esteem. Discovery exercises, visualization training and positive thinking techniques were used. It was also established that there would be no failures in the program. There were no weekly weigh-ins to pass or fail, no diets to "go off" and no recriminations for non-participation in any of the activities. As children were at varying degrees of readiness for change, the program used a variety of approaches. For some children the program sought to ensure them that they were worthwhile and important just the way they were. For others, relevant nutrition and fitness information was provided to help them effectively begin the change process.

Night School Module for Parents. The concurrent parent session furnished the children with a major source of encouragement and support and was considered an integral part of the program. Success in making changes is easier when it is addressed in the context of the family unit (Satter, 1984). The sessions gave parents practical and meaningful ways in which they could support and encourage their child. The sessions also provided them with a further insight and understanding related to the weight management issue.

A listing of lesson topics, the program overviews and the programs goals for the study curricula are included in Appendix A.

Measurement of Dependent Variable A - Fatness and Weight

Identification of overweight students. The primary objective of the study was to assess the impact of a fitness and nutrition program for overweight students. The evening modules were specifically designed for overweight students and their parents. Therefore, the first task was to identify the students who were overweight. This was accomplished by measuring all students in the sixteen treatment and non-treatment schools for weight and height. Tables from the National Centre for Health Statistics were used (Hamill et al., 1979). Students above the 75th percentile of weight-for-height were identified as overweight; students at the 75th percentile or lower were classified as non-overweight.

Problems with predicting fat from body density formulae. Assessing the impact of weight management programs on percentage body fat has been common in the past. Basic scientific assumptions provided the rationale for attempting to predict percentage body fat from body density through hydrostatic weighing or skinfold thickness techniques. The assumptions were that the human body is composed of two compartments, fat and non-fat, and that the densities of each are known

and are the same for all individuals. With a two compartment system with each compartment of known density, it is possible to determine the weight of each portion if one knows the overall density.

However, in a recent series of cadaver dissections, Ross et al. (1986) demonstrated that muscle and bone were not present in fixed proportions in the dissectable adipose tissue free mass and the density of bone varied considerably. All formulae that predict fat based on a constant density for the non-fat tissue are scientifically invalid (Ross et al., 1986). Considering this significant finding, it was decided in the present study not to assess percentage body fat but to examine other means of assessing fatness and weight changes.

The O-Scale System. The resolution of anthropometric data on the thirty-two human cadaver dissections forced a reappraisal of body composition assessment methods (Ross et al., 1986). Motivated by this research, the Kinesiology Department of Simon Fraser University designed the O-Scale System. The O-Scale System requires the accurate measurement of weight, height, six skinfolds and three limb girths. Locations for the specific skinfold sites are depicted in figure 1. The anthropometric proforma for the O-Scale System is included in Appendix B.

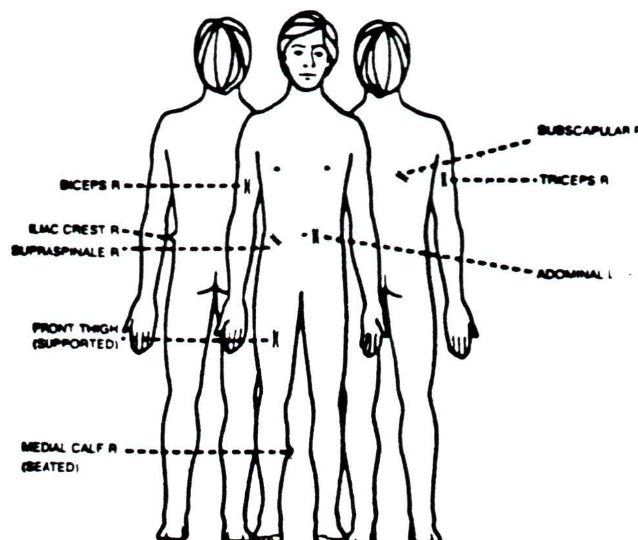

Figure 1. Skinfold and muscle girth sites for O-Scale System.

The O-Scale System has been checked for its validity, reliability and objectivity with a variety of populations including school aged children in the Coquitlam School District (Ross et al., 1986). The O-Scale System is comprised of two scales. Fatness or adiposity is achieved by summing the six skinfolds (sum of six skinfolds) and then by making a size adjustment (proportional sum of six skinfolds). Proportional weight is achieved by taking body weight and making a size adjustment. The O-Scale System permits the monitoring and evaluation of changes in the body mass index.

The O-Scale measurement procedures for the present study were standardized. Measures were taken by individuals who met the standards of practice set by the developers of the O-Scale System (Ross et al., 1986).

Measurement of Dependent Variables B and C - Habits and Knowledge.

As well as examining the impact of program activities on adiposity and weight the study also investigated two other dependent variables: (1) fitness habits and nutrition habits, and (2) fitness knowledge and nutrition knowledge pertaining to weight management. These two variables may be considered "links" in the process of affecting change in adiposity and weight in the targetted population. Before reductions in adiposity and weight (structural conditions) can be expected, positive changes in the appropriate behavioral practices (exercise and eating habits) are expected. Prior to increases in these behavioral patterns positive changes in knowledge related to the behaviors are expected (Ajzen and Fishbein, 1980).

Several criteria were considered when the selection of the measurement instruments for these two dependent variables was made: (1) The instruments should be capable of practical administration within the school setting; (2) The issues of fitness and nutrition should be addressed in each instrument, (3) The instruments should be appropriate for the grade 6 student population, (4) The instruments should be valid

and reliable, and (5) The instruments should assess content that is closely matched to the educational curriculum in the study.

A review of available instruments revealed that very few existed. Fanslow, Pease, Njus and Brun (1982) developed a food intake assessment device for third grade to sixth grade students, and Ikeda et al. (1982) devised a weight control and food energy test for high school students. Neither of these instruments were deemed appropriate for the present study.

Fitness and nutrition habits were measured by the Habit Inventory developed by Mellin et al. (1982). The inventory, designed for the middle school group (ages 11 to 14), consists of questions in each of several different categories: frequency of eating, quantity of food eaten, quality and quantity of exercise, assessment of physical and social activity, hunger cues, eating environment, assertiveness, and time with friends. The Habit Inventory is presented in Appendix C.

Fitness and nutrition knowledge related to weight management were measured by the Knowledge Test, an assessment instrument developed by Silluzio (1980). This instrument was designed for upper elementary school students and assesses knowledge of fitness and nutrition issues that pertain to weight management. A sample of the test is included in Appendix D.

Both the Habit Inventory and the Knowledge Test were pilot tested in two schools that were not involved in the study. These pilots ensured that a consistent administration of the test was identified, practiced and standardized prior to the testing in the treatment and non-treatment schools.

Evaluation of Procedure for Identifying Overweight and Non-Overweight Students

The identification of overweight students prior to the commencement of the formal program activities was an integral component of the study's planning and development. In order to gain an insight into the meaningfulness and accuracy of the procedure an evaluation was undertaken. The primary purpose of this secondary analytical procedure was to determine the nature and degree of overlap that may have existed between "overweight" and "non-overweight" students, pertaining to the sum of six skinfolds and the proportional sum of six skinfolds. In order to examine this overlap groups 1, 2 and 4 were combined into one overweight group while groups 3 and 5 were combined into a non-overweight group.

Minimum, median and maximum scores for: (a) sum of six skinfolds and (b) proportional sum of six skinfolds were determined for the overweight group and for the non-overweight group. Percentage overlaps between the scores of the overweight groups and scores of the non-overweight were then analyzed for the two variables and for each

sex separately. This analysis helped to determine if the procedure for identifying overweight students was also able to discriminate for the two adiposity variables.

Data Collection Procedures

Data were collected on the three categories of dependent variables in the classrooms of the treatment and non-treatment schools. The data were collected on three testing occasions: (a) prior to the initiation of the eight week instructional sessions (pre-test), (b) following the eight week sessions (post-test), and (c) following the completion of the third follow-up session (retention test).

The schedule for data collection was as follows:

1. Assessment of grade 6 students for weight and height. Identification of overweight students. November 1984.

2. Assignment of schools into treatment, non-treatment conditions. November 1984.

3. Training workshop for accuracy and reliability of O-Scale System procedures. December 1984.

4. Pilot testing of Habit Inventory and Knowledge Tests. January 14-18, 1985.

5. Administration of Habit Inventory and Knowledge Tests - pre-test. January 21-25, 1985.

6. Administration of O-Scale System procedures - pre-test. February 4-8, 1985.

7. Initiation of program activities - in-class and two night school components. February 4-8, 1985.

8. Re-administration of Habit Inventory and Knowledge Tests - post-test. March 25-29, 1985.

9. Re-administration of O-Scale System procedures - post-test. April 15-19, 1985.

10. Instruction of follow-up sessions for night school participants. April 24, 15, 1985; May 15, 16, 1985; June 5, 6, 1985.

11. Re-administration of Habit Inventory and Knowledge Tests - retention test. June 3-7, 1985.

12. Re-administration of O-Scale System procedures - retention test. June 10-14, 1985.

Data Analyses

The study investigated the impact of the program activities on three distinct categories of dependent variables with respect to membership in five groups (three treatment, two non-treatment) and over three measurement occasions. The impact of the program on: males only, females only and males and females combined was also examined. Each category of dependent variable was dealt with separately; no correlational relationships between dependent variables were examined.

<u>Considerations for Statistical Treatment of Data</u>. In identifying the appropriate methods for analyzing the data the following factors were considered:

1. The lack of randomization of schools into treatment and control conditions raised the issue of initial equivalents with respect to scores at pre-test. For instance, it could not be assumed that there were no significant differences in the mean scores between the overweight students in groups 1, 2 and 4 at the pre-test. It could not be assumed that there were no significant differences in the mean scores between the non-overweight students in groups 3 and 5 at the pre-test.

2. Groups 1, 2 and 4 were not expected to demonstrate adiposity and weight changes in the same manner as groups 3 and 5. Overweight students were expected to respond differently to a weight management program than were non-overweight students.

3. Differential reactions of males and females to the program activities were not predictable at the outset. The analytical procedures were designed to compare both sexes.

4. Due to time restrictions in the classroom the adiposity and weight data were collected on different days than were the data on knowledge and habits. Students having complete data on all three measurement occasions differed for the three dependent variables.

Selection of Statistical Procedures. Two statistical analyses were used for each of the three dependent variables. Firstly, in order to investigate "between groups comparisons" on the post-test and then on the retention test, analyses of covariance (ANCOVA) were conducted with pre-test scores as covariates. In order to determine the location of statistically significant differences, Scheffe's post hoc procedure was used. Secondly, in order to investigate "within groups comparisons" for each of the five groups over the three testing occasions, analyses of variance (ANOVA) were conducted. Scheffe's post hoc procedure evaluated differences between pairs of means. A detailed description of the sample and analytical procedures for each of the dependent variables follows.

Analysis of Dependent Variable A - Adiposity and weight scores (weight, proportional weight, sum of six skinfolds, proportional sum of six skinfolds, body mass index).

Sample (students with complete adiposity data over all three measurement occasions)

Group/Sex	Male	Female	Total
1	6	14	20
2	23	17	40
3	71	82	153
4	17	13	30
5	58	41	99
Total	175	167	342

Note: 408 students were present for the pre-test. 84% of the 408 students completed all three tests.

Procedure #1A

Compute analyses of covariance for post-test mean scores for adiposity and weight measures (weight - WT, proportional weight - PWT, sum of skinfolds - S6SF, proportional sum of skinfolds - PS6SF, body mass index - BMI) by Group - GRP (1 through 5) with pre-test mean scores as covariates for: (a) males separately, (b) females separately, (c) males and females combined.

Procedure #2A

Compute Scheffe comparison for analyses where significant was indicated by ANCOVA.

Procedure #3A

Compute analyses of covariance for retention test mean scores for WT, PWT, S6SF, PS6SF, BMI by GRP with pre-test mean scores as covariates for: (a) males separately, (b) females separately, (c) males and females combined.

Procedure #4A

Compute Scheffe to determine location of statistical significance, for analyses where significance indicated by ANCOVA.

Procedure #5A

Compute analyses of variance (repeated measures) for the mean scores at each test for each adiposity measure and for each of five groups. Separate analyses for (a) males separately, (b) females separately, and (c) males and females combined.

Procedure 6A

Compute Scheffe to determine location of statistical significance for analyses where significance indicated by ANOVA.

Analysis of Dependent Variable B - Habit Inventory Scores

Sample (Students with complete Habit Inventory data over all three measurement occasions)

Group/Sex	Male	Female	Total
1	6	13	19
2	19	15	34
3	88	97	185
4	16	15	31
5	78	77	155
Total	207	217	424

Note: 455 students were present for the pre-test. 93% of the 424 students completed all three tests.

Procedure #1B

Compute analyses of covariance for post-test mean scores of Habit Inventory by all groups with pre-test mean scores as covariates for: (a) males separately, (b) females separately, (c) males & females combined.

Procedure #2B

Compute Scheffe to determine location of statistical significance, for analyses where significance indicated by ANCOVA.

Procedure #3B

Compute analyses of covariance for retention test mean scores of Habit Inventory by all groups with pre-test mean scores as covariates for: (a) males separately, (b) females separately, (c) males & females combined.

Procedure #4B

Compute Scheffe to determine location of statistical significance, for analyses where significance indicated by ANCOVA.

Procedure #5B

Compute analyses of variance (repeated measures) for the mean scores on each test for the Habit Inventory and for each of the five groups. Separate analyses for (a) males, (b) females, (c) males & females.

Procedure #6B

Compute Scheffe to determine location of statistical significance for analyses where significance indicated by ANOVA.

Analysis of Dependent Variable C - Knowledge Test Scores

Sample (students with complete Knowledge Test data over all three measurement occasions)

Group/Sex	Male	Female	Total
1	6	13	19
2	20	14	34
3	87	96	183
4	11	13	24
5	67	64	131
Total	191	200	391

Note: 455 students were present for the pre-test. 86% of the 455 students completed all three tests.

Procedure #1C

Compute analyses of covariance for post-test mean scores for Knowledge Test by all groups with pre-test mean scores as covariates for (a) males separately, (b) females separately, (c) males & females combined.

Procedure #2C

Compute Scheffe to determine location of statistical significance, for analyses where significance indicated by ANCOVA.

Procedure #3C

Compute analyses of covariance for retention test mean scores for Knowledge Test by all GRP's with pre-test mean scores as covariates for: (a) males separately, (b) females separately, (c) males & females combined.

Procedure #4C

Compute Scheffe to determine location of statistical significance, for analyses where significance indicated by ANCOVA.

Procedure #5C

Compute analyses of variance (repeated measures) for the mean scores on each test for the Knowledge Test for each of the five groups. Separate analyses for (a) males separately, (b) females separately, (c) males & females combined.

Procedure #6C

Compute Scheffe to determine location of statistical significance where statistical significance indicated by ANOVA.

Evaluation of Procedure for Identifying Overweight and Non-Overweight Students

Procedure #1A

Compute minimum, median and maximum scores for (a) sum of six skinfolds and (b) proportional sum of six skinfolds for overweight students (groups 1, 2 and 4) and non-overweight students (groups 3 and 5).

Procedure #2A

Compute percentage overlaps of sum of six skinfolds and proportional sum of six skinfolds for overweight and non-overweight students.

Chapter V

Results and Discussion

Dependent Variable A - Adiposity and Weight Scores

Results. Analyses of covariance (ANCOVA), with mean scores at the pre-test as covariates, followed by Scheffe's post hoc procedure revealed that statistically significant differences in mean scores occurred for all adiposity and weight variables between groups 3, 5 (the non-overweight children) and groups 1, 2 and 4 (the overweight children) on the post-test and on the retention test. These significant differences, present for males, females, and males and females combined, were expected to occur as the comparisons were between overweight students and non-overweight students. However, in support of the null hypothesis - H_1, no statistically significant differences were revealed, for all three sex combinations, between the mean adiposity scores of groups 1, 2 and 4.

Analyses of variance (ANOVA, repeated measures) revealed that no statistically significant increases in mean adiposity scores occurred within any of the five treatment and non-treatment conditions over the three testing occasions and for all sex combinations.

Notwithstanding the lack of statistically significant results there were several findings that suggested a positive impact of the program activities on the adiposity and weight variables. As shown in Table 1, Table 2 and Table 3, overweight students in the treatment groups (group 1 and group 2), on the post-test, tended to demonstrate lower scores in weight, proportional weight, sum of six skinfolds, proportional sum of six skinfolds and body mass index than overweight students in the non-treatment group (group 4). This trend suggested positive program impact existed for the between groups comparisons on the post-test. Similar trends existed at the retention test, the only exception being the lower scores reported by males in group 4 for sum of skinfolds and proportional sum of skinfolds (see Table 4, Table 5, Table 6). In support of the stated null hypothesis - H_1, no consistent differences occurred between group 1 and group 2.

The within groups comparisons for students in group 1 and group 2 between the pre-test and the post-test as shown in Table 7, Table 8, Table 9, Table 10, Table 11, and Table 12, indicated that a strong trend towards decreasingly smaller adiposity and weight scores existed. The trend towards decreasing values for the adiposity and weight scores of group 1 and group 2 was not maintained through to the retention test. Table 13, Table 14, Table 15, Table 19, Table 20 and Table 21 present the mean scores for the non-overweight students in the

treatment schools (group 3) and non-treatment schools (group 5). It is evident that for these two groups and for all sex combinations, the changes in the adiposity and weight variables by testing occasion were small.

The trend of decreasing adiposity and weight scores from the pre-test to the post-test did not exist to the same extent for students in group 4 although decreases in the sum of six skinfolds and proportional sum of six skinfolds were noted (see Table 16, Table 17 and Table 18).

Discussion. Adiposity and weight variables represent measures of body structure which result from physiological and metabolic processes. Considering the various influencing factors which may lead to a reduction in measured weight and fatness, it may not be surprising that no significant differences were found after eight weeks of once-a-week instructional modules followed by three maintenance sessions. Anticipated participant outcomes from a fitness, nutrition and weight mangement program are, in order: (1) improvement in attitudes towards personal responsibility for health, (2) increased knowledge of critical issues concerning fitness, nutrition and weight management, (3) increased practice of good health habits pertaining to physical activity and eating habits, and finally (4) reduction in adiposity and weight. Good health habits, even after positive attitudes and an adequate level of knowledge are established, can be difficult to initiate and maintain (Haggerty, 1977 and Holtzman, 1979).

In an eight week program many of the overweight children in the treatment conditions may not have gained sufficient information, motivation or necessary social support to alter poor habits that may have developed over many years. Effecting change in adiposity and weight is an extremely difficult and challenging task over the short-term and long term.

Several additional factors may have affected the study's ability to demonstrate statistically significant changes in adiposity and weight scores. The fact that there could have been inaccuracies in the measurement of adiposity scores is important. Pollock and Jackson (1984) indicated that in longitudinal studies involving body composition measures, the variability due to accidental and technical errors warrants attention. Considering that the percentage changes in adiposity and weight scores occurring over the duration of an eight week program may be low, any changes that occurred due to the impact of the program activities may have been masked by the measurement variability.

The number of students in each of the five treatment - non-treatment groups varied from 20 in group 1 to 153 in group 3. When the sexes were treated separately, the numbers become very small. For example, there were only 6 males in group 1 and 17 males in group 4. Under these circumstances the performance of a small number of students will have a major impact on the mean score of the particular group.

The program strategies and activites in the study were non-invasive; they focussed on promoting small, manageable and long term changes in exercise and eating habits, and the attainment of a positive self-image. There were no practical physical activity components in the program curriculum that resulted in the supervised expenditure of calories through exercise. This factor when coupled with the fact that the students were not instructed to (necessarily) limit their caloric intake may help to explain the absence of statistically significant reductions in adiposity and weight scores.

Contrary to the present study's findings Brownell and Kaye (1982) reported that 95.2% (60 of 63) of children in their treatment condition lost weight, compared to 21.4% (3 of 14) control children. However, these results were tempered by the fact that the control students were simply those students who chose not to participate in the program activities. The significant reductions in body weight achieved by the treatment condition students can only be attributed to the 10-week program activities with a high degree of uncertainty. Although they also examined the factor of percentage overweight, Brownell and Kaye did not investigate the impact of their program on any adiposity variables. A shortcoming of their study was the lack of understanding of program impact on adiposity, a factor that is inherent in the definition of obesity (Carruth and Iszler, 1981). DeWolfe and Jack (1984) were unable to attribute any reductions in body weight to their program activities which were eight weeks in length. Botvin

et al. (1979), reported that 51% of students who participated in the program lost weight compared with only 16% of the control students. A limitation to this study was that the experimental students were voluntary participants while the control students were simply those who chose not to participate. This self-selection factor was a threat to the study's internal validity. Further, 26% of the 50 volunteers dropped out of the program and were not included in the data analysis.

Dependent Variable B - Habit Inventory Scores

Results. Contrary to the stated null hypothesis - H_2, analyses of covariance (ANCOVA), with mean scores on the pre-test as covariates, followed by Scheffe's post hoc procedure, revealed that statistically significant differences in mean scores occurred between paired comparisons of groups 1, 2, 3, 4 and 5.

The pairs of significantly different Habit Inventory mean scores for the three sex combinations at the post-test and the retention test are shown in Table 22 and Table 23. It is interesting to note that in Table 22, the mean score of females in group 1 and group 2 were significantly greater than the mean scores of females in group 4, F, (4,212) = 22.47, $P < .05$.

For females and males combined, the mean scores of group 2 were significantly greater than the mean scores of group 4, F (4,419)=48.64, $p < .05$. Another noteworthy finding is that the overweight students in the treatment groups (group 1 and group 2) had significantly greater Habit Inventory mean scores than the non-overweight students (group 3 and group 5), F (4,212) = 22.47, $p < .05$; F (4,202) = 29.91, $p < .05$; F (4,419) = 48.64, $p < .05$. The significant differences between group 2 and group 4 for females separately and males and females combined, while present on the post-test, were not evident on the retention test (see Table 23). Further, the significant difference in mean scores between group 1 and group 4 for females on the post-test was not maintained on the retention test (see Table 23).

The within groups comparisons for students in group 1 by testing occasion revealed that the Habit Inventory mean scores on the post-test and on the retention test for males, females, and males and females combined were significantly greater than the mean scores on the pre-test, F (2, 17) = 10.99, $p < .05$; F (2,36) = 23.97, $p < .05$; F (2, 54) = 35.01, $p < .05$ respectively. The within groups comparisons for students in group 2, by testing occasion, revealed that the Habit Inventory mean scores on the post-test and on the retention test for males, females, and males and females combined were significantly different than the mean scores on the pre-test, F (2, 54) = 30.63, $p < .05$; F (2,42) = 35.22, $p < .05$; F (2,99) = 65.05, $p < .05$ respectively (see Table 25). Of primary significance is the fact that students in group 4 (overweight students in the non-treatment schools) did not

demonstrate any significant changes over the three testing occasions (see Table 27).

As shown in Table 26 students in group 3 (non-overweight students in the treatment schools) had significantly greater Habit Inventory mean scores on the retention test when compared to scores on the pre-test, F $(2,261) = 4.78$, $p < .05$; F $(2,288) = 4.21$, $p < .05$; F $(2,552) = 8.97$, $p < .05$. With males and females combined the mean score on the post-test was also significantly greater than the mean score on the pre-test, F $(2,552) = 8.97$, $p < .05$ (see Table 26). Females in group 5 (normal weight students in the non-treatment schools) had a significantly greater mean score on the retention test when compared to the pre-test, F $(2,228) = 4.21$, $p < .05$. No significant differences were noted for males separately and males and females combined nor between the post-test and the pre-test (see Table 28).

Although statistically significant differences did not occur between all the treatment groups and the non-treatment groups and did not occur within all the treatment groups for all sex combinations, it is evident that positive trends did occur. The mean scores on the three testing occasions and for all sex combinations are presented as summary information in Tables 39, 40, 41, 42, and 43 (see Appendix E).

Discussion. A noteworthy finding is that while group 2 was significantly different from group 4 with sexes combined, group 1 was not significantly different from group 4. This is surprising as group 1 students participated in both the in-class and night school activities. This anomaly may be explained by the strong performance of the males in group 4 (non-treatment condition) and the comparatively poor performance by the males in group 1. It may also be speculated that group 2 students, those overweight students who chose not to participate in the special night school sessions with their parents, may have been at a higher degree of psychological readiness for changes in eating and exercise habits. They may have only needed some further encouragement and support that was adequately provided in the context of the grade 6 science classroom. Although not demonstrating statistical significance, it is interesting to note that the mean score of group 1 was greater than the mean score of group 2 on the retention test, males and females combined.

An additional interesting finding is that both on the post-test and on the retention test the Habit Inventory mean scores were significantly higher for groups 1, 2 and 4 (the overweight groups) than for groups 3 and 5 (the non-overweight groups). This finding is consistent with work by Thompson, Jarvie, Lahey and Cureton (1982) that indicated overweight children generally overestimate the amount of physical activity in which they engage.

The investigation of within groups comparisons revealed several significant findings. Firstly, students in group 1 and group 2 demonstrated significant increases in Habit Inventory scores on the post-test and on the retention test when compared to scores on the pre-test (see Table 24 and Table 25). These significant increases were evident for all sex combinations. No significant differences were noted for students in group 4 - overweight students in the non-treatment condition (see Table 27). These findings indicated that: (a) the program activites had a significant impact on increasing habit inventory scores within the two overweight groups (1 and 2), (b) there were no significant increases in habit inventory scores within the overweight group, non-treatment condition, and (c) the significant increase in scores after the pre-test were maintained through the retention phase of the program, indicating that the overweight students in the treatment conditions were able to sustain their improved habits following the initial eight weekly sessions.

Secondly, students in group 3, non-overweight students in the treatment conditions, demonstrated significant increases in Habit Inventory scores after the pre-test(see Table 26). For males separately and females separately within group 3, scores for the retention test were significantly different from scores on the pre-test. Scores on the post-test, however, were not significantly different from scores on the pre-test. For males and females combined, scores at both the post-test and on the retention test were significantly different from those on the pre-test.

For the "sexes separate" finding, the Habit Inventory scores for group 3 students increased from the pre-test to the post-test but not enough for statistical significance. However, during the maintenance phase of the program, students may have increased their commitment to improve personal eating and exercise habits, resulting in significant increases when measured on the retention test. This finding is difficult to interpret, particularly considering that students in group 3 did not participate in any follow-up sessions (the three follow-up sessions were restricted to students in group 1). Females in group 5, (non-overweight students in the non-treatment schools), had significantly higher Habit Inventory mean scores on the retention test than on the pre-test (see Table 28). Scores on the post-test for females in group 5 were not significantly different from those on the retention test nor from those on the pre-test.

The findings pertaining to the non-overweight students clearly indicate the program activities were appropriate as a preventive approach to weight management for individuals who do not have a weight concern. It appeared that the non-overweight required a longer period of time to markedly improve their eating and exercise habits than the overweight students. Both groups benefitted.

Dependent Variable C - Knowledge Test Scores

Results. Contrary to the stated null hypothesis - H_3, analyses of covariance (ANCOVA), with mean scores on the pre-test as covariates,

followed by Scheffe's post hoc procedure revealed that limited statistically significant differences did occur between groups.

The pairs of significantly different Knowledge Test mean scores for the three sex combinations on the post-test are displayed in Table 29. For comparisons between overweight students, the significant difference occurred between the mean scores of group 1 and group 4 for males and females combined, F (4,386) = 10.84, $p < .05$. Non-overweight students in the treatment schools (group 3) demonstrated significantly greater mean scores than overweight students in the non-treatment schools (group 5) across all three sex combinations on the post test, F (4,186) = 3.96, $p < .05$; F (4,195) = 7.04, $p < .05$; F (4,386) = 10.84, $p < .05$. Table 30 indicates that on the retention test significant differences only existed between group 3 and group 5, and for females separately and males and females combined, F (4,195) = 3.98, $p < .05$; F (4,386) = 6.34; $p < .05$.

The within groups comparisons for group 1, as shown in Table 31 reveal that Knowledge Test mean scores on both the post-test and the retention test are significantly different than mean scores on the pre-test, F (2,36) = 6.60, $p < .05$; F (2,54) = 9.47, $p < .05$. Similar significant differences occurred for group 2, F (2,39) = 4.81, $p < .05$; F (2,99) = 7.32, $p < .05$ (See Table 32). These significant differences did not occur for the males separately in group 1 and group 2. Students in group 3 demonstrated significant increases between the retention test and the pre-test mean scores, and between the post-test and the pre-test

mean scores for all 3 sex combinations, (F (2,258) = 12.61, $p < .05$; F (2,285) = 31.10, $p < .05$; F (2,546) = 41.41, $p < .05$ (see Table 33). Table 34 reveals that a significant difference between the retention test mean score and the pre-test mean score occurred for group 4 students, but for males only. For students in group 5 the mean score on the retention test was significantly different from the mean score on the pre-test, males and females combined, F (2,390) = 3.96, $p < .05$ (see Table 35).

Where statistically significant differences did not occur between and within all groups, positive trends were evident. The mean scores on the three testing occasions and for all sex combinations are presented as summary information in Tables, 44, 45, 46, 47, and 48 (See Appendix E).

Discussion. Following the initial eight week program phase of the study, the group that demonstrated the most noteworthy improvement in fitness knowledge and nutrition knowledge was group 3 (non-overweight students in the treatment schools). For all three sex combinations, students in group 3 had significantly greater scores than students in group 5 (non-overweight students in the non-treatment schools) on the post-test (see Table 29). Similar improvements also occured on the retention test (see Table 30).

The lack of significant differences between groups 1, 2, and group 4 are interesting. It appears that the overweight students in the treatment condition (groups 1, 2) did not respond favorably to the

curriculum when compared to overweight students in the non-treatment condition. However, this lack of statistical significance may be the result of small sample sizes in groups 1, 2, and 4. As noted in the summary information in the Appendix, the students in both group 1 and group 2 demonstrate higher Knowledge Test mean scores than students in group 4. If one considers the summary information and the within groups comparisons presented in Table 31, Table 32 and Table 34, it appears that the overweight students in the treatment conditions demonstrated positive changes when compared to the overweight students in the non-treatment conditions.

It is evident that both overweight and non-overweight students showed improvements in fitness knowledge and nutrition knowledge as a result of the program activities. Statistically significant improvements occurred for non-overweight students for all but one sex combination (males, retention test) over the two testing occasions; statistically significant improvements occurred only for overweight students on the post-test, males and females combined. Positive trends towards improvements in fitness knowledge and nutrition knowledge occurred for students in all treatment conditions.

Evaluation of Method for Identifying Overweight and Non-Overweight Students

In order to determine the percentage overlap in adiposity scores between overweight and non-overweight groups, descriptive statistics and

frequency distributions were run to give minimum, median and maximum values for sum of six skinfolds and proportional sum of six skinfolds (see Table 36 and Table 37). The overweight group was created by combining group 1, group 2 and group 4; the non-overweight group was created by combining group 3 and group 5. It is evident that for the sum of six skinfolds and proportional sum of six skinfolds for both sexes, that: (a) There are large ranges in scores for both overweight and non-overweight students; and (b) Some overlap appeared to have occurred between the range of scores for the overweight and non-overweight groups.

Table 38 indicates that significant overlap did occur and that this overlap occurred for both sum of six skinfolds and proportional sum of skinfolds and for both sexes. The percentage of students who were classified as overweight but who had sum of six skinfold scores that overlapped with scores of students in the non-overweight group was 46.9 for females and 62.7 for males. That is, a high percentage of the "overweight" students had recorded adiposity scores (sum of six skinfolds) that were in the upper range of scores recorded by "non-overweight" students. Scores of students in group 3 and group 5 demonstrated a range of 30.6% to 40.1% in percentage overlap with scores of students in the combined overweight group, for the sum of six skinfolds and proportional sum of six skinfolds (see Table 38).

Carruth and Iszler (1981) illustrated the concept that for any grouping

of average body weights by age, sex and height, an excess body weight may indicate: (1) overfat but not overweight; (2) overweight but not overfat; or (3) overfat and overweight. That is, a muscular individual can be overweight, defined as exceeding the 75th percentile of weight for height, and have an acceptable level of body fat. In contrast a sedentary individual who is defined as non-overweight could have a level of body fat that far exceeds the acceptable range. Some individuals are both overweight and overfat while others are neither overweight nor overfat.

In the present study, it appears that the weight-for-height method for classifying students into overweight and non-overweight categories had serious limitations. This method does not effectively "parcel out" the factor of overfat and therefore results in the mis-classification of many students. However, it should be emphasized that a strategy for classifying students into overweight and non-overweight groups was required and that the weight-for-height method was the best one available.

Impact of Gender on Program Impact

There did not appear to be marked differences in performance between males and females. However some sex differences were noted. For instance, the Habit Inventory mean scores of females in group 1 and group 2 at the post-test were significantly different from those of females in group 4. There were no significant differences between males in these groups.

The Knowledge Test mean scores of females in group 3 on the retention test were significantly different from those of group 5 while the mean scores of males in these two groups were not significantly different. Lastly, for the within groups comparisons for the Knowledge Test, the mean scores of females in group 1 and in group 2 on the post-test and on the retention test were significantly greater than the mean scores on the pre-test. No such significant differences occurred for males.

It is difficult to interpret these isolated sex differences. They were not consistent and did not occur with any degree of predictability. The only conclusion that can be made with any sense of certainty is that any relationship between gender and the impact of the study's program activities is not clearly apparent.

Due to the number of tables to which references have been made, the tables have not been interspersed throughout the text. Rather, the tables for the adiposity and weight variables, the habit and the knowledge variables, have been grouped in numerical order and follow the body of the text. Tables with summary information are included in Appendix E.

Table 1

Adiposity and Weight Mean Scores of Males on the Post-test by Group

Variable	$\underline{n}$[a]	Group 1	2	3	4	5
Weight	174	51.8	51.6	38.9	53.9	39.5
Proportional Weight	174	69.9	73.8	57.3	75.8	58.3
Sum of Six Skinfolds	174	109.7	103.2	51.3	104.1	53.5
Proportional Sum of Six Skinfolds	174	121.3	116.2	58.6	117.1	60.9
Body Mass Index	174	21.8	22.6	17.3	23.3	17.6

Note. [a]Number of male students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 2

Adiposity and Weight Mean Scores of Females on the Post-test by Group

Variable	$\underline{n}$[a]	Group 1	2	3	4	5
Weight	168	51.8	50.9	38.9	56.1	39.7
Proportional Weight	168	73.7	73.1	56.6	76.0	56.1
Sum of Six Skinfolds	168	112.9	111.2	58.0	126.8	56.3
Proportional Sum of Six Skinfolds	168	127.8	125.4	65.8	140.7	63.3
Body Mass Index	168	22.6	22.3	17.2	23.6	17.2

Note. [a]Number of female students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 3

Mean Adiposity and Weight Scores of Males and Females Combined on the Post-test by Group

Variable	n^a	Group 1	2	3	4	5
Weight	342	51.8	51.3	38.9	54.9	39.6
Proportional Weight	342	72.5	73.5	57.0	75.9	57.4
Sum of Six Skinfolds	342	112.0	106.6	54.9	113.9	54.7
Proportional Sum of Six Skinfolds	342	125.8	120.1	62.5	127.3	61.9
Body Mass Index	342	22.3	22.5	17.3	23.4	17.5

Note. [a]Number of students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 4

Mean Adiposity and Weight Scores of Males on the Retention Test by Group

Variable	n[a]	Group 1	2	3	4	5
Weight	174	52.9	51.9	39.4	53.7	40.1
Proportional Weight	174	69.5	72.4	57.1	73.8	58.2
Sum of Six Skinfolds	174	118.7	112.2	53.3	106.8	54.9
Proportional Sum of Six Skinfolds	174	130.1	125.2	60.5	119.4	62.0
Body Mass Index	174	21.9	22.3	17.4	22.9	17.7

Note. [a]Number of male students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 5

Mean Adiposity and Weight Scores of Females on the Retention Test by Group

Variable	$\underline{n}^a$	Group 1	2	3	4	5
Weight	168	52.3	51.7	39.7	56.7	40.2
Proportional Weight	168	72.7	73.0	56.3	77.0	55.6
Sum of Six Skinfolds	168	120.7	120.1	60.9	138.3	58.3
Proportional Sum of Six Skinfolds	168	135.6	134.6	68.6	152.8	65.2
Body Mass Index	168	22.4	22.4	17.2	23.7	17.2

Note. [a]Number of female students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 6

Mean Adiposity and Weight Scores of Males and Females on the Retention Test by Group

Variable	n[a]	Group 1	2	3	4	5
Weight	342	52.5	51.8	39.5	55.0	40.1
Proportional Weight	342	71.7	72.6	56.6	74.8	57.1
Sum of Six Skinfolds	342	120.0	115.6	57.5	120.4	56.3
Proportional Sum of Six Skinfolds	342	134.0	129.2	64.9	133.9	63.4
Body Mass Index	342	22.3	22.4	17.3	23.2	17.5

Note. [a]Number of students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 7

Mean Adiposity and Weight Scores of Group 1 Males by Testing Occasion

Variable	n[a]	Testing Occasion 1	2	3
Weight	6	51.8	51.8	52.9
Proportional Weight	6	72.5	69.8	69.7
Sum of Six Skinfolds	6	117.2	110.0	119.0
Proportional Sum of Six Skinfolds	6	131.5	121.2	130.0
Body Mass Index	6	22.3	21.7	21.7

Note. [a]Number of male students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 8

Mean Adiposity and Weight Scores of Group 1 Females by Testing Occasion

		Testing Occasion		
Variable	n[a]	1	2	3
Weight	14	51.3	51.8	52.3
Proportional Weight	14	74.4	73.7	72.0
Sum of Six Skinfolds	14	122.0	113.2	120.9
Proportional Sum of Six Skinfolds	14	138.6	127.9	135.6
Body Mass Index	14	22.5	22.3	22.3

Note. [a]Number of female students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 9

Mean Adiposity and Weight Scores of Group 1 Males and Females Combined by Testing Occasion

Variable	$\underline{n}$[a]	Testing Occasion 1	2	3
Weight	20	51.5	51.8	52.5
Proportional Weight	20	73.8	72.6	71.7
Sum of Six Skinfolds	20	120.5	112.3	120.3
Proportional Sum of Six Skinfolds	20	136.4	124.9	133.9
Body Mass Index	20	22.5	22.3	22.3

Note. [a]Number of students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 10

Mean Adiposity and Weight Scores of Group 2 Males by Testing Occasion

		Testing Occasion		
Variable	n[a]	1	2	3
Weight	23	50.1	51.7	51.3
Proportional Weight	23	73.1	73.6	71.4
Sum of Six Skinfolds	23	110.7	104.1	110.2
Proportional Sum of Six Skinfolds	23	125.3	116.7	122.5
Body Mass Index	23	22.5	22.6	22.4

Note. [a]Number of male students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 11

Mean Adiposity and Weight Scores of Group 2 Females by Testing Occasion

		Testing Occasion		
Variable	n[a]	1	2	3
Weight	17	49.7	50.9	51.7
Proportional Weight	17	72.9	73.2	73.0
Sum of Six Skinfolds	17	114.3	111.5	120.3
Proportional Sum of Six Skinfolds	17	129.8	125.4	134.7
Body Mass Index	17	22.2	22.2	22.5

Note. [a]Number of female students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 12

Adiposity and Weight Mean Scores of Group 2 Males and Females Combined by Testing Occasion

Variable	n^a	Testing Occasion 1	2	3
Weight	40	50.0	51.3	51.5
Proportional Weight	40	73.0	73.4	72.1
Sum of Six Skinfolds	40	112.3	107.2	114.3
Proportional Sum of Six Skinfolds	40	127.2	120.3	127.5
Body Mass Index	40	22.2	22.4	22.2

Note. [a]Number of students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 13

Adiposity and Weight Mean Scores of Group 3 Males by Testing Occasion

		Testing Occasion		
Variable	$\underline{n}$[a]	1	2	3
Weight	70	37.6	38.5	39.2
Proportional Weight	70	56.9	57.0	56.8
Sum of Six Skinfolds	70	52.7	50.0	52.5
Proportional Sum of Six Skinfolds	70	60.2	57.0	59.3
Body Mass Index	70	17.0	17.2	17.3

Note. [a]Number of male students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 14

Adiposity and Weight Mean Scores of Group 3 Females by Testing Occasion

Variable	$\underline{n}$[a]	Testing Occasion 1	2	3
Weight	83	37.7	38.9	39.7
Proportional Weight	83	56.2	56.6	56.3
Sum of Six Skinfolds	83	57.7	58.2	61.2
Proportional Sum of Six Skinfolds	83	65.9	65.8	68.6
Body Mass Index	83	16.9	17.2	17.3

Note. [a]Number of female students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 15

Adiposity and Weight Mean Scores of Group 3 Males and Females Combined by Testing Occasion

		Testing Occasion		
Variable	n[a]	1	2	3
Weight	153	53.2	54.9	55.0
Proportional Weight	153	75.3	75.8	74.8
Sum of Six Skinfolds	153	55.4	59.5	57.3
Proportional Sum of Six Skinfolds	153	63.3	61.8	64.5
Body Mass Index	153	23.0	23.5	23.1

Note. [a]Number of students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 16

Adiposity and Weight Mean Scores of Group 4 Males by Testing Occasion

		Testing Occasion		
Variable	n[a]	1	2	3
Weight	17	51.3	53.8	53.7
Proportional Weight	17	73.5	75.2	73.9
Sum of Six Skinfolds	17	112.5	101.7	107.0
Proportional Sum of Six Skinfolds	17	127.4	114.2	119.3
Body Mass Index	17	22.5	23.2	22.8

Note. [a]Number of male students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 17

Adiposity and Weight Mean Scores of Group 4 Females by Testing Occasion

		Testing Occasion		
Variable	$\underline{n}^a$	1	2	3
Weight	13	55.7	56.6	56.7
Proportional Weight	13	77.6	76.7	76.0
Sum of Six Skinfolds	13	136.2	132.6	138.4
Proportional Sum of Six Skinfolds	13	152.5	147.0	152.8
Body Mass Index	13	23.8	23.8	23.6

Note. [a]Number of female students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 18

Adiposity and Weight Mean Scores of Group 4 Males and Females Combined by Testing Occasion

		Testing Occasion		
Variable	n[a]	1	2	3
Weight	30	53.2	54.9	55.0
Proportional Weight	30	75.3	75.8	74.8
Sum of Six Skinfolds	30	122.8	114.1	120.6
Proportional Sum of Six Skinfolds	30	138.3	127.3	133.8
Body Mass Index	30	23.0	23.5	23.1

Note. [a]Number of students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 19

Adiposity and Weight Mean Scores of Group 5 Males by Testing Occasion

Variable	$\underline{n}^a$	Testing Occasion 1	2	3
Weight	58	38.4	39.5	40.1
Proportional Weight	58	58.2	58.3	58.2
Sum of Six Skinfolds	58	54.8	53.8	55.1
Proportional Sum of Six Skinfolds	58	62.5	60.9	62.0
Body Mass Index	58	17.4	17.6	17.7

Note. [a]Number of male students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 20

Adiposity and Weight Mean Scores of Group 5 Females by Testing Occasion

		Testing Occasion		
Variable	n[a]	1	2	3
Weight	41	38.2	39.5	40.2
Proportional Weight	41	55.6	56.1	55.6
Sum of Six Skinfolds	41	56.1	56.6	58.5
Proportional Sum of Six Skinfolds	41	63.5	63.6	65.2
Body Mass Index	41	16.8	17.1	17.2

Note. [a]Number of female students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 21

Adiposity and Weight Mean Scores of Group 5 Males and Females Combined by Testing Occasion

Variable	n^a	Testing Occasion 1	2	3
Weight	99	38.3	39.5	40.1
Proportional Weight	99	57.2	57.4	57.1
Sum of Six Skinfolds	99	55.3	54.9	56.5
Proportional Sum of Six Skinfolds	99	62.9	62.0	63.3
Body Mass Index	99	17.2	17.4	17.5

Note. [a]Number of students who completed all adiposity and weight measures.

Weight and proportional weight measured in kilograms, sum of six skinfolds and proportional sum of six skinfolds measured in millimetres, body mass index measured in kilograms divided by metres squared.

Table 22

Pairs of Significantly Different Habit Inventory Mean Scores on the Post-test by Group and Sex - Between Groups Comparisons

	Sex		
Variable	Males	Females	Males & Females
Pairs of Means Significantly Different	1,3	2,4	2,4
	1,5	2,5	2,3
	2,3	2,3	2,5
	2,5	1,4	1,3
	4,3	1,5	1,5
	4,5	1,3	4,3
			4,5

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 23

Pairs of Significantly Different Habit Inventory Mean Scores on the Retention Test by Group and Sex - Between Groups Comparisons

Variable	Sex		
	Males	Females	Males & Females
Pairs of Means Significantly Different	1,3	2,5	1,5
	1,5	2,3	1,3
	2,3	1,5	2,5
	2,5	1,3	2,3
	4,3	4,3	4,5
	4,5		4,3

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 24

Pairs of Significantly Different Habit Inventory Mean Scores for Group 1 by Testing Occasion and Sex - Within Groups Comparisons

	Sex		
Variable	Males	Females	Males & Females
Pairs of Means Significantly Different	3,1 2,1	3,1 2,1	3,1 2,1

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 25

Pairs of Significantly Different Habit Inventory Mean Scores for Group 2 by Testing Occasion and Sex - Within Groups Comparisons

	Sex		
Variable	Males	Females	Males & Females
Pairs of Means Significantly Different	3,1 2,1	3,1 2,1	3,1 2,1

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 26

Pairs of Significantly Different Habit Inventory Mean Scores for Group 3 by Testing Occasion and Sex - Within Groups Comparisons

Variable	Sex		
	Males	Females	Males & Females
Pairs of Means Significantly Different	3,1	3,1	3,1 2,1

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 27

Pairs of Significantly Different Habit Inventory Mean Scores for Group 4 by Testing Occasion and Sex - Within Groups Comparisons

Variable	Sex		
	Males	Females	Males & Females
Pairs of Means Significantly Different	Nil	Nil	Nil

Table 28

Pairs of Significantly Different Habit Inventory Mean Scores for Group 5 by Testing Occasion and Sex - Within Groups Comparisons

	Sex		
Variable	Males	Females	Males & Females
Pairs of Means Significantly Different	Nil	3,1	Nil

Note. Pair significantly different at $p < .05$

Table 29

Pairs of Significantly Different Knowledge Test Mean Scores on the Post-test by Group and Sex - Between Groups Comparisons

	Sex		
Variable	Males	Females	Males & Females
Pairs of Means Significantly Different	3,5	3,5	1,4 1,5 3,5

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 30

Pairs of Significantly Different Knowledge Test Mean Scores on the Retention Test by Group and Sex - Between Groups Comparisons

	Sex		
Variable	Males	Females	Males & Females
Pairs of Means Significantly Different	Nil	3,5	3,5

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 31

Pairs of Significantly Different Knowledge Test Mean Scores for Group 1 by Testing Occasion and Sex - Within Groups Comparisons

	Sex		
Variable	Males	Females	Males & Females
Pairs of Means Significantly Different	Nil	3,1 2,1	2,1 3,1

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 32

Pairs of Significantly Different Knowledge Test Mean Scores for Group 2 by Testing Occasion and Sex - Within Groups Comparisons

Variable	Sex		
	Males	Females	Males & Females
Pairs of Means Significantly Different	Nil	2,1 3,1	2,1 3,1

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 33

Pairs of Significantly Different Knowledge Test Mean Scores for Group 3 by Testing Occasion and Sex - Within Groups Comparisons

Variable	Sex: Males	Females	Males & Females
Pairs of Means Significantly Different	3,1 2,1	2,1 3,1	2,1 3,1

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 34

Pairs of Significantly Different Knowledge Test Mean Scores for Group 4 by Testing Occasion and Sex - Within Groups Comparisons

Variable	Sex		
	Males	Females	Males & Females
Pairs of Means Significantly Different	3,1	Nil	Nil

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 35

Pairs of Significantly Different Knowledge Test Mean Scores for Group 5 by Testing Occasion and Sex - Within Groups Comparisons

Variable	Sex		
	Males	Females	Males & Females
Pairs of Means Significantly Different	Nil	Nil	3,1

Note. Member of pair appearing first had higher value. Pairs significantly different at $p < .05$

Table 36

Minimum, Median and Maximum Scores for Sum of Six Skinfolds by Group

Sex, Group	Sum of Six Skinfolds		
	Minimum	Median	Maximum
Males			
Overweight	51.0	108.5	178.1
Non-overweight	22.0	47.0	125.4
Females			
Overweight	58.6	120.5	232.3
Non-overweight	27.0	53.7	118.0

Note. Sum of six skinfolds measured in millimetres.

Table 37

Minimum, Median and Maximum Values for Proportional Sum of Six Skinfolds by Sex and Group

	Proportional Sum of Six Skinfolds		
Sex, Group	Minimum	Median	Maximum
Males			
Overweight	55.9	120.5	195.3
Non-overweight	29.5	54.3	142.0
Females			
Overweight	71.2	135.5	244.0
Non-overweight	32.6	60.3	145.5

Note. Proportional sum of six skinfolds measured in millimetres.

Table 38

Percentage of Students With Overlap of Sum of Six Skinfolds and Proportional Sum of Six Skinfolds by Group and Sex

	Group	
Variable, Sex	Non-Overweight	Overweight
Sum of Six Skinfolds		
Males	39.1	62.7
Females	40.1	46.9
Proportional Sum of Six Skinfolds		
Males	38.5	58.0
Females	30.6	57.1

Chapter VI

Summary, Conclusions and Recommendations

Summary

The review of literature revealed that few reports of comprehensive school health promotion programs for the treatment of obesity exist. However, it may be speculated that there are more programs in operation than have been reported, as many such programs conducted within the school/community context are of a quasi-experimental nature. This is especially true if they are conducted on a large scale utilizing teachers and health professionals for education and intervention support (Williams, 1984). A number of key factors are essential for the successful planning, implementation and evaluation of school-based interventions: commitment from school administrators and classroom teachers, positive teacher attitudes towards the sensitive issue of obesity, endorsement and involvement of parents, support from peers and practical timing of activities in relation to other school programs.

Many children, both overweight and non-overweight, often are inappropriately encouraged to control their weight through low caloric diets or extreme exercise regimens. These weight management strategies may fail more often than they succeed and prompt an increasing number of children to turn to drastic measures such as self-starvation (anorexia nervosa) and induced vomiting (bulimia) to lose weight. The sensible approach to childhood obesity involves alterations in eating and

exercise habits that permit a child to live a reasonably normal life while gradually achieving a normal weight that can be maintained for a lifetime.

The program activities of the present study incorporated the traditional theory of school health education - that the provision of health information leads to healthier lifestyles. However, the present study expanded the traditional knowledge based curricula to address social, psychological and environmental factors associated with the development of health related actions. Specifically the present study explored the role of students' attitudes, needs and perceptions as well as social and environmental forces that exerted an influence on sensible physical activity habits and sensible eating habits.

The major findings of the study were: (a) The program activities had no statistically significant impact on students' adiposity and weight scores; and (b) The program activities had a statistically significant impact on students' fitness habits and nutrition habits and on fitness knowledge and nutrition knowledge for selected sex combinations and on specific testing occasions. For the Habit Inventory variable, statistically significant differences between the groups of overweight students on the post-test were not sustained during the retention phase of the study. For the Knowledge Test variable, statistically significant differences for two of the three sex combinations on the post-test were sustained during the retention phase for the groups of non-overweight students; the statistically significant difference between the groups of overweight students was not sustained.

Although not demonstrating statistical significance there were other findings that may have practical significance to school officials. Overweight students, males and females combined, in the treatment conditions had lower adiposity and weight mean scores when compared with overweight students in the non-treatment schools on the post-test. Regarding the habit variable, students in the treatment conditions had greater mean scores than students in the non-treatment conditions for all sex combinations on the post-test and the retention test. For the knowledge variable, students in the treatment conditions had greater mean scores than students in the non-treatment conditions on the post-test and on the retention test.

Conclusions

The present study makes a contribution to the existing body of knowledge in the domain of school health promotion curricula design and evaluation. The subjects in the study were both overweight and non-overweight. Three curricula were conceptualized, developed and then delivered to over 400 students in nine schools. Three assessment instruments were administered over a period of five months. The support and commitment of school principals, classroom teachers, parents, public health nurses, nutritionists, anthropometrists and, most importantly, students were secured and retained throughout the duration of the study.

The impact of participation was measured in terms of weight, adiposity, behavioral patterns and levels of knowledge. In short, the present study provided a program evaluation of a comprehensive and innovative school-based approach to the prevention and treatment of obesity.

Recommendations

It is evident that a short-term program can have a short-term impact. Future studies should build on these results and strive to develop and evaluate approaches and activities that maintain positive changes in knowledge, habits, adiposity and weight. It is recommended:

1. That the program period for school health promotion programs be lengthened to a minimum of six months with a series of follow-up sessions.

2. That schools be randomly assigned into treatment and control conditions.

3. That a more appropriate method be established for classifying children with higher-than-acceptable levels of body fat.

4. That measurement instruments for fitness knowledge and nutrition knowledge and for fitness habits and nutrition habits be specifically designed for the particular study's curricula.

The results of the present study have implications for health and education professionals who have an interest in school weight management programs. It is recommended:

1. That school administrators and teachers critically examine the existing school activities and resources that are appropriate for students with weight management concerns.

2. That school administrators and teachers identify the needs for weight management activities and resources, and communicate these needs to community public health professionals.

3. That school and public health officials examine the feasibility of establishing positive, innovative and motivational programs on healthy weight management.

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Appendix A

Lesson Topics, Program Overviews and Program Goals for Study Curricula

TABLE OF CONTENTS

Page No.

Program Philosophy ....

Program Overview ....

Program Goals ....

Acknowledgments ....

A Guide to Using This Manual ....

Explanation of Ongoing Activities ....

Teaching Techniques ....

Parent Letter ....

Program Evaluation (Ongoing/Final) ....

Lesson 1 : Historical Perspectives On Nutrition and Fitness ....

Lesson 2 : Defining Physical Fitness ....

Lesson 3 : Appraising Fitness ....

Lesson 4 : Designing and Maintaining Fitness Goals ....

Lesson 5 : Defining Good Nutrition ....

Lesson 6 : Appraising Nutrition ....

Lesson 7 : Designing and Maintaining Nutrition Goals ....

Lesson 8 : Program Review ....

Appendices ....

Bibliography ....

Program Philosophy

In the past few years many programs have been designed in order to disseminate health information to children with the hope that well-informed students would make wise lifestyle choices. Unfortunately this has not always been the case; most of us need only look to ourselves for numerous examples of the breakdown of this theory. The Feeling Great Program attempts to examine and implement other factors that are felt to provide the missing link between knowledge and application.

While acquisition of knowledge is crucial and an integral part of this program, it is addressed in the light of other contributions leading to change. One of the first factors to be examined is the commitment and attitudes of the student. The children are asked to seriously evaluate whether or not they feel that improving their fitness and nutrition is a priority for them. Many of the activities are discussed and carried out in the context of both the peer group and the family structure as the child's social support network has a very definite effect on influencing behavior and shaping attitudes.

One of the most important features of the program is the use of behavior modification techniques to guide the children through the steps necessary to make change. The necessity of increasing awareness through assessing current behaviors, setting and re-setting realistic and appropriate goals, and recording and evaluating progress are all stressed. Overriding all these practical attempts at acquiring positive behavioral change is the strong belief that in order to be meaningful to the students the information and activities must be personalized, presented in a fun way and be activity-orientated.

Program Overview

The Feeling Great School Program is a series of eight one-hour weekly lessons dealing in the topic areas of nutrition and fitness. The program attempts to:

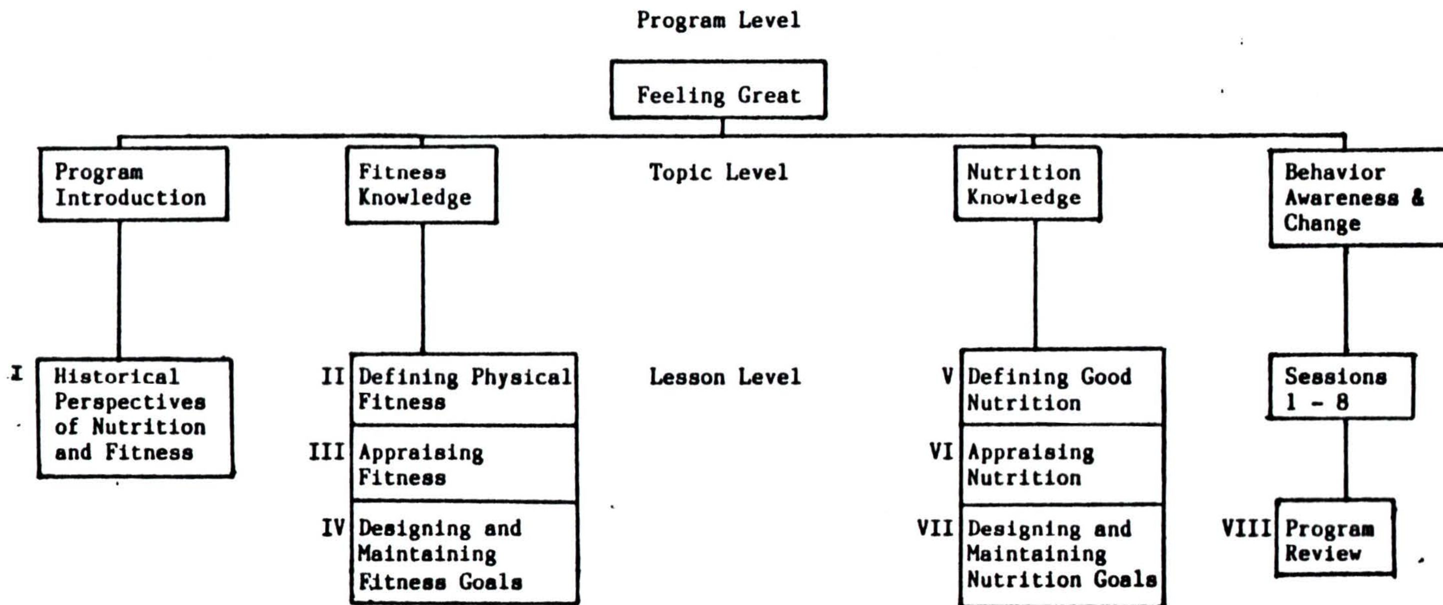
1) Expand the children's knowledge of what fitness and good nutrition really means.

2) Provide the children with current, relevant information and skills on how to evaluate their own fitness and nutritional status.

3) Equip them with the ability to design, implement, and maintain an individual lifestyle plan.

In addition to the school program which can be used as part of the Grade 5/6 Health/Science Curriculum, there are two "Feeling Great" after school programs. These programs have been planned for overweight children and their parents. Their focus is on nutrition and health education as they specifically relate to proper weight management. All three programs can be used independently or in conjunction with one another.

PROGRAM OVERVIEW



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Program Goals

1) To increase the children's fitness and nutrition knowledge.

2) To foster positive attitudes towards fitness and nutrition.

3) To assist the children in setting their own personal fitness and nutrition goals thereby enabling them to make approppriate lifestyle changes.

4) To equip the children with the skills to maintain change.

5) To establish individual contracts for the purpose of assessing ongoing student progress.

6. To establish a social support network through the use of groups, the buddy system, and family involvement.

TABLE OF CONTENTS

Page No.

Program Philosophy ....

Program Overview ....

Program Goals ....

Acknowledgments ....

Confidentiality ....

A Guide to Using this Manual ....

Teacher's Professional Guide ....

Explanation of Ongoing Activities ....

Teaching Techniques ....

Parent Letter ....

Program Evaluations (Ongoing / Final) ....

Lesson 1 : Your're Great ....

Lesson 2 : Diets Don't Work ....

Lesson 3 : Why We Eat and Exercise ....

Lesson 4 : Taking Responsibility ....

Lesson 5 : A Positive Approach ....

Lesson 6 : Thin and Fat Behaviors ....

Lesson 7 : Being In Control ....

Lesson 8 : Maintenance ....

Maintenance Activities ....

Appendices ....

Bibliography ....

Program Philosophy

Health Educators are beginning to become more and more concerned about the increased incidence of overweight in children. Research has indicated that children who have difficulty in maintaining their weight at a healthy level during childhood and adolescence have a markedly increased likelihood of becoming overweight adults.

Not only does obesity and overweight often carry with it health implications, it also has deep and often long lasting psychological effects for the individual. Constant reminders of the current cultural ideal of thinness abound and only serve to ingrain negative feelings towards self for those who do not match the ideal.

The "Feeling Great" program is largely based on the belief that before any changes can be made it is essential that the child must heal and strengthen his internal self-image. It soon becomes clear when working with the majority of overweight children that they often suffer from feelings of inadequacy, failure, anxiety, guilt, rejection and have a serious lack of confidence. It is nearly impossible to effect change when an individual feels that they have little or no control over their life or have such little confidence that they feel they will never succeed.

A great deal of time is spent throughout the program in building up the participant's self-esteem. Discovery exercises, visualization training and positive thinking techniques are some of the ways used to achieve this goal. It is also established at the beginning of "Feeling Great" that there is no failure in the program. No weekly weigh-ins to pass or fail, no diets to go off of and no recriminations for non-participation in any of the activities. This is an important consideration as not all children are at the same stage of readiness for change. For some the preparation for change takes longer than others. For these children the program seeks to ensure them that they are worthwhile and important just the way they are. For those ready to make changes a variety of behavioral techniques along with relevant nutritional and fitness information are provided to help them more effectively begin the change process.

The concurrent "Feeling Great" parent session furnishes the children with another major source of help and support and is considered an integral part of the program. Success in making changes is much easier when it is dealt with in the context of the family. It has been demonstrated in a number of studies that parental involvement and the cooperation of other family members is crucial. The parent sessions attempt to give parents practical and meaningful ways in which they can support and encourage their child and to provide them with insight and understanding related to the weight issue.

Night School
Module - Students

Program Overview

The children's after-school program is a series of eight one hour weekly lessons supplemented by maintenance lessons. The major topics of nutrition, fitness and self-image, as they relate to healthy weight management, are touched upon in each lesson.

The following is a brief summary of the topics dealt with in lessons one through eight.

Lesson 1 — "You're Great" — This initial lesson concentrates on introducing the program participants to the program and to each other. Current theories of weight management, the importance of goal setting and examining feelings about weight are all covered.

Lesson 2 — "Diets Don't Work" — Lesson 2 deals with the importance of a well-balanced diet and fitness program. Myths about diet and exercise are also discussed.

Lesson 3 — "Why We Eat and Exercise" — Reasons why we eat and exercise are examined.

Lesson 4 — "Taking Responsibility" — The children explore the different choices they have in establishing eating and exercise patterns. Locus of control and taking responsibility are also dealt with.

Lesson 5 — "A Positive Approach" — The value of positive thinking is stressed. The children evaluate their readiness for change and consider what the obstacles to positive change might be. The importance of both a balanced nutrition and fitness program is also reviewed.

Lesson 6 — "Thin and Fat Behaviors" — This lesson examines food-related behaviors and categorizes them into thin or fat behaviors. Alternatives to "fat" behaviors are discussed and a self-esteem exercise has also been included.

Lesson 7 — "Being in Control" — The children discuss their rights and responsibilities and how they can learn to be appropriately assertive. Making good eating choices when eating out or going to the corner store for a treat are also considered.

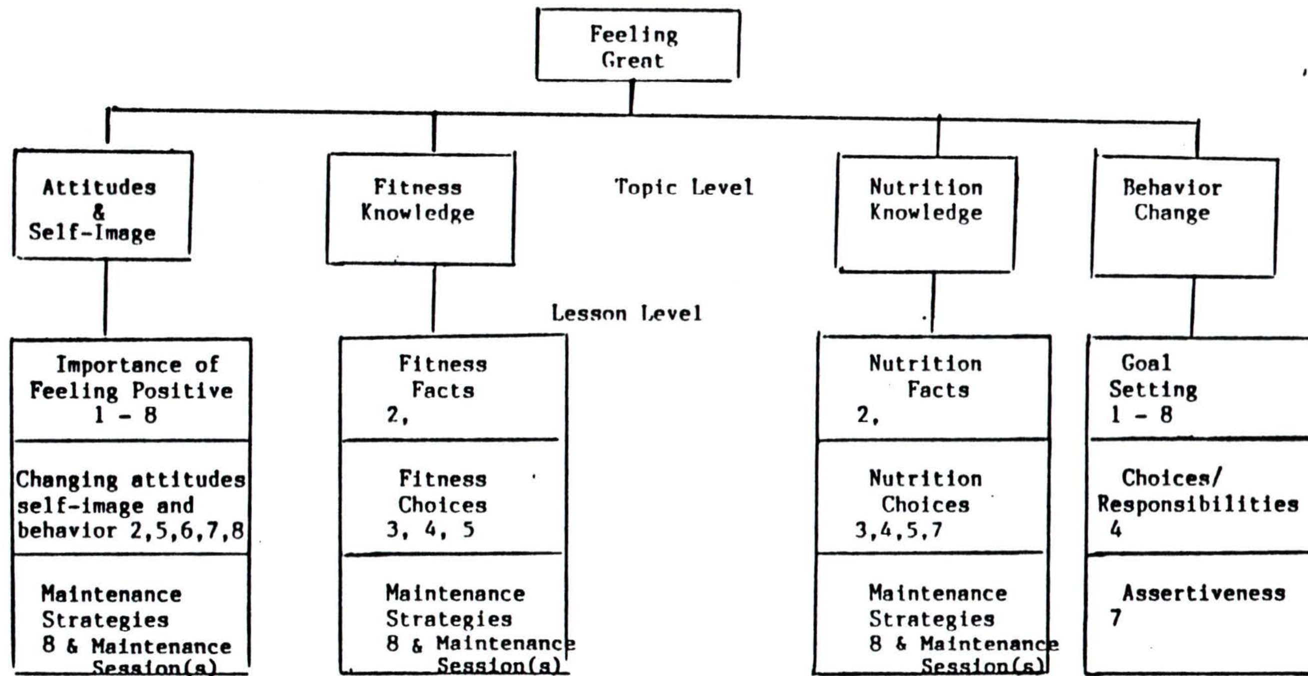
Lesson 8 — "Maintenance" — The focus of this lesson is on anticipating problems which may arise for the children during the maintenance phase and suggesting ways in which to deal with them. In addition the children are also involved in a "futuring" actiivity and an exercise structured to increase self-esteem.

Maintenance — Suggested topics for designing maintenance lesson plans are included in this section.

Note: The "Feeling Great" Children's After-School Program is one part of a two part component which includes the "Feeling Great" Parent Program. Teaching these programs in conjunction with one another is vital to the success of both. In addition to these programs there is also a "Feeling Freat" Health/Science school program.

Night School
Module - Students

Program Overview



* The numbers under the lesson levels correspond to the lessons in which they appear.

Program Goals

1) To guide the children to the realization that they are unique and valuable individuals just as they are.

2) To lead the children towards an understanding of the weight issue.

3) To develop in the children an understanding of some of the reasons for overeating and underexercising.

4) To help the children establish appropriate eating patterns that lead to a lifetime of healthy weight management.

5) To teach the children the values of applying nutrition and fitness knowledge to weight management.

6) To assist the children in learning how to make changes using behavior modification techniques.

7) To provide a means for evaluating the interest in and benefit of the program throughout the duration.

Night School
Module - Students

TABLE OF CONTENTS

Page No.

Program Philosophy ....

Program Overview ....

Program Goals ....

Acknowledgments ....

Confidentiality ....

A Guide to Using this Manual ....

Leader's Professional Guide ....

Explanation of Ongoing Activities ....

Teaching Techniques ....

Parent Letters ....

Family Physician Letter ....

Program Evaluations (Ongoing /, Final) ....

Session 1 : Why Are We Here? ....

Session 2 : Diets Don't Work ....

Session 3 : Choices ....

Session 4 : What's Food and Exercise All About ....

Session 5 : What's Our Role? .. ..

Session 6 : Easy Does It, But Do It ....

Session 7 : A Second Look ....

Session 8 : Coping Power ....

Maintenance Activities ....

Appendices ....

Bibliography ....

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The "Feeling Great" program is largely based on the belief that before any changes can be made it is essential that the child must heal and strengthen his internal self-image. It soon becomes clear when working with the majority of overweight children that they often suffer from feelings of inadequacy, failure, anxiety, guilt, rejection and have a serious lack of confidence. It is nearly impossible to effect change when an individual feels that they have little or no control over their life or have such little confidence that they feel they will never succeed.

A great deal of time is spent throughout the program in building up the participant's self-esteem. Discovery exercises, visualization training and positive thinking techniques are some of the ways used to achieve this goal. It is also established at the beginning of "Feeling Great" that there is no failure in the program. No weekly weigh-ins to pass or fail, no diets to go off of and no recriminations for non-participation in any of the activities. This is an important consideration as not all children are at the same stage of readiness for change. For some the preparation for change takes longer than others. For these children the program seeks to ensure them that they are worthwhile and important just the way they are. For those ready to make changes a variety of behavioral techniques along with relevant nutritional and fitness information are provided to help them more effectively begin the change process.

The concurrent "Feeling Great" parent session furnishes the children with another major source of help and support and is considered an integral part of the program. Success in making changes is much easier when it is dealt with in the context of the family. It has been demonstrated in a number of studies that parental involvement and the cooperation of other family members is crucial. The parent sessions attempt to give parents practical and meaningful ways in which they can support and encourage their child and to provide them with insight and understanding related to the weight issue.

Program Overview

The program is composed of parents of overweight children who volunteer to attend eight weekly sessions (1 hour per week) plus ..... maintenance session(s) after the initial program.

The program is a positive fun-oriented approach to weight management. The sessions will focus on:

- the importance of positive self-esteem and self-confidence
- personal eating and exercise habits
- changing habits through behavior modification
- the examination of social support mechanisms with regard to successful weight management

It is the program's intent that parents will work with their child toward the same goal providing the necessary support and encouragement. As a result of the program it is expected that the parent and child will be capable of making more informed choices which will have far reaching consequences in their lives.

The following is a brief overview of each session:

Session 1: Why Are We Here?

Parents are introduced to the parent's and children's after-school programs. Causes of overweight are discussed and parents are encouraged not to blame themselves or anyone else but rather use their positive energies in more effective ways.

Session 2: Diets Don't Work

A number of nutrition and fitness myths and the fradulence of fad diets are discussed. The parents are asked to set nutrition and fitness goals for their child and encouraged to enhance their child's body image.

Session 3: What's Food and Exercise All About?

The reasons why we eat, nutrient requirements and the value of the Canada Food Guide are discussed. Factors which effect fitness and nutrition choices are also emphasized.

Session 4: Choices

Parents become aware of the changes they can make to improve their family's eating habits and choices available to them to gain a locus of control in their lives. Parent and child will also plan their personal family fitness activity program.

Session 5: What's Our Role?

Session 5 discusses beneficial changes in eating habits, home environment and meal planning. Parents are given an opportunity to evaluate their own and their child's readiness for change and to plan a workable solution.

Program Overview

Session 6: Easy Does It But Do It

The parents differentiate between thin and fat habits and discuss the importance of variety and moderation pertaining to good eating and fitness. Family responsibility patterns are also evaluated.

Session 7: A Second Look

This session focuses on the factors contributing to the feeling of high self-esteem, the benefits of a nurturing family and the challenge of eating out.

Session 8: Coping Power

Session 8 prepares the parents for some of the problems their child may encounter during the maintenance segment. Highlights of the "Feeling Great" Program are reviewed.

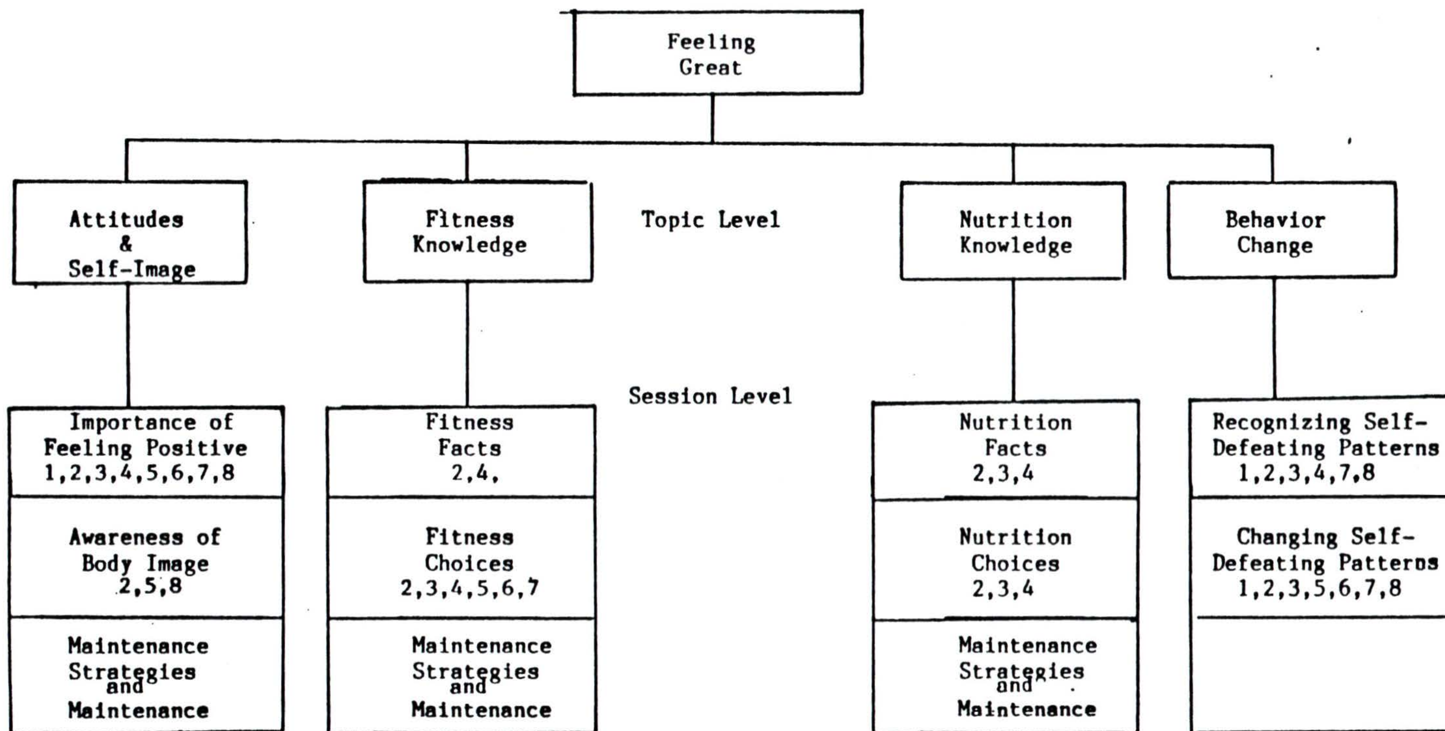
Maintenance:

Suggestions for topics to design the maintenance sessions are included in the "Maintenance" session.

Note: The "Feeling Great" Parent's Program is one of a two-part component which includes The "Feeling Great" Children's After-School Program. Teaching these programs in conjunction with one another is vital to the success of both. In addition to these two programs, there is also a "Feeling Great" School Program for Grade Five/Six students entitled: "Feeling Great" A Guide to Health and Fitness (Children's School Program) Grade Five/Six Level.

The chart on the next page outlines the scope and sequence of the "Feeling Great" Parent's Program.

PROGRAM OVERVIEW



* The numbers under the session levels correspond to the sessions in which they appear.

Program Goals

1. To make the parents aware of what is taking place in the Children's After-School Program.

2. To encourage the parents to further enhance their children's self-esteem and to support their efforts in the program.

3. To expand the parent's fitness and nutrition knowledge and to create an awareness of their family's present fitness and nutrition habits.

4. To examine a variety of factors which determine why we eat and exercise.

5. To make the parents aware of techniques which can be used to help their children with their weight management.

6. To assist the parents in setting their family's fitness and nutrition goals.

7. To provide the parents with an opportunity to record their family's goals and program activities in their "Feeling Great" Family Journal for the purpose of assessing ongoing family progress.

Appendix B

O-Scale System Anthropometric Proforma

B. # O-SCALE SYSTEM ANTHROPOMETRIC PROFORMA

Physique Management Systems
4875 Triumph Street
Burnaby, B.C. V5C 2A1
(604) 291-2194

01	Subject ______ (Last Name) ______ (Given Name)	1	07381
02	Measurement Occasion	6	01
03	Certified Measurer	8	
04	Sex: Male = 1, Female = 2	11	02
05	Classification:	12	04
06	Caliper: S = Slim Guide; H = Harpenden; C = Other	14	S

		Year	mo.	day		
07	Date of observations	85	02	18	15	85.132
08	Date of birth	74	06	10	20	74.438

09	Body mass	33.0	33.0	.	25	033.0
10	Stature (stretched)	.	.	.	29	150.3
11	Triceps sf	8.0	.	.	33	08.0
12	Subscapular sf	5.5	.	.	36	05.5
13	Supraspinale sf	7.0	.	.	39	07.0
14	Abdominal sf	8.5	.	.	42	08.5
15	Front thigh sf	11.5	.	.	45	11.5
16	Medial calf sf	8.0	.	.	48	08.0
17	Arm girth relaxed	19.1	19.1	.	51	19.1
18	Forearm girth (max. relaxed)	19.3	19.5	.	54	19.4
19	Calf girth (max)	27.5	27.7	.	57	27.6

Comments: e.g. Illnesses, Athletic training, Recent weight gain or loss.

Appendix C

Habit Inventory

C. Habit Inventory

The HABIT INVENTORY is not difficult to fill out. There are no "right" or "wrong" answers. Just answer each question based on what you did or felt during the last seven days. For each question, check "often", "sometimes" or "rarely". If you never did it or felt it during the last 7 days, check "rarely". If you always did it or felt it, check "often".

Example:

I ate sweets.	✓	often	0
	______	sometimes	1
	______	rarely	2

I ate sweets.	______	often	0
	______	sometimes	1
	______	rarely	2
I ate vegetables.	______	often	2
	______	sometimes	1
	______	rarely	0
I ate fried or oily foods.	______	often	0
	______	sometimes	1
	______	rarely	2
I drank regular sodas or kool-aid.	______	often	0
	______	sometimes	1
	______	rarely	2
1. The types of food I eat	**Total**	______	

ASSESSING YOURSELF

I ate breakfast.	______	often	2
	______	sometimes	1
	______	rarely	0
I kept nibbling on food.	______	often	0
	______	sometimes	1
	______	rarely	2
I ate a lot in the evening.	______	often	0
	______	sometimes	1
	______	rarely	2
I snacked many times during the day.	______	often	0
	______	sometimes	1
	______	rarely	2
2. How often I eat	**Total**	______	

I had second helpings of food.	______	often	0
	______	sometimes	1
	______	rarely	2
I ate a lot when I snacked.	______	often	0
	______	sometimes	1
	______	rarely	2
I had small amounts of food.	______	often	2
	______	sometimes	1
	______	rarely	0
I ate more than my friends.	______	often	0
	______	sometimes	1
	______	rarely	2
3. How much I eat	**Total**	______	

I exercised hard in P.E. class.	______	often	2
	______	sometimes	1
	______	rarely	0
I spent my afternoons sitting down.	______	often	0
	______	sometimes	1
	______	rarely	2
I got some vigorous exercise.	______	often	2
	______	sometimes	1
	______	rarely	0
I sat around on the weekend.	______	often	0
	______	sometimes	1
	______	rarely	2

4. How much I exercise — Total ______

I felt bored.	______	often	0
	______	sometimes	1
	______	rarely	2
I was very busy.	______	often	2
	______	sometimes	1
	______	rarely	0
I had nothing to do.	______	often	0
	______	sometimes	1
	______	rarely	2
I put off doing things.	______	often	0
	______	sometimes	1
	______	rarely	2

5. How active I am — Total ______

I felt really hungry.	______	often	2
	______	sometimes	1
	______	rarely	0
I ate when I was not hungry.	______	often	0
	______	sometimes	1
	______	rarely	2
I felt really full.	______	often	0
	______	sometimes	1
	______	rarely	2
I stopped eating when I was barely satisfied.	______	often	2
	______	sometimes	1
	______	rarely	0

6. **Listening to my hunger cues** **Total** ______

I ate because it was time to eat.	______	often	0
	______	sometimes	1
	______	rarely	2
I ate because I was bored.	______	often	0
	______	sometimes	1
	______	rarely	2
I ate because I was nervous or upset.	______	often	0
	______	sometimes	1
	______	rarely	2
I ate because I was depressed or unhappy.	______	often	0
	______	sometimes	1
	______	rarely	2

7. **Eating when I am not hungry** **Total** ______

I ate quickly.	______	often	0
	______	sometimes	1
	______	rarely	2
I was relaxed when I started eating.	______	often	2
	______	sometimes	1
	______	rarely	0
I ate while I watched T.V. or did homework.	______	often	0
	______	sometimes	1
	______	rarely	2
I took small bites of food.	______	often	2
	______	sometimes	1
	______	rarely	0

8. **My eating style** **Total** ______

I kept sweets in the house.	______	often	0
	______	sometimes	1
	______	rarely	2
I kept vegetables in the house.	______	often	2
	______	sometimes	1
	______	rarely	0
I kept food in my bedroom.	______	often	0
	______	sometimes	1
	______	rarely	2
I kept fruit in the house.	______	often	2
	______	sometimes	1
	______	rarely	0

9. **My eating environment** **Total** ______

I ate because people offered me food.	_______	often	0
	_______	sometimes	1
	_______	rarely	2
I talked about my problems.	_______	often	2
	_______	sometimes	1
	_______	rarely	0
I told people ways they could help me.	_______	often	2
	_______	sometimes	1
	_______	rarely	0
I spoke up and said what I thought.	_______	often	2
	_______	sometimes	1
	_______	rarely	0
10. Speaking up	Total	_______	

I spent time with my friends.	_______	often	2
	_______	sometimes	1
	_______	rarely	0
I felt lonely.	_______	often	0
	_______	sometimes	1
	_______	rarely	2
I telephoned a friend.	_______	often	2
	_______	sometimes	1
	_______	rarely	0
I spent time with a friend during the weekend.	_______	often	2
	_______	sometimes	1
	_______	rarely	0
11. Time with friends	**Total**	_______	

Appendix D

Knowledge Test

KEY

D. Knowledge Test

Directions:

In this set of questions, each question contains three true statements and one false statement. Check the boxes in front of the three statements that are true.

Sample:

S-1. Which of the foods below are fruits?

- [✓] 1. Apples
- [✓] 2. Pears
- [ ] 3. Lettuce
- [✓] 4. Bananas

S-2. Which of the activities below involve running?

- [ ] 1. Swimming
- [✓] 2. Soccer
- [✓] 3. Basketball
- [✓] 4. Softball

** ** ** ** ** ** ** ** ** ** ** **

1. When people are upset or frightened and their bodies tense up, which three things below can help them relax?

- [✓] 1. Doing some stretches.
- [✓] 2. Going jogging.
- [ ] 3. Taking their pulse.
- [✓] 4. Breathing deeply.

2. Paul's mother fried a pound of potatoes for supper one night. The potatoes and the oil they were fried in cost about 25¢. A few nights later, she bought a new kind of potato chips that Paul had seen advertised on T.V. A pound of those chips cost $2.50. Why were the chips so much more expensive?

- [✓] 1. Because T.V. advertising often raises the price of a product.
- [✓] 2. Because the chips come in a brightly-colored plastic tube.
- [ ] 3. Because the chips have more vitamins and minerals than plain potatoes.
- [✓] 4. Because the chips are sliced, salted, and fried in a big factory.

3. Which three statements tell something about meditation?

- [✓] 1. It is used by some people to reduce high blood pressure.
- [✓] 2. It makes the body use less oxygen.
- [ ] 3. It stimulates "fight or flight" body signals.
- [✓] 4. It slows down the heart rate.

4. When you compare people who do regular aerobic exercise and those who don't, which three things are true for the exercisers?

- [ ] 1. Their hearts beat more quickly when they run for the bus than the non-exercisers.
- [✓] 2. Their hearts pump more blood with each beat than the non-exercisers.
- [✓] 3. Their hearts beat more slowly when they are resting than the non-exercisers.
- [✓] 4. Their hearts beat fewer times a day than the non-exercisers.

5. Which three of these diseases happen more often in smokers than in non-smokers?

- [✓] 1. Heart disease
- [ ] 2. Arthritis
- [✓] 3. Emphysema
- [✓] 4. Lung cancer

6. Which three things below are likely to happen to people who smoke cigarettes over several years?

- [✓] 1. Their hearts beat faster than non-smokers' hearts.
- [✓] 2. Their blood gets less oxygen than non-smokers' blood.
- [✓] 3. The cilia in their lungs beat more slowly than non-smokers' cilia.
- [ ] 4. Their blood vessels get wider than non-smokers' blood vessels.

7. Which three statements tell something that is true about pulse rates?

[ ] 1. They are usually about the same for healthy people of any age.

[✓] 2. They are higher during exercise.

[✓] 3. They are lower during sleep.

[✓] 4. They are higher in people who smoke.

8. Which three things below happen each time the heart muscle contracts?

[✓] 1. The blood is pushed through the arteries.

[✓] 2. The heartbeat can be heard through a stethoscope.

[ ] 3. The heart is resting before the next beat.

[✓] 4. A pulse can be felt in the neck.

9. Joe and his family are trying to eat better.
Which three things are they doing?

[✓] 1. Eating more fish and chicken.

[✓] 2. Eating less salt.

[✓] 3. Exercising to burn up extra calories.

[ ] 4. Eating more beef and pork.

10. Which three statements tell something that is true about regular arm exercise?

[✓] 1. It makes the arm muscles bigger.

[✓] 2. It increases the blood supply to the arm.

[ ] 3. It increases the number of muscles in the arm.

[✓] 4. It makes the muscle fibers thicker.

11. Mr. Smith is about 20 pounds overweight. Which things are most likely to help him lose weight safely?

    [✓] 1. Walking an extra mile every day.

    [ ] 2. Going on a diet of grapefruit and steak.

    [✓] 3. Eating 100 calories less every day.

    [✓] 4. Climbing the stairs at work every day instead of taking the elevator.

12. Some people weigh more than they should. Which three statements help explain why people may be overweight?

    [✓] 1. People sometimes eat too much when they feel unhappy.

    [ ] 2. Many people inherit a big appetite from their parents.

    3. Some people were fed too much when they were babies.

    [✓] 4. Many people use food to make them feel good about themselves.

13. Which three statements tell something that is true about your lungs?

    [ ] 1. They fill up completely every time you breathe.

    [✓] 2. They exchange gases for your body.

    [✓] 3. They can take in extra air when you exercise.

    [✓] 4. They filter dirt from the air as you breathe.

14. Which three statements tell something that is true about fat?

    [✓] 1. It insulates your body.

    [✓] 2. It protects your organs.

    [ ] 3. It is digested quickly.

    [✓] 4. It stores energy.

15. Which three of these foods contain all the essential amino acids?

[✓] 1. Peanut butter on whole wheat bread.

[✓] 2. Cheese.

[✓] 3. Fish.

[ ] 4. Oatmeal.

16. Which three of these are among the six categories of nutrients?

[✓] 1. Amino acids.

[ ] 2. Water.

[✓] 3. Fats.

[✓] 4. Carbohydrates.

17. Which three ingredients on a label tell you that your cereal contains a form of sugar?

[✓] 1. Lactose.

[✓] 2. Honey.

[ ] 3. Cornstarch.

[✓] 4. Molasses.

18. Fresh fruits and vegetables that we buy out of season cost more than those we buy <u>in</u> season because out-of-season foods:

[ ] 1. Have to be harvested in the winter, using more oil to heat the tractors.

[✓] 2. Require long periods of refrigeration for proper storage.

[✓] 3. Must be transported over long distances from the farm to the supermarket.

[✓] 4. Cannot be grown on local farms when the weather is cold.

19. We have more different kinds of food available in stores today than our grandparents did because:

- [x] 1. Food is now transported all over the country.
- [ ] 2. There are now more farms and farmers to grow the food.
- [x] 3. We can easily get foods from other countries.
- [x] 4. Manufacturers have invented new food combinations.

SECTION 2

Directions:

In this set of questions, each statement is either true or false. Check the correct box.

Sample:

S-1. Running is the only kind of exercise that keeps people physically fit.

[ ] true

[✓] false

S-2. Many animals besides cows provide milk.

[✓] true

[ ] false

** **

20. People would be healthier if they did not eat any fats.

[ ] true

[✓] false

21. If you see someone with big muscles, you know that person is physically fit.

[ ] true

[✓] false

22. If you continue to do the same amount of exercise every week, your muscles will not get stronger.

[✓] true

[ ] false

23. Most immigrants (people who move to a new country) change their eating habits even before they begin to learn the new language.

[ ] true

[✓] false

24. As blood cells die, your body replaces them.

[✓] true

[ ] false

25. Your stomach is the only part of your body that digests food.

[ ] true

[✓] false

26. When your muscles are ready for action, they are loose and relaxed.

[ ] true

[✓] false

27. There are some vitamins you do not need to eat every day.

[✓] true

[ ] false

28. You could live for only a few days without water.

[✓] true

[ ] false

29. The average Canadian eats more fresh fruits and vegetables than his or her grandparents did 50 years ago.

[✓] true

[ ] false

30. Vegetables are more nutritious if you cook them a long time than if you cook them a short time.

[ ] true

[✓] false

31. One gram of carbohydrate has twice as many calories as one gram of protein.

[ ] true

[✓] false

32. One of the requirements for astronauts is being physically fit. Astronauts who spend 2 weeks in a space capsule will lose their fitness if they don't exercise a lot.

- [x] true
- [ ] false

33. The better shape you are in, the more slowly your heart should beat when you are resting.

- [x] true
- [ ] false

SECTION 3

Directions:

In each of these sets of questions, there is only one true statement. Check the box in front of the statement that is true.

Sample:

S-1. Which of these statements tells something that is true about vegetables?

[ ] 1. They grow on trees.

[ ] 2. They come from animals.

[ ] 3. They are usually eaten for dessert.

[✓] 4. Many people grow them in their gardens.

S-2. Which one of these sports can sometimes require a helmet?

[ ] 1. Swimming

[✓] 2. Baseball

[ ] 3. Soccer

[ ] 4. Bowling

** **

34. People who don't stand up straight often have weak abdominal muscles. Which of these problems often results from weak abdominal muscles?

[✓] 1. Back aches

[ ] 2. Stomach aches

[ ] 3. Leg pains

[ ] 4. Appendicitis

35. Cereals that have lots of sugar added to them are advertised on TV for one of the following reasons. Check the right reason.

[ ] 1. The sugar gives kids lots of long-lasting energy.

[ ] 2. Highly-sugared cereals cost families less money than other cereals.

[ ] 3. Canadians have been accustomed to buying highly-sugared cereals for over 100 years.

[✓] 4. Food companies find it easy to sell sweet-tasting cereals.

36. Most TV programs are paid for

- [✓] 1. By the companies that advertise their products.
- [ ] 2. By the government
- [ ] 3. By the companies that manufacture TV sets.
- [ ] 4. By the TV stations.

37. Which one of these statements tells something that is true about flexibility?

- [ ] 1. It can never be improved by exercise.
- [ ] 2. It is one of the benefits of jogging.
- [✓] 3. It helps prevent injuries to joints.
- [ ] 4. It is less important for everyday fitness than muscle power is.

38. Most people who are doing aerobic exercise can tell when they are in their target zone without taking their pulses. They know this because:

- [ ] 1. They are all out of breath.
- [ ] 2. Their legs feel too tired to go on.
- [ ] 3. Their hearts are beating nice and slowly.
- [✓] 4. They are breathing hard but can still talk to a friend.

39. The target zone heart rate for most 5th graders is about:

- [ ] 1. 60 - 80 beats a minute.
- [ ] 2. 80 - 100 beats a minute.
- [✓] 3. 130 - 170 beats a minute.
- [ ] 4. 180 - 210 beats a minute.

40. Which one of these statements is true about complete proteins?

- [ ] 1. They are all you need for a balanced diet.
- [✓] 2. They contain all the essential amino acids.
- [ ] 3. They must be refrigerated or freeze-dried.
- [ ] 4. They can be found only in meat and fish.

41. Bill and Sue are 16 years old, and they have both been active in sports since they were little. Which of these statements is likely to be true about them?

[ ] 1. Bill can swim longer distances than Sue.

[ ] 2. Sue is better coordinated than Bill.

[✓] 3. Bill has stronger stomach muscles than Sue.

[✓] 4. Sue is more flexible than Bill.

42. Fatty deposits that close off a coronary artery can lead to:

[✓] 1. A heart attack

[ ] 2. Tired blood

[ ] 3. Anemia

[ ] 4. Varicose veins

43. When you run for 10 minutes, which of these things happens?

[ ] 1. More blood goes to your stomach to help digest your food faster.

[ ] 2. More blood goes into your legs to bring carbon dioxide to the leg muscles.

[✓] 3. You breathe faster, to bring extra oxygen to your blood.

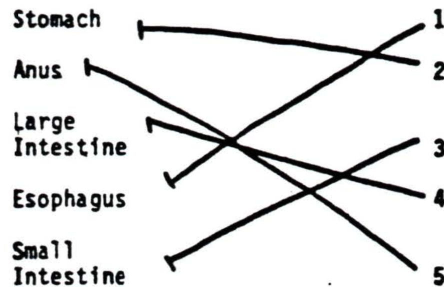
[ ] 4. Your muscles contract slowly because running relaxes them.

SECTION 4

Directions:

In this set of questions, answer according to the directions given before each question.

44. Match the parts of your digestive tract with the numbers from 1-5 in the order in which the food passes through your body.



45. How many of the Four Food Groups are represented in each of these meals?

1. Peanut butter sandwich

   Frozen yogurt

   Apple

   Number of food groups 4

2. Egg

   Doughnut

   Black coffee

   Orange juice

   Number of food groups 2

46. The label on a can of chili con carne reads: "Ingredients: water, beef, red beans, tomato paste, chili powder, garlic powder." Check the ingredient that you think makes up most of the contents of the can.

beef

chili powder

red beans

tomato paste

water ✓

garlic powder

47. Put a check beside all of the activities below that can be aerobic exercises.

Bowling

Swimming ✓

Disco dancing ✓

Weight lifting

Baseball

Fast walking ✓

48. Catherine and Susan are the same height. Even though they wear the same size dress, Catherine exercises a lot and is very muscular, while Susan does not exercise and is a little bit fat. Which one probably weighs more?

Catherine ✓ Susan

Appendix E

Summary Information on Habit Inventory and Knowledge Test Results, Tables 39-48.

Table 39

Habit Inventory Mean Scores of Males, Females, Males and Females Combined on the Post-test by Group

Variable	*n*[a]	Group 1	2	3	4	5
Habit Inventory						
Males	207	92.7	86.7	60.9	81.1	59.4
Females	217	83.2	88.2	61.7	67.5	62.9
Males and Females	424	86.2	87.4	61.3	74.5	61.2

Note. [a]Number of students who completed all Habit Inventory measures.

Table 40

Habit Inventory Mean Scores of Males, Females, Males and Females Combined on the Retention Test by Group

Variable		Group				
	n[a]	1	2	3	4	5
Habit Inventory						
Males	207	96.0	89.2	61.8	87.0	59.6
Females	217	87.3	89.8	62.8	75.3	66.0
Males and Females	424	90.1	89.4	62.4	81.4	62.8

Note. [a]Number of students who completed all Habit Inventory measures.

Table 41

Habit Inventory Mean Scores of Males, by Testing Occasion and Group

		Testing Occasion		
Variable	n^a	1	2	3
Habit Inventory				
Group 1	6	53.8	92.7	96.0
Group 2	19	56.2	86.7	89.2
Group 3	88	56.6	60.9	61.8
Group 4	16	78.2	81.1	87.0
Group 5	78	58.0	59.4	59.6

Note. [a]Number of male students who completed all Habit Inventory measures.

Table 42

Habit Inventory Mean Scores of Females, by Testing Occasion and Group

Variable	*n*[a]	Testing Occasion 1	2	3
Habit Inventory				
Group 1	13	51.3	83.2	87.3
Group 2	15	57.9	88.2	89.8
Group 3	97	58.0	61.7	62.8
Group 4	15	67.5	70.7	75.3
Group 5	77	61.6	62.9	66.0

Note. [a]Number of female students who completed all Habit Inventory measures.

Table 43

Habit Inventory Mean Scores of Males and Females, by Testing Occasion and Group

		Testing Occasion		
Variable	n^a	1	2	3
Habit Inventory				
Group 1	19	52.1	86.2	90.1
Group 2	34	56.9	87.4	89.4
Group 3	185	57.4	61.3	62.4
Group 4	31	74.6	74.5	81.4
Group 5	155	59.8	61.2	62.8

Note. [a]Number of students who completed all Habit Inventory measures.

Table 44

Knowledge Test Mean Scores of Males, Females, Males and Females Combined on the Post-test 2 by Group

Variable	n[a]	Group 1	2	3	4	5
Knowledge Test						
Males	191	29.7	26.1	26.0	22.9	22.6
Females	200	29.1	27.4	28.2	22.8	23.3
Males and Females	391	29.3	26.6	27.2	22.8	23.0

Note. [a]Number of students who completed all Knowledge Test measures.

Table 45

Knowledge Test Mean Scores of Males, Females, Males and Females Combined on the Retention Test by Group

Variable	*n*[a]	Group 1	2	3	4	5
Knowledge Test						
Males	191	27.7	25.3	26.1	26.6	22.8
Females	200	27.0	27.9	28.0	25.0	24.0
Males and Females	391	27.2	26.4	27.1	25.7	23.4

Note. [a]Number of students who completed all Knowledge Test measures.

Table 46

Knowledge Test Mean Scores of Males, by Testing Occasion and Group

Variable	n[a]	Testing Occasion 1	2	3
Knowledge Test				
Group 1	6	21.7	29.7	27.7
Group 2	20	20.5	26.1	25.3
Group 3	87	21.8	26.0	26.0
Group 4	11	20.5	22.9	26.6
Group 5	67	21.0	22.6	22.8

Note. [a]Number of male students who completed all Knowledge Test measures.

Table 47

Knowledge Test Mean Scores of Females, by Testing Occasion and Group

Variable	$\underline{n}$[a]	Testing Occasion 1	2	3
Knowledge Test				
Group 1	13	20.9	29.1	27.0
Group 2	14	22.1	27.4	27.9
Group 3	96	21.9	28.2	28.0
Group 4	13	22.7	22.8	25.0
Group 5	64	21.8	23.3	24.0

Note. [a]Number of female students who completed all Knowledge Test measures.

Table 48

Knowledge Test Mean Scores of Males and Females, by Testing Occasion and Group

Variable	$\underline{n}$[a]	Testing Occasion 1	2	3
Knowledge Test				
Group 1	19	21.2	29.3	27.2
Group 2	34	21.2	26.6	26.4
Group 3	183	21.9	27.2	27.1
Group 4	24	21.7	22.8	25.7
Group 5	131	21.4	23.0	23.4

Note. [a]Number of students who completed all Knowledge Test measures.

VITA

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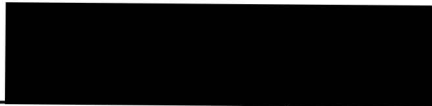
Author 
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