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Physiological, Anthropometrical, and Self Concept Changes in Overweight College Women as Affected by Exercise and Voluntary Diet

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PHYSIOLOGICAL, ANTHROPOMETRICAL, AND SELF CONCEPT CHANGES IN OVERWEIGHT COLLEGE WOMEN AS AFFECTED BY EXERCISE AND VOLUNTARY DIET

BY

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This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Advisor Date

Head, Health, Physical Education, and Recreation Department Date

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CHAPTER I

INTRODUCTION

Significance of the Study

The lack of physical activities plus the abundance of food have caused a national problem of overweight in the world today. Studies have shown that being overweight is one of the most common causes of premature death in the United States.[1,2] It is common knowledge that weight will be added if calorie intake exceeds the amount of energy expended, therefore, physical exercise and caloric intake control in weight reduction should exist if the greatest amount of adipose tissue is to be lost.[3] An individual may live a longer, healthier life through physical conditioning and by eliminating excess body fat.

The psychology of obesity constitutes still another problem. It has been suggested that social pressures on an obese girl cause such psychological symptoms as ". . . obsessive concern with body image, passivity, withdrawl, and expectation of refection."[4] The current study was directed towards investigating the effects of a combination exercise

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[1]Kenneth H. Cooper, Aerobics (New York: M. Evans Co., Inc., 1968), pp. 136-140.

[2]Jean Mayer, "Overweight---What to Do," U. S. News and World Report, 67:60-64, October 20, 1969.

[3]Jean Mayer, "Exercise and Weight Control," Science and Medicine of Exercise and Sports, ed. W. J. Johnson (New York: Harper and Brothers, 1960), pp. 301-309.

[4]Samuel M. Fox III, Obesity and Health, (Washington. D. C.: U. S. Department of Health, Education and Welfare, 1966), p. 31.

program and voluntary diet on selected anthropometric and physiological functions of overweight girls and whether or not changes in self concept occurred.

Statement of the Problem

The purpose of this study was twofold: to analyze the effects of a combination exercise program and voluntary diet on selected anthropometric and physiological variables of overweight girls at South Dakota State University, and to determine if measurable changes in self concept were evident.

Hypotheses

1. In the selected anthropometric and physiological variables of overweight girls there is a significant improvement as a result of participation in a voluntary diet and prescribed exercise program.

2. There is no significant measurable change in self concept of overweight girls as a result of participation in a voluntary diet and prescribed exercise program.

Limitations and Delimitations

1. The study was limited to fifty-five South Dakota State University volunteer women students with body fat of twenty-five percent or greater.

2. The diet was a voluntary diet controlled by each individual subject with the aid of a calorie chart and counseling on the use of the calorie chart by the investigator.

3. The exercises completed by the Experimental Group were limited to warm-up exercises the first ten minutes of each session, two levels of the XBX Royal Canadian progressive exercise program, and a progressive jogging program. The exercise program was conducted Monday through Friday for a total of thirty-six training days.

4. Only the variables of percent body fat, weight, selected girth measurements, cardiovascular fitness, and self-concept were investigated.

Definition of Terms

Adipose tissue. Adipose tissue is the subcutaneous layer of fat measureable with skinfold calipers because of very little connective tissue.[5]

Obesity. Obesity is an excess of adipose tissue. For the purpose of this study, twenty-five percent or more body fat was considered obese. The terms obesity and overweight have been used interchangeably by numerous authors and no distinction was made between them in this study.

Self Concept. The view of the self is composed of that system of ideas, attitudes, appraisals, concepts, value judgements, and commitments pertaining to one's own person; the deep personal feelings about oneself.[6] In the current study, the Tennessee Self Concept Scale by William H. Fitts was used to test self concept.

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[5]Jean Mayer, Overweight: Causes, Cost, and Control (New Jersey: Prentice-Hall, Inc., 1968), p. 31.

[6]Raymond F. Gale, Developmental Behavior, A Humanistic Approach (London: Collier-Macmillan, 1969), p. 231.

CHAPTER II

REVIEW OF RELATED LITERATURE

Obesity has become a national problem today and perhaps a national obsession. Magazine articles, radio, and television programs all stress the theme that an ever increasing proportion of Americans are overweight and that overweight carries the penalty of increased sickness and earlier death.[1]

Obesity is present when the body is loaded with excessive fat. A common practice of determining if one is obese is through the use of a height-weight chart. The significance of such tables can be questioned on several grounds, one of which is the lack of appreciation of variability in shape and body composition of individuals of similar heights and weights. A person with a large muscle mass and large bone mass may be judged as overweight according to the chart when he actually has little fat.[2]

In a study conducted by Sloan, Burt, and Blyth, low correlations were found between height, weight, and density. The study showed the inadequacy of assessing body fat on the basis of height and weight alone.[3]

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[1]Jean Mayer, Overweight: Causes, Cost, and Control (New Jersey: Prentice-Hall, Inc., 1968), p. 1.

[2]Ibid., p. 26.

[3]A. W. Sloan, J. J. Burt, and C. S. Blyth, "Estimation of Body Fat in Young Women," Journal of Applied Physiology, 17:970, November, 1962.

"The consensus is that skinfolds are of proven value as useful measures of total adiposity, particularly in young people."[4]

Exercise and its Effect on Overweight

According to Mayer, it is the balance between the output of energy and the intake of calories which determines the extent of overweight. The facts demonstrate that exercise is the great variable in energy expenditure and that exercise does not necessarily increase food intake.[5] An overweight person will require more energy and, unless fed more, burn a greater amount of body fat, for the same amount of exercise than will a person of normal weight.[6]

In respect to physical activity, Mayer also believes obesity can be, in many instances, due to the mechanization and development of modern means of transportation which tend to decrease physical activity. For some, physical activity is depressed to such an extent that the sedentary state is reached and excessive calories accumulate fat.[7]

Burt and Blyth indicate that if we are to meet the challenge that the overweight individuals are facing physical educators with today, we must reexamine the role of exercise in weight control. In recent years there has been a marked increase in the number of overweight individuals, due in large part to inactivity. The writers also state that physical

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[4]Samuel M. Fox III, Obesity and Health (Washington, D.C.: U.S. Department of Health, Education, and Welfare, 1966), p. 31.

[5]Mayer, op. cit., p. 69.

[6]Ibid., p. 71.

[7]Ibid., p. 77.

activity is as important as caloric reduction in the control of weight. Physical educators must avoid minimizing the role of both exercise and diet.[8] They state that their fundamental principal of physiology is that "the store of body fat can be increased or decreased only if energy intake is greater or less, respectively, than the energy expenditure."[9]

According to Burt and Blyth, (1) body weight can be maintained or reduced by a considerable reduction in caloric intake, (2) body weight can be maintained or reduced by vigorous daily exercise with no reduction in caloric intake, and (3) body weight can be maintained or reduced by only a small reduction in caloric intake and a corresponding amount of daily exercise.[10]

Stefanicsh, Heald, and Mayer studied obese and nonobese adolescent boys. It was observed that the calorie intake of the obese was not higher and, in most cases, was lower than that of the nonobese. The degree of participation in active exercises was observed to be generally less for the obese than for the nonobese.[11]

Johnson, Burke, and Mayer reported that in a study of twenty-eight obese high school girls and twenty-eight nonobese high school girls, the nonobese were found to be relatively inactive, but the obese girls were

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[8]John J. Burt and Carl S. Blyth, "The Role of Exercise in Weight Control," Journal of Health, Physical Education and Recreation, 32:23, January, 1961.

[9]Ibid.

[10]Ibid., p. 24

[11]P. A. Stefanicsh, F. P. Heald, and J. Mayer, "Calorie Intake in Relation to Energy Output of Obese and Nonobese Adolescent Boys," American Journal of Clinical Nutrition, 7:55-62, 1959.

significantly more so. On the statistical basis, inactivity was much more important than overeating.[12]

According to Yudkin, weight will be lost either by reducing caloric intake, by increasing physical activity, or by both.[13] Advice to increase physical activity is strenuously resisted by most overweight people. Much of their affluent lives is directed to reducing activity rather than increasing it.[14]

Dorris and Stunkard used mechanical pedometers to determine the physical activity levels of fifteen obese women and twenty-five obese men, in comparison to the activity of matched nonobese control subjects. The overweight group was significantly less active than the nonobese group. The nonobese women walked an average of 4.9 miles per day in comparison to the obese women who walked 2.0 miles per day. For the men, the comparable figures were 6.0 to 3.7 miles per day. Statistical analysis of the caloric expenditure data revealed that the differences between the obese and nonobese subjects was considerably greater among women than among men. The decreased physical activity was shown to be a major factor in the obesity of women.[15]

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[12]Mary L. Johnson, Bertha S. Burke, and J. Mayer, "Relative Importance of Inactivity and Overeating in the Energy Balance of Obese High School Girls," American Journal of Clinical Nutrition, 4:42, 1956.

[13]J. Yudkin, Obesity: Medical and Scientific Aspects, ed. I. McLean Baird and Alan N. Howard (Edinburgh and London, 1969), p. 91.

[14]Ibid., p. 92.

[15]R. J. Dorris and A. J. Stunkard, "Physical Activity: Performance and Attitudes of a Group of Obese Women," American Journal of Medical Science, 223:627, June, 1957.

Diet and Its Effect on Overweight

In his publication, Aerobics, Cooper has this to say about physical exercise:

> I want to make it clear . . . exercise alone will not take off weight. If you expect to lose weight solely through exercise, you've been grossly misled.
>
> If you ran a solid hour, covering ten miles in that hour, or an average of six minutes per mile . . . you would burn off the equivalent of about 1200 calories.[16]

Burt and Blyth indicate that weight control through physical activity and diet, and not through diet alone, should be emphasized. Diet alone may do the job temporarily. However, a far more satisfactory weight control program is one of regular activity combined with sensible eating habits.[17]

Johnson, Burke, and Mayer report that dieting is still the most important method of weight control, with exercise, in the final analysis, serving only as a means of expending calories.[18] Also it has been demonstrated that as a sedentary animal increases its daily amount of physical activity, its food consumption decreases. Therefore, an obese person will not eat more if he increases his daily exercise.[19] Total absence of such activity leads to the accumulation of weight, and even obesity, in animals and man.[20]

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[16]Kenneth H. Cooper, Aerobics (New York: M. Evans Company, Inc., 1968), pp. 136-137.

[17]Burt and Blyth, op. cit., p. 24.

[18]Johnson, Burke, and Mayer, op. cit., p. 28.

[19]Ibid., p. 27.

[20]Ibid., p. 37.

Mayer also indicated that determining the caloric content of the diet is but one aspect of dietary prescription. The more varied a diet is, the greater are the chances that it will be nutritionally adequate, thus eliminating the need for nutritional supplements such as vitamin pills. The goal of any reducing program is not merely to lose weight, but to keep it off. The obese patient needs a basic education in the caloric content of various foods in various size portions.[21]

According to Yudkin, caloric reduction must come from a reduction of proteins, fats, carbohydrates, or a combination of these. A reduction in all can be achieved simply by a curtailment of all that the patient eats.[22]

Berryman sees a great need for the proper motivations for weight reduction in order to succeed in the pursuit of leanness.[23]

Roby and Davis indicate that a fundamental purpose of exercise, such as jogging, is to increase the expenditure of one's energy per unit time.[24] Jogging possesses unique advantages over all other forms of physical activity and is seemingly ideal for the overweight populations of our society.[25]

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[21]Ibid., p. 159.

[22]Baird and Howard, op. cit., p. 92.

[23]G. H. Berryman, "Obesity--A Brief Review of the Problem," Metabolism, 3:544, 1954.

[24]Frederick B. Roby and Russell P. Davis, Jogging for Fitness and Weight Control (W. B. Saunders Company, 1970), p. 1.

[25]Ibid., p. 2.

Research by Roby and Davis reports that the cause of obesity is primarily the result of reduced levels of physical activity. Many obese people take in fewer calories daily than their normal counterparts. Obesity results in those people who are less apt to engage in active sports or other strenuous activities.[26]

Self Concept and How It Relates to Overweight

Self concept is determined by everything that has happened to the self until now. It is the idea, states Schneiders, that a person has of himself--his meaning and worth, his particular identity, his feelings, attitudes, values, beliefs, experiences, failures, hopes, goals, and aspirations.[27] Self esteem, according to Cox, originates from two sources: from within the individual and from the opinion of others.[28] The opinion an individual has of himself is clearly an important component of his behavior.[29]

According to Rogers, the self is described as follows:

> The self-structure is an organized configuration of perceptions of the self which are admissible to awareness. It is composed of such elements as the perceptions of one's characteristics and abilities; the percepts and concepts of the self in relation to others and to

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[26]Ibid., p. 23.

[27]Schneiders, Alexander A., Personality Development in Adolescence (Milwaukee: Bruce Publishing Company, 1960), p. 301.

[28]James J. Cox, "Help Your Child to Self-Esteem," Today's Health. 46:26, Feburary, 1968.

[29]"Studies in Self-Esteem," Scientific American, 218:96, February, 1968.

the environment; the value qualities which are perceived as associated with experiences and objects; and the goals and ideals which are perceived as having positive or negative valence.[30]

According to Combs and Snygg, a child is not born with a concept of self, hence, self concept is determined through environmental factors. This formation begins in the tender stages of infancy. They report that early self concept is stabilized in pre-school years but major changes are likely all through life. Adolescence is a most crucial stage for development of the self concept because during this period the physical self is undergoing drastic changes.[31] Strang says, "During early adolescence, acceptance of bodily changes contributes to the self concept."[32]

Schneiders reports that the self concept embraces an image of the body and what it should and should not do. He further suggests that the body image, size, and appearance have deep seated psychological implications.[33]

In a study by Suczek, the self concept and attitudes of overweight women about themselves were distinguished by an extreme emphasis on psychologic strength, hyper-normality, narcissistic pride, and by a denial of weakness. The obese woman's dimensions reflected her need for strength

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[30]Carl R. Rogers, Client-Centered Therapy (Boston: Houghton Mifflin Company, 1951), p. 501.

[31]Arthur W. Combs and Donald Snygg, Individual Behavior (New York: Harper and Row, 1959), p. 81.

[32]Ruth Strang, The Adolescent Views Himself (New York: The Macmillan Company, 1963), p. 81.

[33]Alexander A. Schneiders, Adolescents and the Challenge of Maturity (Milwaukee: Bruce Publishing Company, 1965), pp. 195-197.

and massiveness in order to deny any image of self that was felt to be basically weak or inadequate. There were tendencies for the grossly obese to be the most power oriented. Among them there were also more of those who were aware of anxiety and of internal psychologic stress.[34]

A study was conducted by Doudlah on the relationship between the self concept, the body image, and the movement concept of college girls with low and average ability. There was a relationship between self concept and body image, and body image and movement concept. The null hypothesis was rejected at the one percent level of confidence between self concept and body image.[35]

According to Silverstone, obesity beginning in childhood or adolescence often leads to considerable secondary psychological problems. It can, on occasion, cause a warped idea within the patient of his or her own body image.[36]

According to Schneiders, self concepts can be negative or positive. He contends that feelings and attitudes based on negative self concept can lead to a great deal of frustration.[37] Strang believes that a positive attitude toward the self in all aspects of life is a most important determinant of successful life adjustment.[38]

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[34]Robert F. Suczek, "The Personality of Obese Women," American Journal of Clinical Nutrition, 5:197-198, March-April, 1957.

[35]Anna May Doudlah, "The Relationship Between the Self Concept, the Body-Image and the Movement Concept of College Freshmen Women with Low and Average Ability," (unpublished Master's thesis, Women's College of the University of North Carolina, Greensboro, 1962), p. 51.

[36]J. Trevor Silverstone, Obesity: Medical and Scientific Aspects, ed. I. McLean Baird and Alan N. Howard (Edinburgh and London, 1969), p. 49.

[37]Schneiders, op. cit., p. 198

[38]Strang, op. cit., p. 72.

Clark says that body poise and grace are recognized as immediate desirable traits for girls.[39] Cratty reports that Coleman's study, "The Adolescent Society," found girls could succeed socially by being attractive, dressing well, and by coming from a family with above average cultural advantages.[40]

Jacob sees building a sense of confidence through physical education activities. An appreciation by the individual of his or her own body should have reinforcement through the proper use and proper sense of "what I can do."[41]

Adler states that feelings of inferiority relate to low skilled individuals. He theorized that if an individual is discouraged and feels that his best efforts cannot improve the situation, he will want to move into circumstances where he can feel strong.[42]

Kelley has stated that the self consists in part at least, of the accumulated backlog of the individual's experience, which is built mostly in relation to others.[43] Kelley discounted a dualistic conception of the

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[39]Harrison H. Clarke, Application of Measurement to Health and Physical Education (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1959), p. 18.

[40]Bryant J. Cratty, Movement Behavior and Motor Learning (Philadelphia: Lea and Febiger, 1964), p. 126.

[41]Joseph S. Jacob, "Psychiatry, the Body Image and Identity," Values in Sports (Washington, D. C.: AAHPER, 1963), p. 201.

[42]Alfred Adler, What Life Should Mean to You (New York: G. P. Putnam's Sons, 1958), p. 21.

[43]Association for Supervision and Curriculum Development, ASCD Yearbook: Perceiving, Behaving, Becoming--A New Focus For Education (Washington, D. C.: National Education Association, 1962), p. 190.

physical body and the psychological self since the organism acts as a whole.[44]

According to a study by Zakrajsek, there is a significant relationship between self concept and motor ability at the .01 level of confidence. Students with high self concepts scored higher than students with low self concepts in motor performance. Students who scored high in motor performance had higher positive attitudes toward themselves, whereas students who scored low in motor performance had lower and more negative attitudes toward themselves.[45]

Zakrajsek also states that effects of a good physical education program can go deeper than the learning of skills. Physical activities, when well planned to meet individual needs, can and do contribute to the enhancement of the self. Good physical education programs offer one the opportunity to meet success, build self confidence, stabilize emotional and mental health, and formulate positive attitudes toward himself. The acceptance of the individual by his peer group does influence his own judgement of himself.[46]

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[44]Ibid., p. 14.

[45]Zakrajsek, Dorothy Berlin, "The Relationships Between Self Concept, Motor Ability and Peer Evaluation for Junior High School Girls," (unpublished Master's thesis, Michigan State University, East Lansing, 1966), p. 40.

[46]Ibid., p. 41.

Measuring the positive and negative changes in self concept is possible. This work, however, hinges upon the development of more refined methodology and far more sensitive instruments with which to measure these subtle changes in the self than are at present available.[47]

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[47]Gloria Ulert Greenberg, "The Effect of Success and Failure on the Tendency to Alter Attitudes Toward Self," (unpublished Master's thesis, University of Miami, Coral Gables, Florida, January 1, 1965), p. 42.

CHAPTER III

METHOD AND PROCEDURE

The purpose of this study was to analyze the effects of a combination exercise program and voluntary diet on selected anthropometric and physiological variables of overweight college women. An additional purpose was to determine whether or not changes in self concept occurred.

Source of Data

Skinfold measurements were taken from eighty-five volunteer females enrolled at South Dakota State University during the 1971-1972 college year. Sixty students with an overweight factor of twenty-five percent or more body fat were classified as subjects for the study. Of the original thirty women assigned to each group, one subject dropped from Group I (Experimental) and four from Group II (Control). Therefore Group I consisted of twenty-nine subjects and Group II had a total of twenty-six. Table V indicates the physical characteristics of the fifty-five subjects at the beginning of the study and appears in Appendix B.

Organization of the Study

On January 6, 1972, subjects with twenty-five percent or more body fat met with the investigator for an overview of the study. The self concept phase of the study, however, was not emphasized in order not to influence their answers on the Tennessee Self Concept Scale. Test dates and times were then set for each subject. On February 1, 2, and 3, 1972, initial weight, height, and girth measurements were taken. To determine

cardio-respiratory efficiency, the Astrand's Predicted Maximal Uptake Test was employed. The Tennessee Self Concept Scale was also administered to all subjects as a group on February 3, 1972.

The selected subjects were randomly assigned to one of two groups and the groups were then randomly designated as the Experimental Group (Group I) and the Control Group (Group II). On February 7, 1972, Group I began the exercise program which was held Monday through Friday for one hour a day for a total of thirty-six exercise days. The subjects also kept a calorie count of all foods eaten and reported to the investigator at weekly intervals.

Group II continued their regular daily eating routine and did not participate in the exercise program. Subjects also kept a calorie count which was turned in to the investigator once every week.

The subjects were retested on all parameters on March 30 and 31, 1972. On May 15 and 16 an additional follow-up test was administered to the experimental group of subjects to determine what would happen to the subjects after a period of time when they were not engaged in an organized exercise or diet routine. However, the subjects were not retested on the self concept scale on the third test.

Administration of the Treatment

The treatments administered to Group I consisted of the XBX Canadian Air Force Exercises, jogging, and various recreational activities.

XBX Royal Canadian Air Force Exercises. When the Royal Canadian Air Force set up its fitness program, plans were based on three facts: (1) physical fitness is a direct result of physical activity, (2) physical

activity leading to physical fitness must be vigorous and regular, and (3) people will accept challenge.[1] In addition, "research has clearly shown that the most effective way to take off weight and keep it off is through a program which combines exercise and diet."[2]

In the current study, the XBX was planned for gradual progression and levels were not skipped. The subjects performed two levels each day, five days a week. Each day, subjects were given twelve minutes to repeat or to move up one level if they had completed the previous level in the twelve minutes.

The purposes of the XBX exercises were to increase muscle tone, muscular strength, muscular endurance, flexibility, and efficiency of the heart. The first four exercises, toe touch, knee raise, lateral bend, and arm circle, were used to improve and maintain flexibility and mobility in those areas of the body which are usually neglected. The fifth exercise, sit-ups, was for strengthening the abdominal region and the hip flexor muscles. Exercise six, chest and leg raise, exercised the long muscles of the back, buttocks, and hamstrings. Exercise seven, side leg raise, concentrated on the muscles of medial sides of the thighs. Exercise eight, push-ups, was primarily for the arms, shoulders and chest. Exercise nine, leg lifting, was partly for flexibility in the waist area

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[1] Revised U. S. Edition of the Official Royal Canadian Air Force Exercise Plans for Physical Fitness (New York: Pocket Books, Inc., 1962), p. 1.

[2] Ibid., p. 7.

and for strengthening the muscles of the hips and sides. The tenth exercise, running in place with jumping, exercised the legs and was an aid in conditioning the heart and lungs.

The levels had been planned for gradual progression. The XBX incorporated a method to make the work load greater. The time limit for each exercise remained the same in all charts but the number of times the exercise was performed within this time limit was increased at each level within each chart. Popular music with a fast rhythm was often used during these exercises as a motivating factor.

Jogging. Jogging is an exercise that is more strenuous than a walk and can be a very vigorous exercise. Jogging can be varied with a change in the pace, distance covered, and the amount of time walking. A progressive program of jogging provides a gradual increase of stress placed on the cardiovascular and respiratory systems of the body.[3]

The jogging program in the present study was administered thirty out of the thirty-six days of training, on the average of four days a week. The program allowed each jogger to progress at her own rate based on her level of fitness. Subjects ran in the indoor hypodrome, outdoor track, or country roads, and were timed at each run. They all began with a run-walk pace of one mile during the first seven days of jogging with a mean time of 10:52. The next four days of jogging they ran 1.25 miles

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[3]Frederich B. Roby and Russell P. Davis, Jogging for Fitness and Weight Control (Philadelphia: W. B. Saunder Company, 1970), pp. 1-13.

with a mean time of 12:15. The following seven days of training they progressed to 1.50 miles with a mean time of 15:19, and increased to two miles for the last eleven days with a mean time of 19:15. Table I indicates the mean and range of time for each day of jogging.

Recreational activities. The first ten minutes of each session were devoted to various recreational activities. The purpose of having recreational activities was mainly for providing variety within the training period. Tumbling, rope jumping, and relays were some of these activities. During the recreational activities, the subjects were all constantly reminded to be active. Two Fridays, during the training period, were set aside for recreational volleyball and basketball. This was mainly for subject motivation and variety.

Calorie Counting Procedure

Dieting is still the most important method of weight control.[4] The subjects in Group I were put on a voluntary diet, each of them attempting to lessen their caloric intake from 500 to 1000 calories a day. The mean of the group before they began their voluntary diet was 2250 calories a day. This was determined by having each subject keep a calorie chart for three weeks before the actual training period began.

Subjects in Group I and Group II used a reprint of a section of the book Nutritional Data, by H. J. Heinz Company as a guide to the

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[4]Gordon E. Howard, "Diet, Exercise, and Weight Control," Consumer Bulletin, 51:27, October, 1968.

TABLE I

PROGRESSIVE JOGGING PROGRAM

Week	Day	Distance	Mean Time	Range
1	Monday	1.00 Mile	11:28	9:54
	Tuesday	1.00 Mile	11:31	7.04
	Thursday	1.00 Mile	11:06	6:18
	Friday	1:00 Mile	10:22	7:36
2	Tuesday	1.00 Mile	10:17	5:24
	Thursday	1.00 Mile	10:47	7:06
	Friday	1.00 Mile	10:58	4:42
3	Tuesday	1.25 Mile	12:36	9:24
	Thursday	1.25 Mile	12:42	9:42
	Friday	1.25 Mile	11:24	9:48
4	Monday	1.25 Mile	12:18	8:12
	Tuesday	1.50 Mile	16:36	9:24
	Thursday	1.50 Mile	15:06	11:30
	Friday	1.50 Mile	15:00	12:48
5	Monday	1.50 Mile	15:00	11:30
	Tuesday	1.50 Mile	14:20	10:24
	Wednesday	1.50 Mile	15:30	10:02
	Thursday	1.50 Mile	15:43	7:17
6	Monday	2.00 Mile	19:48	10:00
	Tuesday	2.00 Mile	18:48	10:18
	Wednesday	2.00 Mile	17:24	10:18
	Thursday	2.00 Mile	17:54	11:54
	Friday	2.00 Mile	17:06	11:48
7	Monday	2.00 Mile	17:54	10:06
	Tuesday	2.00 Mile	20:03	11:00
	Wednesday	2.00 Mile	20:03	9:47
	Thursday	2.00 Mile	20:33	10:52
	Friday	2.00 Mile	20:40	10:46
8	Monday	2.00 Mile	21:34	12:23

number of calories they consumed each day. Group I attempted to consume fewer calories than they had previously and Group II was instructed to continue their regular eating habits. Charts developed by the investigator were used by the subjects to fill in the approximate amounts and types of food plus the approximate number of calories in each food. Every Thursday the subjects would report with their charts to the investigator. Honesty and accuracy were emphasized. Appendix A indicates the caloric chart which was used. Table IV indicates calorie consumption mean per week for Group I and Group II and appears in Appendix B.

Method of Collecting Data

Identical procedures of measurement were used for all subjects on all tests. Dressed in a minimal amount of clothing, the subjects' weight, height, three girth measurements, and two skinfold measurements were taken and recorded.

Weight. Each subject was weighed in a minimal amount of clothing to an accuracy of one-quarter pound. Data appear in Table VIII, Appendix B.

Height. Height was measured to the nearest one-half centimeter, each subject with her feet flat, eyes straight ahead, and back in contact with the measuring rod. Each subject was instructed to reach the ceiling with the posterior-superior portion of her head. The height was then measured. Data appear in Table IX, Appendix B.

Girth measurements. With the use of anthropometric tape, girth measurements were taken and recorded to the nearest one-half centimeter.

The tape was used to measure the waist, hip, thigh, and upper arm. It was pulled just tight enough to be smooth. The subjects were instructed to stand with their feet in a natural position and body erect. The waist measurement was taken around the waist just above the iliac crest but below the last rib. The hip measurement was taken around the hip on a line from the lateral projections of the greater trochanters of each femur bone. The thigh measurement was taken at a line around the thigh below the gluteus maximus muscle fold. The upper arm girth measurement was made around the right arm at a line below the insertion of the deltoid muscle with the arm adducted and hanging freely at the subject's side. Data appear in Table X, XI, and XII for hip, thigh, and arm measurements respectively and appear in Appendix B.

Skinfold measurement. Three measures of adipose tissue were taken from each of the two sites on each subject using the Lange Skinfold Calipers. The mean of the three measurements was calculated and recorded in millimeters. From these computed means, the density was computed employing the formula recommended by Sloan.[5]

Density = 1.0764 - 0.00081 (Suprailiac) - 0.00088 (Arm)

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[5]A. W. Sloan, J. J. Burt, and C. S. Blyth, "Estimation of Body Fat in Young Women," Journal of Applied Physiology, 17:967-970, November, 1962.

From this density formula, the percent of body fat was calculated by using a formula by Brozek.[6]

$$\text{Percent Body Fat} = \frac{4.57}{\text{density}} - 4.142$$

To measure skinfold, loose tissue on the specific parts of the body was grasped. This tissue included a double layer of skin plus subcutaneous fat. Muscle was not included in the measurement. Skinfold measurements were taken on the right side of the body at the locations of the suprailiac crest and over the triceps of the upper arm.

The suprailiac skinfold was taken on the right hip at a point at the top of the crest of the illium or hip bone.[7] A vertical grasp of skin was taken and the calipers grasped about one centimeter below the site where the skinfold was lifted.

The upper arm measurement was taken on the triceps at a point halfway between the tip of the acromial process and the tip of the elbow. The shoulder was adducted and the elbow bent at a ninety degree angle while a grasp of skin was taken. The arm was then dropped and hung freely. The skinfold was lifted on the back side of the right arm parallel to the long axis of the arm. The calipers grasped about one centimeter below the site where the skinfold was lifted. Data appear in Table XIII, Appendix B.

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[6]Josef Brozek, "Densitometric Analysis of Body Composition: Revision of Some Quantitative Assumption," Annals of New York Academy of Science, 110:130, 1963.

[7]Henry J. Montoye (ed.), An Introduction to Measurement in Physical Education, Vol. II, Growth, Development, and Body Composition (Indianapolis, Indiana: Phi Epsilon Kappa Fraternity, 1970), pp. 55-56.

Cardio-respiratory efficiency. Astrand's Predicted Maximal Oxygen Uptake Test was used to measure cardio-respiratory efficiency in each of the subjects.[8] The test was used to predict the maximum oxygen uptake from the steady state of the heart during submaximal exercise. Pedal frequency was kept constant by the use of a metronome as each subject rode the bicycle ergometer six minutes, beginning at a load of one and one-half kilograms and with a pedal frequency of fifty revolutions per minute. The heart rate of each subject was taken with a stethoscope the last fifteen seconds of each minute. The intensity of the work brought the heart rate to a steady state of 130 to 150 beats per minute after six minutes. If the heart rate did not reach a steady state of 130 beats per minute after two to three minutes, the work load was increased by one half kilogram. Also if the heart rate exceeded 150 beats per minute at any time during the six minutes, the work load was decreased by one half kilogram. An average of the last two minutes was used to predict the maximal oxygen uptake in liters per minute. The subject's weight was the basis for recording maximal oxygen uptake in milliliters per kilogram of body weight per minute (ml/kg/min) by employing the Astrand Rhyming nomogram. Prior to the initial testing, the subjects were oriented to the riding on the ergometer. Data appear in Table XIV, Appendix B.

Tennessee Self Concept Scale. The self concept has become a popular and important means of studying and understanding human behavior. The

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[8]Per-Olaf Astrand, Work Test with the Bicycle Ergometer (Varber Sweden: Monark-Crescent AB), pp. 16-39.

individual's concept of himself has been demonstrated to be highly influential in much of his behavior and also to be directly related to his general personality.[9]

The Tennessee Self Concept Scale is comprised of 100 self descriptive statements which the subject used to portray his own picture of himself. The scale is available in two forms; the Counseling Form and a Clinical and Research Form. In this study, the Counseling Form was administered, because of its appropriateness for self-interpretation, to both Group I and Group II on February 3, 1972, and again on March 31, 1972.

At the time of the testing, the subjects were not told the test dealt with self concept. They were instructed to fill out the questionnaire and to answer the questions honestly. Also they were told that no one other than the investigator would see their answers. The test covered ten general areas which were: "self criticism," "identity," "self satisfaction," "behavior," "physical self," "moral-ethical self," "personal self," "family self," "social self," and the "total positive score." The "total positive score" was used by the investigator to determine changes in self concept, because, in Fitts' estimation, it is the most important single score on the Counseling Form. It reflects the overall level of self esteem.[10]

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[9]William H. Fitts, Tennessee Self Concept Scale (Nashville, Tennessee: Counselor Recordings and Tests, 1965), p. 1.

[10]Ibid., p. 2.

Table VI indicates the means of ten areas of the Tennessee Self Concept Scale from Test I and Test II of Group I and Group II. Table VII indicates the raw data for the Tennessee Self Concept Scale. Both tables appear in Appendix B.

CHAPTER IV

ANALYSIS AND DISCUSSION OF RESULTS

Organization of Data for Analysis

The data collected in this study were analyzed to determine the significance of the changes in the selected parameters from Test I to Test II for the Control Group as compared to the changes from Test I to Test II for the Experimental Group. The data were also analyzed to determine what changes occurred in the Experimental Group as a result of a discontinuance of the exercise and voluntary diet control program.

An analysis of covariance was completed to compute an F ratio to determine whether there was a significant difference among the changes of the groups' means from Test I to Test II.[1] The analysis of covariance corrected final means to account for initial mean differences between the groups.[2] The .05 level of confidence was accepted as the minimal level needed in order for a difference to be considered significant. Raw scores for all parameters appear in Appendix B.

Analysis of the Data

Table II shows the pre-training and post-training means for the two groups in the parameters measured, and the final test means (Test III) from Group I.

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[1]Jerome C. Weber and David R. Lamb, Statistics and Research in Physical Education (St. Louis: The C. V. Mosby Company, 1970), p. 151.

[2]Ibid., p. 146.

TABLE II

TABLE OF MEAN CHANGES ON ALL PARAMETERS

Variable	Group I			Group II	
	Test I	Test II	Test III	Test I	Test II
Body Weight (lbs.)	154.20	150.06	151.40	147.83	149.59
Waist (cm.)	76.71	73.71	75.21	76.00	76.10
Hip (cm.)	100.50	98.03	99.19	99.15	99.59
Thigh (cm.)	65.05	62.84	63.98	59.77	59.92
Arm (cm.)	28.47	27.48	28.34	28.15	28.60
Percent Body Fat (%)	28.42	25.89	26.69	27.81	27.39
Maximal Oxygen Uptake (ml/kg/min)	31.10	45.48	37.20	30.81	34.12
Total Positive Score (points)	319.48	334.48		315.31	319.62

The limits which the F ratio needed to reach to achieve significance with one and fifty-two degrees of freedom was 4.04 at the .05 level of confidence and 7.19 at the .01 level of confidence.[3] Table III shows the analysis of covariance for the two groups in the parameters measured. The F ratios of 22.926, 24.295, 27.033, 22.157, 22.611, 15.867, and 64.633 obtained for waist, hips, weight, arm, percent body fat, thigh, and cardio-respiratory efficiency indicated a significant difference among the groups beyond the .01 level of confidence. The F ratio for "total positive score" on the self concept scale did not indicate a significant difference among the groups. From looking at the means, it can be seen that the Experimental Group showed a significant improvement over the Control Group in all parameters except "total positive score."

Discussion of Results

A study of statistical information compiled as a result of this study indicates that the Experimental Group improved to a significant degree over the Control Group in the changes of waist measurement, hip measurement, arm measurement, thigh measurement, body weight, percent body fat, and cardio-respiratory efficiency as measured by the predicted maximal oxygen uptake test. Within the limitations of this study, exercise, jogging, and diet would seem to be a good program for college women for improvement in the above parameters. No significant difference among the groups was found in "total positive scores" on the Tennessee Self Concept Scale.

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[3]Ibid., p. 232.

TABLE III

RESULTS OF ANALYSIS OF COVARIANCE ON ALL PARAMETERS

TEST I - TEST II

Variable	Source of Covariance	df	SS (Adjusted)	MS (Adjusted)	F*
Body Weight	Treatment	1	410.09	410.09	27.033
	Error	52	788.76	15.17	
Waist	Treatment	1	120.82	120.82	22.926
	Error	52	274.10	5.27	
Hips	Treatment	1	122.69	122.69	24.295
	Error	52	262.81	5.05	
Thigh	Treatment	1	45.38	45.38	15.867
	Error	52	148.60	2.86	
Arm	Treatment	1	25.48	25.48	22.157
	Error	52	59.58	1.15	
Percent Body Fat	Treatment	1	59.92	59.92	22.611
	Error	52	137.88	2.65	
Cardio-Respiratory Efficiency	Treatment	1	1706.31	1706.31	64.633
	Error	52	1372.53	26.40	
Total Positive Score	Treatment	1	2055.05	2055.05	3.06
	Error	52	34904.96	671.25	

*$F_{.05}(1/52) = 4.04$, $F_{.01}(1/52) = 7.19$

The investigator found remarkable improvements in the anthropometric measurements of the subjects as a result of an exercise and diet program. Significant losses were found in all four measurements taken. In Krause's study, the jogging program, without a diet routine, showed a significant improvement in only thigh measurement, with no significant change in waist, hip, or arm.[4] Roby and Davis indicated that fat deposits tend to accumulate in the thigh and hip regions in women. During weight loss, fat will be reduced all over the body but in proportion to the amount present at any given site or location.[5] Fox indicates that exercise during weight reduction and a sound diet are two necessities in preventing obesity.[6] This is also in agreement with Cooper who explains that exercise alone will not take off weight but calorie intake must be lessened.[7] The results of the current study support this literature.

The Experimental Group, involved in dieting and exercise, did have more significant physiological changes than the subjects in Krause's jogging program. Perhaps this was due to the additional diet factor, but could be attributed to the greater amount of exercise as compared to that administered by Krause. In the Krause investigation, jogging was the only

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[4]Jo Ann Krause, "Effects of An Appetite Suppressant and Exercise Upon Selected Physiological and Anthropometric Measurements in Overweight College Women" (unpublished Master's thesis, South Dakota State University, Brookings, South Dakota, 1971), pp. 40-41.

[5]Frederick B. Roby and Russell P. Davis, Jogging For Fitness and Weight Control (Philadelphia: W. B. Saunders Company, 1970), pp. 22-26.

[6]Samuel M. Fox III, Obesity and Health (Washington, D. C.: U. S. Department of Health, Education, and Welfare, 1966), p. 46.

[7]Kenneth H. Cooper, Aerobics (New York: M. Evans Company, Inc. 1968), pp. 136-137.

form of exercise and was administered four days a week, for eight weeks. Subjects in the present study exercised five days a week and jogged on the average of four days a week for thirty-six training days. The jogging was also done over a longer distance than in Krause's study.[8]

It was evident to the investigator that the subjects were being exercised adequately. Each day two levels of XBX were completed by each subject, each one within twelve minutes. There were complaints of soreness throughout the jogging program, and each day from ten to fifteen subjects found it necessary to have their ankles taped.

Cooper states that if exercise is of sufficient intensity and duration, a training effect will be produced which will increase the capacity of the body to utilize oxygen.[9] Cardio-respiratory efficiency, in the present study, increased in the Experimental Group from a mean of 31.10 ml/kg/min for Test I to 45.48 ml/kg/min in Test II. Krause,[10] Yeager and Brynteson,[11] and Lengkeek[12] have also reported significant increases in cardio-respiratory fitness as a result of exercising programs, however, their reported increases were not as great as were found

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[8]Krause, op. cit., p. 23.

[9]Cooper, op. cit., p. 16.

[10]Krause, op. cit., p. 41.

[11]Susan Yeager and Paul Brynteson, "Effects of Varying Training Periods on the Development of Cardiovascular Efficiency of College Women," Research Quarterly, 41:590, December, 1970.

[12]Betty Lengkeek, "Selected Anatomical and Physiological Responses as Affected by a Rope-Skipping and Cycling Program for College Women," (unpublished Master's thesis, South Dakota State University, Brookings, South Dakota, 1971), p. 41.

in this study. Subjects in Krause's jogging program increased in cardiorespiratory efficiency from 28.15 ml/kg/min to 32.82 ml/kg/min, an increase of only 4.67 ml/kg/min[13] compared to the increase of 14.38 ml/kg/min in the present study. Yeager's subjects, who exercised thirty minutes, three days per week, increased in maximal oxygen uptake from 38 to 46 ml/kg/min,[14] which was below the increase found in this study. Such results provide further evidence as to the sufficiency of the exercise program followed in the current study.

Although the mean weight loss in the Experimental Group was only 4.14 pounds compared to a 1.76 pound increase in the control group, this represented a significant difference between the two groups. All but four subjects in the present study, involved in the thirty-six day training program, showed a decrease in weight. Individual losses varied from -0.75 pound to -10.75 pounds. This indicates that body weight can be reduced by vigorous daily exercise with a combined voluntary diet. Krause found a weight loss in her subjects of 2.86 pounds after eight weeks of jogging which was less than the weight loss found in the present study.[15]

Norms had been previously established using percentile scores of a standardized group test on the Tennessee Self Concept Scale. A broad sample of 626 people from various parts of the country ranging in age

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[13]Krause, op. cit., p. 64.

[14]Yeager and Brynteson, loc. cit.

[15]Krause, op. cit., p. 52.

from twelve to sixty-eight were used as subjects."[16] In comparison to the established norms, for Test I (initial test), Group I's "total positive score" mean was found to be in the fortieth percentile. For Test II (final test), the mean for Group I increased to the forty-sixth percentile. The mean scores of Group II changed slightly from the thirty-ninth percentile for Test I to the fortieth percentile for Test II.

Although there was no significant difference in changes from Test I to Test II between Groups I and II, there was a positive increase in nine out of the ten areas of the self concept test for the Experimental Group from Test I to Test II. The "total positive score" mean increased from 319.31 to 334.48. This increase is consistent with most findings and reports. Strang states, " . . . acceptance of bodily changes contributes to the self concept."[17]

Perhaps the weight loss of the group, even though significant, was not great enough to cause the difference in the change in "total positive score" between Group I and Group II to reach the .05 level of confidence. Although a change may not have been significantly evident on the Tennessee Self Concept Scale, Schneiders believes that body image, size and appearance have deep seated psychological implications.[18] Perhaps the eight

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[16]William H. Fitts, Tennessee Self Concept Scale (Nashville, Tennessee: Counselor Recording and Tests, 1965), p. 13.

[17]Ruth Strang, The Adolescent Views Himself (New York: The Macmillan Company, 1963), p. 81.

[18]Alexander A. Schneiders, Adolescents and the Challenge of Maturity (Milwaukee: Bruce Publishing Company, 1965), pp. 195-197.

week program in the current study was not long enough to cause significant changes in self concept if, as Schneiders proposes, this is a "deep seated" trait.

Even though self concept results were not statistically significant, all subjects who lost weight indicated to the investigator that they felt their self image had improved. The subjects believed that their confidence in themselves increased as they found they could improve in the number of sit-ups done or in the number of laps run. Jacob believes confidence can be built through physical education activities. The individual learns to appreciate her own body through a reinforcement of "what I can do."[19] Also, Zakrajsek states that good physical education programs offer one the opportunity to meet success, build self confidence, stabilize emotional and mental health, and formulate positive attitudes toward himself.[20]

For the interest of the investigator, the Tennessee Self Concept Scale was also administered to the 1972 top five Miss South Dakota State University queen candidates. Their "total positive score" mean was 360 which was much higher than the "total positive score" means from the Experimental Group, and ranked in the fifty-fifth percentile. According to Fitts, persons with high scores tend to like themselves, feel that they

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[19]Joseph S. Jacob, "Psychiatry, the Body Image and Identity," Values in Sports (Washington, D. C.: AAHPER, 1963), p. 201.

[20]Dorothy B. Zakrajsek, "The Relationships Between Self Concept, Motor Ability, and Peer Evaluation for Junior High School Girls," (unpublished Master's thesis, Michigan State University, East Lansing, 1966), p. 40.

are persons of value and worth, have confidence in themselves, and act accordingly.[21] The mean score of the five queen candidates on the "social aspect" of the test was 74.0 (fifty-eighth percentile) in comparison to the Experimental Group's mean scores of 64.45 (forty-fourth percentile) for Test I and 67.52 (forty-ninth percentile) for Test II. This section of the test refers to "self as perceived in relation to others," It reflects the person's sense of adequacy and worth in his social interaction with other people.[22] Cratty states that according to Coleman in his study, "The Adolescent Society," girls could succeed socially by being attractive, dressing well, . . ."[23]

A final test (Test III) was administered to the Experimental Group six weeks after the completion of the exercise and diet program. The results of Test I to Test II from the Experimental Group show a mean weight loss of 4.14 pounds. The mean change in weight from Test II to Test III was a gain of 1.34 pounds. Subjects tended to lose weight during the training period but could not continue this loss after the program. Similar changes also occurred in the Experimental Group with all other measurements. Subjects tended to improve in all parameters during the training period, but began to return to the point from which they started after the exercise program. This is in accord with Modell who has done considerable work in the area of drugs. He states that

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[21]Fitts, op. cit., p. 2.

[22]Fitts, op. cit., p. 3.

[23]Bryant J. Cratty, Movement, Behavior, and Motor Learning (Philadelphia: Lea and Febiger, 1964), p. 126.

ninety percent of obesity cases are psychogenic. Regardless of the measures used to help the obese patient lose weight, unless something positive is done about the psychogenic factors involved, when drug treatment stops, the painfully lost pounds will inevitably find their way back.[24] Although Modell dealt with a drug treatment, the investigator believes the treatment of exercise and diet could also apply.

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[24] Walter Modell (ed.), Drugs of Choice 1970-1971 (St. Louis: The C. V. Mosby Company, 1970), p. 284.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was twofold: to analyze the effects of a combination exercise program and voluntary diet on selected anthropometric and physiological variables of overweight girls, and to determine if measurable changes in self concept were evident.

The subjects in this study were fifty-five female students at South Dakota State University who were considered overweight by a factor of twenty-five percent body fat. All subjects were pre-tested to determine their initial physical characteristics as measured by the following parameters: six anthropometric measurements, cardio-respiratory efficiency, and "total positive score" on the Tennessee Self Concept Scale.

The subjects were randomly assigned to the Experimental Group or Control Group after the initial testing. The Experimental Group took part in a thirty-six day exercise and jogging program and voluntary diet.

This study, including all testing periods, was completed over a period of eighteen weeks and six days, from January 6, 1972, to May 16, 1972. The experimental treatment was a period of thirty-six training days beginning February 7, 1972, and ending March 30, 1972 with Test I preceding the treatment. Test II followed the thirty-six day treatment. All parameters were measured in both tests. Exact tests were administered on the same dates to the Control Group. The Experimental Group was given an additional follow-up test on May 15 and 16 on all parameters except the self concept scale.

The analysis of covariance technique was used to compare the effects of the changes in the Experimental Group to the changes in the Control Group from Test I to II. The .05 level of confidence was accepted as the minimal level needed in order for a difference to be significant. The results revealed that the Experimental Group improved in all variables to a significant degree over the Control Group with the exception of self concept. Results in Test III for the Experimental Group revealed that all parameters began to retrogress towards Test I levels after a discontinuation of the exercise and voluntary diet control program.

Conclusions

Under the conditions of this present study, and within the limitations described, the following conclusions were drawn:

1. Significant improvements in physiological and anthropometrical variables occurred as a result of a voluntary diet and exercise program.

2. Significant but small improvements in body weight and girth measurements does not bring about concurrent significant changes in self concept.

Recommendations

The following recommendation is made for further study:

1. Because of the great interest by overweight college women, that a program similar to this should be made a part of the curriculum of Health, Physical Education and Recreation at South Dakota State University.

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APPENDICES

APPENDIX A

FOODS AND THEIR NUMBER OF CALORIES

Dairy Products		
Butter	716	1 tbsp.
Cheese		
Cheddar	398	1 oz. (1" cube)
Cottage	95	1 oz. cottage
Cream cheese	371	1 oz.
Swiss	370	1 oz.
Cream	204	1 tbsp.
Whipping cream	130	1 tbsp.
Ice cream (plain)	207	1 slice
Milk		
Fluid, whole	68	1 cup
Fluid, non-fat	36	1 cup
Malted beverage	104	1 cup
Sherbert	123	1/2 cup
Fats, Oils		
Cooking fats, vegetable	884	1 cup
Margarine	320	1 tbsp.
Mayonnaise	308	1 tbsp.
Oils, salad or cooking	384	1 tbsp.
Salad dressing, French	394	1 tbsp.
Fruits		
Blueberries (raw)	61	1 cup
Blueberries (cnd., sweet)	98	1 cup
Cranberries (raw)	48	1 cup
Cranberry sauce (canned)	198	1 cup
Raspberries, red (frozen)	98	3 oz.
Strawberries (frozen)	95	3 oz.
Citrus fruit		
Grapefruit (raw)	40	1 cup sections
Grapefruit (canned)	72	1 cup
Orange	45	1 medium (2 1/2" diameter)
Tangerine	44	1 medium (2" diameter)
Melon		
Cantaloupes	20	1/2 melon (5" diameter)
Watermelon	28	1/2 slice (3/4" x 10")

Tree, Vine and Other Fruits		
Apples (raw)	58	1 medium ($2\frac{1}{2}$" diameter)
Apricots (canned, sweet)	80	4 medium halfs, 2 tbsp.
Banana	88	1 medium (6 x $1\frac{1}{2}$")
Cherries (raw)	61	1 cup pitted
Cherries (red, sour, canned)	48	1 cup pitted
Dates (dried)	284	1 cup pitted
Figs (canned, sweet)	113	3, 2 tbsp. sirup
Grapes		
Peaches (raw)	46	1 cup
Peaches (canned, sweet)	68	1 cup
Pears (raw)	63	1 medium
Pears (canned, sweet)	68	2 halfs, 2 tbsp. sirup
Raisins (dry)	268	1 cup
Fruit Juices		
Apple juice (frozen or canned)	50	1 cup
Apple sauce (frozen or canned)	72	1 cup
Fruit cocktail, (canned, sweet)	70	1 cup
Grape juice (canned, sweet)	67	6 oz.
Grapefruit juice (canned, sweet)	52	1 cup
Orange juice (fresh)	44	1 cup
Orange juice (canned)	44	1 cup
Pineapple juice (canned)	49	1 cup
Prune juice (canned)	71	1 cup
Tomato juice (canned)	21	1 cup
Grains and Grain Products		
Bran Flakes	292	1 cup
Corn Flakes	385	1 cup
Oatmeal, cooked	63	1 cup
Puffed Rice	392	1 cup
Puffed Wheat	355	1 cup
Baked and Cooked Products		
Breads		
French or Vienna	270	1 lb.
Raisin	284	1-1/2" slice
Whole wheat bread	240	1-1/2" slice
Rye bread	244	1-1/2" slice

Cakes		
Angel Food	270	2" section of 3" cake
Foundation	350	1 square, 3x2x1
Fruit, dark	354	2x2x$\frac{1}{2}$
Plain	327	1 cupcake
Sponge	291	2" section of 8" cake
Corn bread	219	1, 2" muffin
Crackers, graham	393	2 medium
Crackers, saltine	431	2, 2" square
Doughnuts	425	1
Fig bars	350	1 large
Gingerbread	327	1, 2" cube
Macaroni and cheese cooked	211	1 cup
Muffins	280	1, 2" muffin
Noodles, cooked (egg)	67	1 cup
Pancakes, wheat	218	1, 4" sector of 9" diam.
Pancakes, buckwheat	176	1, 4" diameter
Pies		
Apple	246	1, 4" sector of 9" diam.
Mince	252	1, 4" sector of 9" diam.
Pumpkin	202	1, 4" sector of 9" diam.
Pretzels	369	5 small sticks
Rolls, plain	309	1 roll
Rolls, sweet	323	1 roll
Spaghetti, Cooked	149	1 cup
Waffles	287	1, $4\frac{1}{2}$x5x$\frac{1}{2}$
Nuts and Nut Products		
Almonds, dry	597	1 cup
Brazil nuts, shelled	646	1 cup
Cashews, roasted	578	1 cup
Chestnuts, fresh	191	20 chestnuts
Coconut, dry, sweet	556	1 cup shredded
Peanuts, roasted	559	1 cup
Peanut butter	576	1 tbsp.
Pecans, raw	696	1 cup of halves
Walnuts, raw	654	1 cup halves
Meat, Poultry and Sea Food		
Beef		
Chuck, cooked	309	3 oz. chuck
Hamburger	364	3 oz. ground
Porterhouse, cooked	342	3 oz. steak
Rib roast, cooked	319	3 oz. roast
Round, cooked	233	3 oz. round
Corn beef, canned	216	3 oz. corned
Corn beef hash, canned	141	3 oz. hash

Dried or chipped beef	203	2 oz. dried
Roast beef, canned	224	3 oz. roast
Lamb		
Medium fat, raw	317	3 oz.
Rib chop, raw	356	4 oz. chop
Rib chop, cooked	418	4 oz. chop
Leg roast, raw	235	3 oz. roast
Leg roast, cooked	274	3 oz. roast
Pork		
Bacon, fried	607	2 slices
Ham, fresh, raw	344	3 oz. ham
Ham, cured, cooked	397	3 oz. ham
Pork luncheon meat, canned	289	2 oz.
Veal		
Veal, medium fat	190	4 oz.
Veal cutlet, cooked	219	3 oz. cutlet
Stew meat, cooked	296	3 oz.

Variety Meats and Mixtures

Chile con carne	600	1 cup
Liver, beef, raw	136	3 oz.
Liver, beef, fried	208	2 oz.
Sausage, bologna	221	1x1½" diameter
Sausage, frankfurter (cooked)	248	1, 7x3/4"
Sausage, pork, raw		

Fish and Sea Foods

Bluefish, baked	155	4 oz.
Frog legs, raw	73	4 oz.
Haddock, cooked	158	1 fillet 4x3x½"
Halibut, cooked	182	1 fillet 4x3x½"
Lobster, canned	92	3 oz.
Oyster stew	91	1 cup, 6-8 oysters
Salmon, canned	203	3 oz.
Sardines, canned	278	4 oz.
Scallops, raw	78	4 oz.
Shrimp, canned	127	3 oz.
Tuna fish	198	3 oz. drained

Eggs and Poultry

Chicken, fryers, raw	112	1 breast
Chicken, roaster, raw	200	4 oz.
Duck	322	4 oz.
Goose	366	4 oz.
Turkey	268	4 oz.
Eggs, raw, whole	162	1 medium

Sugars and Sweets

Caramels	415	7/8" square x 1/2"
Fondant	352	1" square x 5/8"
Fudge, plain	411	2" square x 5/8"
Marshmallows	325	5, 1 1/2" diameter
Peanut Brittle	441	1 1/2" x 3"
Chocolate syrup	209	1 tbsp. syrup
Cocoa (beverage with milk)	95	1 cup
Honey	294	1 tbsp.
Jellies	252	1 tbsp.
Syrup (table blends)	252	1 tbsp.

Vegetables

Roots and tubers		
Beets, red, raw	42	1 cup diced
Carrots, raw	42	grated, 1 cup
Carrots, canned	30	diced, 1 cup
Potatoes, sweet, raw	123	1, 6" x 1 3/4"
Sweet, boiled	123	1, 5" x 2 1/2"
Candied	179	1, 6" x 1 3/4"

APPENDIX B

TABLE IV

CALORIE CONSUMPTION

Week	Mean	
	Group I	Group II
February 7 - 13	1208	1601
February 14 - 20	1256	1640
February 21 - 27	1299	1716
February 28 - March 5	1195	1766
March 6 - 12	1271	1808
March 13 - 19	1251	1735.
March 20- 26	1289	1778
March 27 - April 2	1408	
April 10 - 16	1612	
April 17 - 23	1527	
April 24 - 308	1494	
May 1 - 7	1705	
May 8 - 14		

TABLE V

PHYSICAL CHARACTERISTICS OF FIFTY-FIVE SUBJECTS AT THE BEGINNING OF THE STUDY

Subject	Group	Age	Height	Weight	% Body Fat
1	I	19	166.0	144.75	25.3
2	I	20	177.0	173.50	31.2
3	I	19	165.0	147.25	28.6
4	I	20	163.5	144.25	32.4
5	I	19	166.0	152.25	28.6
6	I	18	154.0	129.00	28.6
7	I	19	167.5	154.50	32.2
8	I	20	160.0	167.00	32.5
9	I	18	170.0	138.50	25.4
10	I	19	166.5	141.50	25.3
11	I	20	161.5	137.75	25.3
12	I	29	152.5	164.50	31.7
13	I	20	168.0	149.50	25.3
14	I	19	169.5	193.25	28.2
15	I	19	158.5	138.50	25.3
16	I	18	156.5	137.25	25.0
17	I	18	161.0	145.25	26.8
18	I	20	164.0	159.00	27.2
19	I	18	166.5	172.75	30.6
20	I	19	155.5	173.25	32.7
21	I	19	163.0	149.00	28.6
22	I	19	162.5	150.00	28.6
23	I	21	171.0	179.00	30.4
24	I	18	170.0	175.00	33.8
25	I	18	170.0	163.75	28.7
26	I	19	158.0	158.00	29.0
27	I	19	167.0	136.25	25.2
28	I	18	163.0	130.75	25.6
29	I	19	169.5	166.50	26.1
Mean	I	19.34	164.22	149.42	28.42

TABLE V (Continued)

Subject	Group	Age	Height	Weight	% Body Fat
30	II	18	166.5	142.25	25.2
31	II	18	163.0	157.00	27.1
32	II	19	166.0	135.50	25.4
33	II	19	167.0	145.75	26.5
34	II	19	167.5	141.75	29.5
35	II	19	165.0	172.50	28.6
36	II	19	161.0	126.50	26.8
37	II	19	169.5	175.50	29.8
38	II	19	162.0	135.00	29.7
39	II	21	154.0	130.75	26.2
40	II	18	167.5	174.00	31.7
41	II	19	162.0	136.00	25.2
42	II	18	169.5	163.25	28.8
43	II	19	168.5	156.75	29.5
44	II	18	163.5	158.25	25.2
45	II	19	172.0	152.00	29.8
46	II	18	165.0	131.00	26.9
47	II	21	167.5	197.75	34.3
48	II	20	166.5	142.75	30.4
49	II	18	162.5	153.50	26.5
50	II	18	151.0	120.50	25.2
51	II	19	156.0	129.75	29.3
52	II	19	156.0	129.75	27.3
53	II	18	167.0	123.50	26.1
54	II	18	176.0	162.50	27.3
55	II	18	156.5	134.25	25.2
Mean	II	18.77	164.75	147.85	27.81

TABLE VI

TENNESSEE SELF CONCEPT SCALE

MEANS OF TEST 1 AND TEST 2 OF GROUP I AND GROUP II

	Group I		Group II	
	T_1	T_2	T_1	T_2
Self Criticism	37.69	36.45	38.54	37.65
Total Positive Score	319.31	334.48	315.31	319.62
Row I (Identity)	119.83	125.48	116.39	118.73
Row II (Self-satisfaction)	93.03	98.48	89.46	94.65
Row III (Behavior)	106.59	110.55	101.46	105.73
Column A (Physical self)	59.52	64.07	57.69	59.54
Column B (Moral-ethical self)	67.10	68.00	63.27	66.39
Column C (Personal self)	61.35	64.38	57.08	60.04
Column D (Family self)	67.69	70.48	66.08	67.27
Column E (Social self)	64.45	67.52	63.50	65.69

TABLE VII

RAW DATA FOR THE TENNESSEE SELF CONCEPT TEST
(Group 1, Test 1)

Subject	Self Criti-cism	Total P	1	2	3	A	B	C	D	E
1	40	335	127	101	105	63	76	61	66	67
2	39	305	120	85	100	52	65	59	63	66
3	45	370	137	110	123	68	73	71	83	75
4	31	384	134	122	129	67	89	71	82	76
5	43	337	130	101	108	65	62	69	75	68
6	39	295	106	87	99	59	67	54	56	56
7	42	317	121	93	103	59	66	60	66	66
8	25	275	72	116	92	56	49	71	57	57
9	47	295	122	73	101	62	50	50	69	64
10	35	286	103	92	93	57	65	54	67	55
11	29	336	129	94	117	66	80	57	67	69
12	35	345	128	101	115	59	81	70	70	64
13	45	310	115	95	100	61	60	66	65	58
14	41	285	107	82	95	58	59	47	49	70
15	43	320	125	89	106	58	64	57	77	64
16	41	366	136	112	117	68	75	70	79	73
17	33	304	115	83	104	50	69	60	57	66
18	47	326	128	87	112	62	58	64	74	69
19	37	295	121	68	106	52	58	59	67	59
20	28	315	113	85	113	49	78	58	68	58
21	34	307	120	86	100	56	69	58	70	54
22	47	286	108	78	99	55	59	56	52	64
23	40	305	116	88	101	57	65	62	65	56
24	31	317	118	89	112	52	67	59	78	63
25	32	354	130	107	116	64	78	68	71	72
26	44	301	119	90	95	53	65	57	63	66
27	35	336	125	104	109	69	64	67	73	65
28	31	316	121	84	107	65	61	58	64	64
29	34	337	129	96	114	64	74	66	70	64
Means	37.69	318.62	119.83	93.03	106.59	59.52	67.10	61.35	67.69	64.45

TABLE VII (Continued)

RAW DATA FOR THE TENNESSEE SELF CONCEPT TEST
(Group 1, Test 2)

Subject	Self Criticism	Total P	1	2	3	A	B	C	D	E
1	44	336	127	103	109	70	71	63	65	70
2	37	320	128	88	105	56	63	64	70	67
3	37	372	147	112	115	70	74	72	81	76
4	32	400	145	129	126	76	91	72	84	76
5	43	360	144	109	107	69	68	66	84	73
6	38	296	112	80	102	57	62	55	60	60
7	41	334	122	107	105	62	67	61	73	71
8	35	303	119	80	102	58	60	54	62	67
9	48	285	116	69	100	58	45	53	68	61
10	38	326	121	103	102	63	60	65	68	70
11	23	397	131	129	138	70	90	75	80	83
12	41	345	130	102	113	62	76	68	72	67
13	36	320	114	96	110	65	64	63	66	62
14	39	296	111	78	105	55	65	50	54	71
15	43	360	122	112	127	66	74	71	86	63
16	33	362	126	117	118	70	70	71	79	72
17	29	326	119	93	114	64	64	69	61	68
18	45	352	137	92	123	73	68	67	71	73
19	33	380	143	124	113	64	83	75	84	74
20	24	336	122	99	118	65	75	60	75	64
21	35	310	120	93	97	59	63	63	65	60
22	47	296	116	80	100	56	56	60	63	61
23	33	307	124	87	98	58	64	63	67	57
24	41	305	108	90	107	56	65	55	69	60
25	30	355	133	103	119	67	73	70	76	69
26	45	318	125	90	99	58	63	65	65	64
27	29	360	129	115	116	77	70	71	71	71
28	30	326	128	89	109	69	66	63	63	65
29	28	317	120	87	109	65	62	63	63	63
Means	36.45	334.17	125.48	98.48	110.55	64.07	68.00	64.38	70.48	67.52

TABLE VII (Continued)

RAW DATA FOR THE TENNESSEE SELF CONCEPT TEST
(Group II, Test 1)

Subject	Self Criticism	Total P	1	2	3	A	B	C	D	E
30	47	247	98	67	84	61	38	43	57	49
31	43	286	116	70	102	54	54	53	64	63
32	32	322	112	101	101	64	70	68	53	69
33	41	317	121	87	109	54	69	63	62	69
34	37	336	124	105	107	62	76	66	73	59
35	37	334	134	103	96	62	69	61	75	66
36	34	284	115	72	98	48	65	52	57	62
37	36	327	123	90	115	62	63	63	72	68
38	41	206	73	50	83	41	47	36	41	41
39	30	360	126	109	125	65	72	73	70	80
40	38	315	109	98	106	60	62	60	66	65
41	49	335	120	107	108	69	57	62	71	76
42	20	375	134	113	129	70	85	71	77	73
43	32	301	117	77	106	51	57	58	63	72
44	45	317	119	90	108	55	62	59	73	68
45	38	359	139	107	112	63	76	71	81	67
46	33	329	121	97	111	59	75	58	70	67
47	47	358	99	77	83	44	51	46	62	56
48	44	310	144	97	97	58	64	65	55	66
49	44	322	129	94	98	65	68	56	71	61
50	43	335	94	65	77	45	47	32	61	51
51	34	300	113	95	92	52	65	56	67	60
52	33	359	132	114	113	71	78	66	74	70
53	44	265	112	72	80	55	41	45	59	63
54	34	315	120	93	101	59	67	62	67	59
55	46	285	112	76	97	51	67	39	77	51
Means	38.54	315.31	116.39	89.46	101.46	57.67	63.27	57.08	66.08	63.50

TABLE VII (Continued)

RAW DATA FOR THE TENNESSEE SELF CONCEPT TEST
(Group II, Test 2)

Subject	Self Criticism	Total P	1	2	3	A	B	C	D	E
30	48	255	105	63	87	64	38	38	54	60
31	33	317	124	77	113	54	65	64	66	64
32	28	366	128	122	117	70	80	75	64	78
33	39	345	125	105	115	59	72	66	74	74
34	34	330	124	98	108	64	73	65	69	59
35	39	344	129	106	108	61	74	65	75	68
36	41	315	119	86	109	60	66	62	60	66
37	33	344	122	109	113	56	73	72	74	68
38	49	265	96	73	95	50	52	44	47	71
39	26	340	121	107	112	65	68	72	66	69
40	37	317	116	96	104	57	69	57	68	66
41	45	365	130	114	120	71	77	66	75	75
42	22	375	134	117	125	74	86	68	76	72
43	38	299	115	82	100	54	57	56	61	69
44	40	296	113	83	100	53	57	60	61	65
45	30	350	125	103	121	66	70	71	77	66
46	34	349	120	109	120	67	78	64	70	70
47	37	289	102	86	101	50	56	55	65	63
48	48	333	121	105	107	64	72	66	62	69
49	39	315	123	91	100	60	63	61	71	57
50	42	229	93	63	74	42	49	31	65	42
51	42	330	133	94	103	68	64	60	67	70
52	32	348	127	110	110	65	72	65	73	72
53	45	274	104	83	84	52	48	53	60	58
54	32	310	120	93	97	55	72	59	66	58
55	46	310	118	86	106	47	75	46	83	59
Means	37.65	319.62	118.73	94.65	105.73	59.54	66.39	60.04	67.27	65.69

TABLE VIII

RAW DATA FOR BODY WEIGHT (LBS.)

Subject	Group	Test I	Test II	Test III
1	I	144.75	141.25	148.25
2	I	173.50	165.25	160.00
3	I	147.25	140.25	142.75
4	I	144.25	145.00	150.00
5	I	152.25	145.75	144.00
6	I	129.00	120.00	124.00
7	I	154.50	151.75	153.75
8	I	167.00	160.00	163.75
9	I	138.50	142.50	145.50
10	I	141.50	138.00	135.75
11	I	137.75	130.50	130.50
12	I	164.50	160.00	154.75
13	I	149.50	147.00	147.00
14	I	193.25	187.00	193.25
15	I	138.50	136.50	139.00
16	I	137.25	135.50	138.75
17	I	145.25	136.00	138.00
18	I	159.00	149.25	150.00
19	I	172.75	168.25	168.50
20	I	173.25	162.50	163.50
21	I	149.00	147.75	149.00
22	I	150.00	148.00	144.75
23	I	179.00	174.25	177.50
24	I	175.00	177.00	181.00
25	I	163.75	154.75	148.75
26	I	158.00	157.25	158.25
27	I	136.25	135.75	134.00
28	I	130.75	132.25	133.50
29	I	166.50	162.50	173.25
Mean	I	154.20	150.06	151.40

TABLE VIII (Continued)

Subject	Group	Test I	Test II
30	II	142.25	145.25
31	II	157.00	158.00
32	II	135.50	140.25
33	II	145.75	147.00
34	II	141.75	138.75
35	II	172.50	172.75
36	II	126.50	132.75
37	II	175.50	185.00
38	II	135.00	134.75
39	II	130.75	128.25
40	II	174.00	177.00
41	II	136.00	138.00
42	II	163.25	155.00
43	II	156.75	159.75
44	II	158.25	162.25
45	II	152.00	156.50
46	II	131.00	136.75
47	II	197.75	198.50
48	II	142.75	143.00
49	II	153.50	156.00
50	II	120.50	127.75
51	II	129.75	128.50
52	II	145.75	151.00
53	II	123.50	128.00
54	II	162.50	156.00
55	II	134.25	132.50
Mean	II	147.83	149.59

TABLE IX

RAW DATA FOR WAIST MEASUREMENT (CM.)

Subject	Group	Test I	Test II	Test III
1	I	74.0	72.5	74.0
2	I	83.0	75.0	76.0
3	I	69.5	72.0	71.0
4	I	77.5	76.0	78.0
5	I	76.0	70.0	74.0
6	I	71.0	68.0	69.0
7	I	81.0	81.0	81.0
8	I	78.5	75.5	76.5
9	I	66.0	67.0	69.0
10	I	72.5	71.0	71.0
11	I	75.0	69.0	69.0
12	I	82.0	79.0	78.0
13	I	72.0	67.0	68.0
14	I	90.0	83.5	88.0
15	I	67.5	67.0	68.5
16	I	73.5	69.0	72.0
17	I	80.0	75.0	76.0
18	I	79.0	71.0	74.0
19	I	86.0	82.0	83.0
20	I	87.0	84.0	83.0
21	I	73.5	72.0	74.0
22	I	73.0	71.0	71.0
23	I	87.0	84.0	89.0
24	I	85.0	80.0	86.0
25	I	74.0	73.0	70.5
26	I	80.0	80.0	81.5
27	I	67.0	66.0	67.0
28	I	70.0	69.0	71.0
29	I	74.0	68.0	72.0
Mean	I	76.71	73.71	75.21

TABLE IX (Continued)

Subject	Group	Test I	Test II
30	II	69.0	69.0
31	II	86.0	86.0
32	II	72.5	73.5
33	II	71.5	71.0
34	II	70.5	72.0
35	II	78.0	80.0
36	II	69.0	69.0
37	II	90.0	95.0
38	II	70.5	71.0
39	II	79.0	77.0
40	II	84.0	84.0
41	II	67.5	67.0
42	II	90.0	82.0
43	II	82.5	82.5
44	II	76.5	78.0
45	II	79.0	78.0
46	II	66.0	69.0
47	II	91.0	89.0
48	II	75.5	74.5
49	II	74.5	76.0
50	II	74.5	75.0
51	II	71.0	71.0
52	II	74.0	75.0
53	II	67.0	69.0
54	II	74.5	73.0
55	II	72.0	71.0
Mean	II	76.00	76.10

TABLE X

RAW DATA FOR HIP MEASUREMENT (CM.)

Subject	Group	Test I	Test II	Test III
1	I	97.0	95.0	95.0
2	I	103.0	101.0	99.0
3	I	87.0	94.0	94.0
4	I	100.0	98.0	100.0
5	I	105.0	95.0	95.0
6	I	86.5	86.5	86.5
7	I	104.0	101.0	101.0
8	I	103.0	100.0	102.0
9	I	98.0	97.5	97.5
10	I	95.0	89.0	92.0
11	I	92.0	92.0	95.0
12	I	108.5	105.0	103.0
13	I	101.0	98.0	98.0
14	I	112.5	106.5	110.0
15	I	98.0	95.0	99.0
16	I	97.0	97.0	97.0
17	I	100.0	97.0	97.5
18	I	96.0	96.0	98.0
19	I	109.5	105.0	110.0
20	I	110.5	104.0	105.5
21	I	96.0	96.0	99.0
22	I	102.5	100.0	99.0
23	I	105.5	103.0	105.0
24	I	110.0	109.0	112.0
25	I	100.0	96.0	95.5
26	I	105.0	105.0	104.0
27	I	93.0	89.0	91.0
28	I	92.0	90.0	90.0
29	I	107.0	103.0	106.0
Mean	I	100.5	98.03	99.19

TABLE X (Continued)

Subject	Group	Test I	Test II
30	II	98.0	99.0
31	II	104.0	105.0
32	II	91.0	95.0
33	II	102.0	100.0
34	II	97.0	99.0
35	II	115.0	115.0
36	II	90.0	95.0
37	II	105.0	109.0
38	II	90.0	92.0
39	II	94.0	92.0
40	II	109.0	109.0
41	II	91.0	94.0
42	II	106.0	104.0
43	II	98.0	99.0
44	II	104.0	104.0
45	II	94.0	98.0
46	II	97.0	99.0
47	II	117.0	115.0
48	II	102.0	100.0
49	II	103.5	102.5
50	II	91.0	89.0
51	II	91.0	94.0
52	II	100.0	100.0
53	II	92.0	93.0
54	II	105.5	105.5
55	II	91.5	92.0
Mean	II	99.15	99.59

TABLE XI

RAW DATA FOR THIGH MEASUREMENTS (CM.)

Subject	Group	Test I	Test II	Test III
1	I	60.0	60.0	60.0
2	I	64.0	63.0	62.0
3	I	62.0	60.0	61.0
4	I	60.0	59.0	62.0
5	I	61.0	59.0	63.0
6	I	59.5	57.5	63.0
7	I	63.0	60.5	61.0
8	I	66.0	62.0	66.0
9	I	62.5	61.0	64.0
10	I	59.5	60.0	60.0
11	I	63.0	59.0	59.0
12	I	72.0	68.0	69.0
13	I	63.0	63.0	64.0
14	I	72.0	70.0	72.0
15	I	65.0	65.0	64.0
16	I	61.0	61.0	62.0
17	I	64.0	61.0	61.0
18	I	64.5	59.5	62.0
19	I	67.0	67.0	67.0
20	I	74.0	70.5	70.5
21	I	63.0	63.0	63.0
22	I	65.0	69.0	65.0
23	I	68.0	66.5	70.0
24	I	70.0	67.5	73.0
25	I	68.0	62.0	63.0
26	I	65.0	64.0	66.0
27	I	59.0	58.0	57.0
28	I	59.0	60.0	59.0
29	I	66.5	66.5	67.0
Mean	I	65.05	62.84	63.98

TABLE XI (Continued)

Subject	Group	Test I	Test II
30	II	64.0	65.0
31	II	57.5	59.0
32	II	59.0	60.5
33	II	61.5	62.0
34	II	58.0	59.0
35	II	72.0	76.0
36	II	57.0	58.0
37	II	63.5	66.0
38	II	59.0	59.0
39	II	60.0	58.0
40	II	66.0	66.0
41	II	59.0	58.5
42	II	63.0	63.0
43	II	64.0	63.0
44	II	63.0	65.0
45	II	61.0	61.0
46	II	57.0	58.0
47	II	74.0	74.0
48	II	67.0	67.0
49	II	65.5	65.0
50	II	57.0	58.0
51	II	63.0	63.0
52	II	58.0	60.0
53	II	56.0	56.0
54	II	64.0	64.0
55	II	59.0	59.0
Mean	II	59.77	59.92

TABLE XII

RAW DATA FOR ARM MEASUREMENTS (CM.)

Subject	Group	Test I	Test II	Test III
1	I	25.5	25.0	26.0
2	I	31.0	29.0	30.0
3	I	27.0	26.5	27.0
4	I	30.0	29.0	30.0
5	I	28.5	28.0	28.0
6	I	28.5	25.0	26.0
7	I	28.5	27.5	28.5
8	I	32.5	31.0	32.0
9	I	26.0	26.0	28.0
10	I	25.0	25.0	24.5
11	I	26.5	24.0	25.0
12	I	31.5	29.0	30.0
13	I	26.0	26.0	27.0
14	I	30.5	30.0	32.0
15	I	26.5	26.5	28.0
16	I	28.5	28.0	28.0
17	I	27.0	27.0	26.5
18	I	30.0	27.5	28.5
19	I	30.5	28.0	30.0
20	I	28.5	28.0	28.5
21	I	31.0	29.0	31.0
22	I	27.5	27.5	27.0
23	I	28.0	28.0	29.0
24	I	28.0	28.0	29.0
25	I	29.0	27.5	27.0
26	I	31.0	30.5	31.0
27	I	28.0	27.0	28.0
28	I	26.0	26.0	27.0
29	I	29.0	27.0	29.0
Mean	I	28.47	27.48	28.34

TABLE XII (Continued)

Subject	Group	Test I	Test II
30	II	27.5	28.0
31	II	30.5	29.0
32	II	25.0	27.0
33	II	28.0	27.0
34	II	26.5	29.0
35	II	30.0	32.0
36	II	25.0	27.0
37	II	30.5	31.0
38	II	28.5	30.0
39	II	31.0	28.0
40	II	32.5	32.5
41	II	26.0	27.0
42	II	30.0	27.0
43	II	29.5	30.5
44	II	28.0	29.5
45	II	26.0	27.5
46	II	27.0	29.0
47	II	33.0	33.0
48	II	28.0	27.0
49	II	30.0	30.0
50	II	25.5	26.0
51	II	27.5	28.0
52	II	27.0	26.5
53	II	25.0	26.0
54	II	27.0	28.0
55	II	27.5	28.0
Mean	II	28.15	28.60

TABLE XIII

RAW DATA FOR PERCENT BODY FAT

Subject	Group	Test I	Test II	Test III
1	I	25.3	24.8	25.1
2	I	31.2	29.8	27.6
3	I	28.6	24.8	24.8
4	I	32.4	32.4	33.3
5	I	28.6	20.8	22.5
6	I	28.6	24.8	24.8
7	I	32.2	29.5	30.7
8	I	32.5	29.5	29.8
9	I	25.4	20.8	25.2
10	I	25.3	24.8	24.3
11	I	25.3	24.8	24.6
12	I	31.7	29.1	30.0
13	I	25.3	22.5	22.6
14	I	28.2	26.4	28.7
15	I	25.3	23.9	23.4
16	I	25.0	24.2	24.5
17	I	26.8	24.3	23.7
18	I	27.2	24.4	24.2
19	I	30.6	29.4	29.5
20	I	32.7	29.4	30.1
21	I	28.6	25.2	26.5
22	I	28.6	27.3	25.1
23	I	30.4	28.4	31.8
24	I	33.8	31.5	33.9
25	I	28.7	23.9	23.7
26	I	29.0	29.0	30.7
27	I	25.2	23.1	24.1
28	I	25.6	23.2	24.2
29	I	26.1	22.3	24.7
Mean	I	28.42	25.89	26.69

TABLE XIII (Continued)

Subject	Group	Test I	Test II
30	II	25.2	25.0
31	II	27.1	28.1
32	II	25.4	24.6
33	II	25.6	25.2
34	II	29.5	28.1
35	II	28.6	29.0
36	II	26.8	28.1
37	II	29.8	33.8
38	II	29.7	27.2
39	II	26.2	24.2
40	II	31.7	31.4
41	II	25.2	24.2
42	II	28.8	27.2
43	II	29.5	29.4
44	II	25.2	23.8
45	II	29.8	28.8
46	II	26.9	27.0
47	II	34.3	35.3
48	II	30.4	29.6
49	II	26.5	25.6
50	II	25.2	24.1
51	II	29.3	29.1
52	II	27.8	27.5
53	II	26.1	25.5
54	II	27.3	25.2
55	II	25.2	25.2
Mean	II	27.81	27.39

TABLE XIV

RAW DATA FOR CARDIO-RESPIRATORY EFFICIENCY (ML/KG/MIN)

Subject	Group	Test I	Test II	Test III
1	I	32.0	39.0	31.0
2	I	20.0	41.0	29.0
3	I	30.0	44.0	32.0
4	I	26.0	39.0	32.0
5	I	32.0	53.0	55.0
6	I	44.0	52.0	48.0
7	I	23.0	45.0	27.0
8	I	26.0	43.0	42.0
9	I	34.0	38.0	36.0
10	I	32.0	44.0	41.0
11	I	32.0	58.0	42.0
12	I	24.0	29.0	30.0
13	I	31.0	47.0	42.0
14	I	28.0	36.0	31.0
15	I	54.0	61.0	60.0
16	I	32.0	46.0	35.0
17	I	24.0	45.0	38.0
18	I	31.0	49.0	35.0
19	I	33.0	54.0	37.0
20	I	25.0	38.0	34.0
21	I	37.0	37.0	36.0
22	I	31.0	52.0	52.0
23	I	35.0	57.0	28.0
24	I	28.0	39.0	27.0
25	I	31.0	49.0	31.0
26	I	22.0	38.0	31.0
27	I	32.0	44.0	36.0
28	I	29.0	45.0	39.0
29	I	44.0	57.0	43.0
Mean	I	31.10	45.48	37.20

TABLE XIV (Continued)

Subject	Group	Test I	Test II
30	II	38.0	36.0
31	II	27.0	31.0
32	II	26.0	28.0
33	II	32.0	40.0
34	II	28.0	27.0
35	II	26.0	28.0
36	II	26.0	28.0
37	II	25.0	30.0
38	II	34.0	36.0
39	II	42.0	43.0
40	II	20.0	26.0
41	II	34.0	34.0
42	II	26.0	43.0
43	II	30.0	35.0
44	II	25.0	27.0
45	II	29.0	39.0
46	II	33.0	32.0
47	II	23.0	27.0
48	II	34.0	34.0
49	II	30.0	37.0
50	II	29.0	29.0
51	II	36.0	40.0
52	II	27.0	30.0
53	II	39.0	41.0
54	II	38.0	44.0
55	II	33.0	35.0
Mean	II	30.81	34.12

APPENDIX C

Week I February 7-11, 1972

Ran one mile February 7, 8, 10, 11 plus two XBX levels a day
February 9--exercise to music plus two XBX levels
Great deal of interest
All determined to lose weight

Week II February 14-18, 1972

Ran one mile February 15, 17, 18 plus two XBX levels a day
February 14 and 16 ran relays plus two XBX daily
Still great interest
Enjoyed relays--got acquainted--more relaxed
No complaints of soreness

Week III February 21-25, 1972

Ran 1.25 miles February 22, 24, 25, plus two XBX levels a day
February 21, 23--relays, circle exercises plus two XBX daily
Enjoyed variation in exercises
Some complaints of soreness
Seven girls had ankles taped for jogging

Week IV February 28-March 3, 1972

Ran 1.25 mile February 28, plus two XBX levels daily
Ran 1.50 mile February 29, March 2, March 3, plus two levels daily
March 1 ran relays, Club 15, Debbie Drake Record plus two XBX levels
March 3 ran at 6:30 a.m., then played volleyball, two XBX levels
Enjoyed exercise to Club 15, ran to music
Some discouragement--some lost only one or two pounds so far
Enjoy volleyball

Week V March 6-10, 1972

Weather nicer so could get outside to run each day
Continued two levels XBX daily
March 10, did the Twelve Minute run just for variation

Week VI March 13-17, 1972

Began to run two miles
There was a great deal of motivation--subjects hurried to beat their previous records

APPENDIX C (Continued)

Week VII March 20-24, 1972

Some getting tired of running every day
Times rarely improved--the mean time increased

Week VIII March 27-29

Continued exercising and running March 27
March 28 and 29 remeasured