

A STUDY OF THE RELATIONSHIP OF THE
LOSS OF EXCESS WEIGHT TO THE
MOTOR PERFORMANCE ABILITY
OF COLLEGE WOMEN

by

Sarah Margaret Robinson

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APPROVED BY

Director *C. W. Ulrich*

Examining Committee

Rosemary McGeary

Pauline E. Keeney

Christy Davis

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CHAPTER I

INTRODUCTION

Overweight and its more extreme condition, obesity, have been designated as "the number one health problem today." (3:23) This is a credible statement in light of the facts published in a Public Health Report of 1954 which indicated that twenty per cent or more of the United States population was at that time overweight. The estimates quoted were based upon evidence gathered in four different studies completed at different times and in different geographical locations. (10) These estimates have been substantiated by numerous empirical observations and the current periodical literature abounds in articles concerned with weight control.

In discussing the problem of overweight, it is essential to understand the terminology in current usage. In defining overweight some authors use the classification "overweight" in reference to the individual whose actual weight is ten to twenty-five per cent above his desirable weight, and reserve the term "obese" for that person whose actual weight is more than twenty-five per cent above his desirable weight. (29) It must be realized, however, that standards of desirable weight vary considerably, depending upon the criteria used. The casual observer would notice very little difference between an individual twenty-three per cent over his desirable weight for his height and build and another individual twenty-seven per cent over his desirable weight for the same height and build. If both of these people had an ample fat

distribution they would probably look about the same with respect to weight status. The obese and the overweight are in physiological terms, the same; the question is one of degree.

It is possible to be in good health and at the same time be over the desirable weight. (34) For example, the football lineman may have little excess fat, yet he often is "beefed up"--and hence overweight. One of the most accurate determinants of overweightness due to excess fat is a measurement of the thickness of the fat deposits in the subcutaneous layers of the skin. (14) This layer of fat in the healthy person of normal weight is between one-fourth and one-half an inch thick. The exact measurement of the fatty layer is usually made with a device called a skin caliper which is used to measure skin folds and the fat component at selected body sites. An abnormally thick layer of fat in the subcutaneous layer is the source of most overweightness. The condition of overweightness accompanied by excess fat deposits has been termed by Sherman (34:77) "over-fatness." Therefore, since overweightness and obesity are potentially alike, and because undesirable overweightness is almost always related to the support of excess body fat, the terms overweight, obese, and over-fat were used synonymously throughout the course of this paper.

Although today it is believed that overweightness is undesirable, the historical perspective affords a different view. At one time such adjectives as portly and stout carried not only the connotation of the man's physical condition but an implication of his socio-economic station as well. In effect such terms reflected the fact that a person

could afford to eat well and thus bespoke of societal status. It is true that Greek and Roman philosophers spoke and wrote of moderation and that the Greeks admired the beauty of the perfect human form in art and athletics, but that ancient era was also an age of gourmandizing. In fact, if we are to believe Shakespeare, the Romans (or perhaps the Shakespeareans) viewed Cassius with suspicion for his "lean and hungry look." In Medieval times a certain moral value was indicated with regard to the individual's weight status, in that the Church forbade gluttony; yet, Ayers (3:23) reminds us that "the monks seemed well enough fed." Renaissance paintings give us a clue as to the degrees of over-fatness during that era. There were many rotund individuals of which Henry VIII of England is a prime example. Samuel Pepys' Diary presents accounts of overwhelming amounts of food being consumed even in Cromwellian England. The men of medicine early suspected the ill effects of overeating. In 1507 the court physician to Louis XII, Nicole de la Chesnaye, published a pamphlet entitled "La Condemnation du Banquet" in which he attributed to overeating: apoplexy, paralysis, epilepsy, pleurisy, colic, quinsy, dropsy, jaundice, and gout. (3:23)

Subsequent centuries saw little change in overeating habits among those who could afford to overindulge. It was toward the close of the eighteenth century that Thomas Bedoke wrote of controlling obesity in his "Observations of the Nature and Cure of Calculus" and in 1827 William Wadd followed with "Comments on Corpulence." With the publication of "Banting's Letter to the Public" in 1863 in which Banting described the advantages of losing excess fat, we see the real beginnings

of modern thought on the problem of weight control. A. W. Pennington observed that it was at this time that:

medical research progressed from the era of guessing what was going on inside a house (body) by observing what went in at the door and went out through the chimney. (3:23)

Hence, it was around the turn of the twentieth century that there was an increase in interest in the measurement of oxygen consumption and caloric expenditure. Though many people still held to the theory that "want of exercise and consumption of alcohol" was the prime cause of overweight, obesity research kept pace, from the beginning, with other discoveries in medicine.

A sharp change in the concern of women toward their weight status emerged after the first World War. The "boyish figure" was popularized; and although the cause of this phenomenon seems unclear, it did emphasize leanness and weight control. The emerging independence of women suggested by the entrance of the woman into the business world, the inclusion of women in sport activities and the change in social mores with the war years probably accentuated the "boyish figure" concept. Fashion styles seemed to have shaped this idea as much as any other factor. The fashion designs exerted influence on clothes, on diets and on beauty aids in the form of hormone extracts and drugs. The fashion fostered empty promises with regard to weight control. (3:23) These influences declined during the depression years although such fashion indications still can be found on the contemporary scene.

Today we hold that overweight is a medical and not a moral problem. (3:24) The basic cause of overweight is too much food intake

for the amount of energy expenditure. Only a relatively small percentage of overweight cases are due to organic malfunction, although such claims are prolific. This latter fact is, perhaps, one of the most often misunderstood of medical concepts.

Medical literature indicates that it is unwise to be overweight. The incidence of diabetes, arteriosclerosis, cancer, high blood pressure and the complications of pregnancy are higher among the overweight than among persons of normal desirable weight. The resistance of the overweight individual to respiratory infection is low; he is a poor surgical risk. The strain which the overweight person places upon his circulatory system, metabolism and endocrine functions can contribute to further ill health. (14) The problem of obesity as related to Selye's stress theories gives further support to the stand that overweight poses serious psychological as well as physiological complications. (30) It has been written that:

When the psychologist, anthropologist, social psychologist, and the psychiatrist equated the irrational behavior of the compulsive eater with a personality maladjustment, the modern concept of obesity emerged full blown. Not only was overweight unhealthy, unfashionable, and unlovely, but a refusal to stop overeating became a symptom of frustration, insecurity, anxiety, dependence, inadequacy, or immaturity. The validity of this concept still arouses controversy. (3:23)

While most nutritionists would hold to the concept that the total person must be involved in nutritional understanding (including re-education in eating habits, and more complete understanding of the meaning of food), and although there is real regard for the mental health of the overweight patient, all nutritionists are not convinced that overeating has a purely psychological basis. (3:23) The proper function of the appetite is a

factor to be considered, as is the relationship between the caloric and nutritional needs of the overweight patient and his degree of physical activity.

Educators, like nutritionists, are concerned with the well-being of the total person. Physical educators especially are acquainted and concerned with the problems which a student must face with regard to his physical and emotional health. These problems may be amplified by the overweight individual. That a relationship exists between the physiological and the psychological implications of the problem of the overweight has been suggested. One question which the physical educator might pose is whether the overweight status of the individual student affects his ability to perform basic motor skills. This is an area of inquiry which is in need of investigation.

Before any investigation in the area of motor performance ability testing can be discussed, however, it is necessary to arrive at some acceptable definition of the term "motor ability." One concept of motor ability is that it is composed of the characteristics of motor educability and achievement. The term can be explored further by analysis of the two components. Achievement refers to the level of attained ability at the time of measurement; educability is "the inherent aptitude (mental and motor) for learning new skills." (31:342) Tests of motor ability generally exclude items based solely on strength and fitness or physical capacity.

Tests of general motor ability or general physical efficiency are most often used as preliminary measurements in classifying individuals

for participation in physical education classes. (21) The predictive value of this type of test is high, relative to the success of the individual in physical education skills.

Thus, if there were a significant relationship between loss of excess weight and the student's score on a motor ability battery, it might be assumed that the student would achieve more educationally from her physical education experiences if she were at her desirable weight. In addition, sensible weight control could establish a more prudent pattern for healthful living.

In terms of health, appearance, social status, self-realization and movement potential, optimum weight seems a desirable goal for today's college woman.

CHAPTER II

STATEMENT OF THE PROBLEM

The problem was designed to investigate the relationship between the loss of excess weight and the motor performance ability of college women. As an additional factor it was necessary that a plan for organized weight control be devised and administered. This plan was designed to be subjected to analysis for possible inclusion in future programs of physical education. The weight loss program was based on dietary restriction and exercise level increase.

In connection with the above problems the following definitions were utilized throughout the study.

Overweight: The weight status of the individual who is ten per cent or more above the desirable weight.

Desirable weight: The amount which an individual should weigh for her body type as calculated by use of ankle girth equivalent tables. The result of the calculation is taken as an indication of the upper limit of desirable weight which the individual should never exceed. For many persons a figure ten per cent below this upper limit could be taken as the desirable weight because of the limitations of the measurement by ankle girth equivalents which do not provide for corrections for the person with unusually large ankles.

Motor ability: The factors of motor educability, both motor and mental, combined with the level of achievement of the individual at the time she was tested.

CHAPTER III

REVIEW OF LITERATURE

Man's existence is dependent upon the food which he consumes. Food is used for heat or mechanical energy. Food is required for the building and repair of body tissues. Food is necessary for the proper regulation of body processes. Any substance, which when taken in by the body serves one of the three functions listed above, may be termed a "food." Mitchell (23:12) stated that foods are composed of "nutrients" which are of specific, though perhaps unknown, composition. The nutrients may be divided by their chemical composition into the organic and the inorganic. Organic nutrients, those which contain carbon, are proteins, vitamins, carbohydrates, and fats; the inorganic nutrients are mineral salts and water.

Proteins, carbohydrates, and fats are the food essentials which provide man with the energy necessary for muscular work. The other essential in the production of energy is oxygen. The product of the oxidation of food is energy. The measure of the energy produced by food is the calorie, which is the unit of heat required to raise the temperature of one kilogram of water one degree centigrade. The amount of heat given off by energy-producing food nutrients has been established as follows: one gram of protein yields four calories; one gram of carbohydrate yields four calories; one gram of fat yields nine calories. This amount of energy which a food supplies to the body is called its specific dynamic action.

A certain number of calories per day are required to maintain the life of the individual. This minimum amount of energy is called the basal metabolism. Basal metabolism is the heat or energy production measured in calories, of the relaxed, resting, fasting individual at a comfortable room temperature. Since the amount of oxygen used parallels the heat production, the basal metabolism is usually determined by measuring the amount of oxygen consumed for a short time and then calculating for a twenty-four hour period. Any activity in which the individual might engage during the day will require energy above this basal level.

The nutrients which build and repair tissues are the mineral salts, proteins, and water. It is essential that these nutrients be included in the diet each day. (23:13)

The nutrients which regulate body processes are the carbohydrates containing cellulose, vitamins, mineral salts and water. In the absence of any of these nutrients various manifestations of malnutrition may occur. It is possible that the poor nutritional habits of the obese may lead to malnutrition in the sense that there may be an absence of a vital nutrient in spite of the fact that the overweight individual is overfed. (32)

A simple calculation of the number of calories consumed per day, which can be accomplished by comparing foods eaten with prepared charts indicating the number of calories per portion of food, serves to point out to the individual about how much food energy his intake provides-- either for consumption through activity or storage in the form of fat--

but it does not tell him the whole story of his diet in terms of nutritional balance. Eating more food each day than the body spends in activity will ultimately result in the condition of overweightness.

Medical opinion indicates that overweightness is a serious health problem. Cureton (9) quoted Deaver's summary of the medical literature on the subject of overweight. He pointed out the dangers to health which overweight poses and stressed the overload which fat puts on the heart. Every pound of fat requires about 4,500 feet of blood vessels; thus obesity demands an expansion of the capillary beds as well as an increase in the nutritive requirements of the body. Diseases of the circulatory system, as well as other bodily systems, are of unusually high incidence in the overweight. (14) A strain also may be placed upon the respiratory system and some evidence can be cited indicating that both vital capacity and maximal breathing capacity are reduced in the obese. (24)

Although both the circulatory system and the respiratory system are adversely affected by the condition of overweight, the system which usually bears the brunt of the blame for the condition of obesity is the endocrine system. Most of the misconceptions of the laity pertaining to endocrine causes of overweightness could be dispelled with a few basic understandings. One of these basic knowledges is an understanding of the Law of the Conservation of Energy which states that the quantity of energy involved in a transformation is constant. This clearly indicates that normally, obesity "comes only from eating more food than is required to meet the energy expenditure of the body," (14:25) since the energy consumed

in food must be equal to energy expended or converted into fat. A second basic concept to be understood is that of the water balancing ability of the body:

The water balance of the normal human body is approximately $2/3$ of the body weight; and is distributed in different proportions in the various body tissues. All persons may show a variation in weight daily of from one to three pounds directly attributable to changes in water balance. (33:193)

If the average person realized the implications of these principles he would not be fooled into thinking that his overweight was "normal" or that weight fluctuations were phenomenal. (33)

The endocrine system does, however, play a part in the distribution of fat over the various areas of the body. There are definite patterns of distribution characteristic of the male and female bodies regulated by endocrine glands. For example, females tended to gain deposits of fat first in the gluteal region and thighs while males tend to gain fat first in the abdominal region. Even so, no glandular disturbance has been found to negate the Law of the Conservation of Energy. The thyroid gland, an endocrine gland, has an influence on the basal metabolic rate (14) as do certain other physiological factors such as body surface area, age, and sex, but these factors do not necessarily change the specific dynamic action of the food on the metabolism. (14)

As mistaken as it is for the typically obese person to remain overweight, Joliffe (14) related that there are times when weight reduction is contraindicated: in true hyperinsulinism and Addison's disease, liver cirrhosis, gout and gastric ulcers, fatal diseases, tuberculosis, behavior problem children and children between the ages of

eight and fourteen years. In all of these cases the obese person needs the extra stores of fat for growth, maintenance of life or psychological support. These cases of medically approved overweight should never be classed with the erroneous contraindications of: being "naturally fat," "too old," "pregnant," suffering from "heart disease." Proper weight maintenance or prescribed loss is a "must" in all of the above cases.

(14)

The question of how people become overweight can be answered by the application of physiological principles. A far more deceptive question is one of why people become overweight. Psychological instability may be a decidedly strong factor. Selye states that most people overeat because of "derailed adaptive reactions" which could be interpreted as an inability on the part of the individual to meet and cope with stressful situations other than by eating. (30:183)

The fact that people eat to satiate their appetites must not be overlooked. The appetite center is located in the hypothalamus of the brain. Joliffe (14:9) calls it the "appestat" because like a thermostat it reacts to the body's internal function. Organic diseases can disturb its normal function but like any conditioned reflex it can be trained. Mayer (20) hypothesizes that the greatest influence upon the appetite center may be the glucostatic level of the blood sugar nourishing the hypothalamus. This level of blood sugar supply may be regulated reflexly by the hypothalamus. Habit is a deciding factor in the regulation of intake balance, as is the intention of the individual toward food and his psychosomatic state. (14) Studies by Passmore and others (26) indi-

cated that the normal function of the appetite may be partially dependent on a normal amount of exercise.

In establishing who actually is overweight, nutritionists and other investigators have used many criteria. Some of the most common criteria used are measurements of fat folds in the subcutaneous layers of the skin, measurements of specific gravity, the use of tracer substances, equations of build and frame and body development. Feinstein (2) in reviewing and choosing among the available systems accepted the tabular values based on low mortality rates and took into account the factors of appearance, general build and the distribution of fatty tissue. (2) From some studies which he conducted, Feinstein was not able to arrive at a superior system for the calculation of the ideal weight of the individual but he did devise a formula by which reducing diet data of diverse origin can be compared. (2) The system involves a formula in which the initial weight is divided by the product of the surplus weight and target (desirable) weight multiplied times 100. This represents a reduction coefficient. When multiplied times the actual amount of weight lost an index of reduction which can be compared to other similar indices is obtained. Feinstein (2) constructed a range for the reduction index which denoted success or failure.

Jean Mayer has stated that the overweight individual may be determined by empirical observation. "If he looks fat, he's overweight" Mayer has declared.

One of the methods most frequently employed to judge the correct weight for an individual of a given height is using tables of height-

weight.

Life insurance companies have published tables of "desirable" weight based upon the average weight for each inch of height of their policy holders considered to be in good health. The averages were made for men at age thirty and for women at age twenty-five. The averages for women tend to correlate with the lowest mortality rates. (20) The earliest of these tables may have lacked accuracy as they were based on the criteria of height, weight and age only. Also, heights and weights were assessed with the subjects in shoes and clothing which might have tended to make the weight range "heavier." Unfortunately this practice was continued in later tables when body types were included as an important factor. The most recently published standards of height-weight were compiled by the Metropolitan Life Insurance Company mainly from the data of the Build and Blood Pressure Study of the Society of Actuaries in 1959. (25) These tables can be used as indicators of possible overweight or underweight, but it must be remembered that they are based upon averages of normal weight for a given height and build. Mistakes can be made in the estimation of build which may limit the validity of the measure; nonetheless, this method, especially with the new criteria, can be regarded as a good screening measure. If an individual is twenty-five per cent over the upper limit set on these tables he is probably overweight.

Having once established that an individual ought to lose weight, the basic causes for the individual's weight gain, his approximate ideal weight and speed at which he should progress to attain his optimum weight,

the physician or therapist is faced with the decision of what type of program should be pursued with the patient. Certain approaches will not produce the maximum in desired results, while other approaches might be expected to get good results.

Data collected by Tuttle (37) and others from school boys, young men, elderly men, and young women indicated that the skipping of breakfast is ineffective in weight reduction. The same studies indicated that the most effective weight reducing regimen were those in which the daily food intake was geared to the energy requirements of the individual. (37)

There are no effective mechanical "spot reducers." Vibrating machines and "shaking devices" serve no therapeutic value in loss of weight. Likewise, girdles and "sweating garments" have no value in hastening weight loss. No known vitamin, mineral or protein or other food supplement is a substitute for a low-calorie diet.

In the realm of drugs the following advice has been rendered:

1) Appetite depressants may be useful only temporarily and may only serve to mask appetite. 2) There are drugs which will cause a temporary loss of water and therefore create the illusion that fat has been lost. Also, "Many such products contain recommendations for dosages which may actually cause weight gain rather than weight loss." (22:1731) 3) Drugs may be used to stimulate metabolism but these are definitely not safe unless taken with medical supervision. (22) The physician may even find it necessary to caution his patients against falling for frauds in the advertising of reducing aids. (22)

The positive measures which the physician or therapist may take

are many and effective. The primary concern is often one of re-training the food habits of the patient as well as helping him to an understanding of weight loss and control. (4) The rate of food withdrawal is based on the principle of the caloric deficit which is the difference between caloric intake and expenditure. It is generally accepted that food deficit equal to 3500 calories is also equal to the loss of one pound of body fat, adipose tissue being $\frac{4}{5}$ fat and $\frac{1}{5}$ water. The most desirable rate of loss is that of from one to two pounds lost per week. (33) This will usually require a reduction of the intake to from 1200 to 1600 calories per day. (19) This caloric need can be estimated but the "Food Normogram" can also be used. The food norm is a chart which can indicate the amount of caloric expenditure of any individual provided the height, weight, age and approximate degree of activity are known. (14) The approximation of activity curbs the exactness of caloric measurement and somewhat limits the value of the food normogram.

Caloric allowances usually indicated for women up to age twenty-five place the average caloric expenditure at 2300 calories per day for the individual 5 feet 4 inches tall and weighing 128 pounds. (36) The individual of greater weight will need more calories for his basal state. Thus, the obese usually have a caloric expenditure much greater than the average, and consequently a greater intake.

An alternative to the calorie counting method of food withdrawal is a system now in use which was adapted from the diabetics "exchange" method. This method, if followed, insures good nutritional balance for the dieter. It is easily taught and followed, offers a wide choice of

foods and involves no calorie counting. Other of its advantages are that it makes meals adjustable to hunger periods and that no special foods are required. (4)

With this system the patient is given a skeleton menu for the day's requirements listed by food groups: milk, meat, vegetable and fruit, bread-cereal-potato-legume and fats and sweets. The general caloric values of foods of specific portions are listed with the food groups. The overweight person is given instructions about how many choices he may make each day from each group. He may eat the food at any time, but must not substitute among the food groupings. According to Turner (36) this method provides a diet of from 1200 to 1800 calories per day depending upon which modification is selected.

Doctor-patient relations are often a very important factor in the treatment of the overweight. (4) A graph can be used successfully in charting the progress of the weight loss; it also indicates clearly the degree of individual difference in the pattern of loss and any "cheating" on the part of the patient. To be successful such supportive counseling as is indicated should accompany the weight loss program. (4) Group therapy has been suggested, and used in some cases. (17)

"Muscular exercise increases the caloric expenditure more than any other single factor." (14:28) This being true one would naturally expect that exercise would be included in the regimen of weight loss programs. Until fairly recently the role of exercise in weight control and weight reduction had not been fully realized. One of the popular comments of many practitioners of weight loss by diet alone was the classic remark of

Rose that: "the only form of exercise essential to the control of body weight is the exercise of the intelligence." (33:194) Mayer (20) pointed out that in studies by Green in 1939 of more than two hundred overweight persons, the onset of obesity could be directly traced to a sudden decrease in activity. Mayer further commented:

While no one questions the fact that overweight is a manifestation of imbalance between caloric intake and energy expenditure, it does not necessarily follow that the etiologic element . . . is (the) excessive intake. . . . It could be lack of expenditure. (20:340)

In dispelling old fears that exercise increases appetite, Mayer referred to the studies of Passmore on appetite control which indicated that in certain animals exercise is necessary for proper function of the appetite. Mayer also pointed out that the cost of energy in exercise is proportional to body weight, the cost being greater in the more obese individual. If the person reducing is to accept the prescription of exercise in spite of any preconceived prejudice, he must first understand the principle that exercise once performed and energy once expended have required caloric usage which can never be regained. For instance, if it takes seven hours of wood chopping to lose one pound of fat, the fat will be lost whether the chopping is done in one continuous session or in seven sessions of one hour duration each. (20:340) Mayer cautions the therapist with the comment that exercise is an important aid to weight reduction but only if carried out frequently, consistently and in moderation. Posture improvement can also be a concurrent benefit of the exercises for energy expenditure. (20)

The physical educator is interested in the overweight person, too.

With an understanding of physiological function and exercise, the physical educator, guided by the counsel of a physician, can do much to aid in the correction or prevention of the overweight problem. In addition, the physical educator is concerned with his students' motor learning. In order that all students might gain the maximum from their physical education instruction, the physical educator often uses some form of test of general motor ability either to approximate more closely the homogeneous groupings or to tailor his teaching to the needs of his students.

Much of the motor testing of men students has been based on a Strength Index obtained from a gross score of six strength items plus lung capacity. It has been proposed as a measure of general athletic ability; Clarke cites some evidence to support this theory. (8) Other tests of athletic ability include the Sigma Delta Psi Test (21), which indicates all-round athletic ability and includes minimum standards of proficiency in twelve areas; the Phillips JCR Test which includes jumping, pull-up, and running items; (21) the Wear Multiple Obstacle Course; (21) and the University of California Physical Efficiency Test, (21) consisting of tests of swimming, combative activities, agility and anthropometric measurement. The primary emphasis in these tests seems to be on strength and level of achievement.

Since motor ability is said to be composed of the elements of motor educability and motor achievement, physical educators have also attempted to construct tests which measure the capacity of educability. One of the first pieces of work in this area was done by David K. Brace. (21) In 1927 he designed a test to measure "inherent motor

skill"; this test is most often used now, as revised by McCloy; the revision labeled the Iowa Brace Test. The test was based upon the passing or failing of several stunts, and relied heavily upon the factor of strength in its first design; the McCloy revisions sought to remove some of its weaknesses. (21) The Sargent Vertical Jump is often combined with other tests in batteries of motor educability tests. The Sargent Jump measures the ability of the body to develop power in relation to its own weight. Work has been done with such batteries by Larson and Stansbury. (21)

Two of the most important tests of motor ability for girls are Powell and Howe's "Newton" test of motor ability for girls and the Scott Motor Performance Battery. The Newton battery uses three items based on strength, power, speed and coordination. The Scott test has a three or four-item form with several alternate substitutions which can be made in the battery. Norms are available for high school girls and college women. (21)

Age-Height-Weight Classifications basing motor skill predictability on anthropometric measurements have received considerable attention in the work of McCloy, Neilson and Cozens. Many studies have shown that such classifications are as yet inadequate for use with women students. (21)

Cearley found in working with track and field performances of both boys and girls nine to seventeen years of age that the relationship of performance to the variables of height, weight and age was non-linear. (7)

However, a study of gross motor build in women shows significant relationships between mesomorphy (as defined by Cureton) and strength and power. The study was one of motor fitness in which motor fitness is said to be composed of agility, flexibility, power and strength. (27) This does not necessarily coincide with a definition of motor ability.

Keeney (16) analyzed the body weight in reference to the strength/weight ratio of championship weight lifters and found a linear decrease in proportionate strength with increasing body weight for the upper weight classes. "Proportions of muscle tissue in the body, ratio of contractile to structural proteins in the muscle," or favorable skeletal build may be the causes of the linear decrease. (16)

Dr. Janet Wessel of Michigan has recently completed some studies of a relationship between weight status and motor performance in which the measured factors were not found to be related at a statistically significant level. (42) Although Joliffe (14) stated that excess fat may be a mechanical impediment, research is needed in the area of weight loss and its specific relationship to motor performance.

Gentile (28) has experimented with a program of weight rehabilitation and physical conditioning for high school boys. The primary objective in his program seemed to be fitness. Although a fitness type of program, it was not designed as an investigation of a possible relationship between weight status and motor ability, or efficiency.

If there exists a relationship between overweightness and motor performance ability, then a program in which the motor performance ability of the overweight student is measured before and after the loss

of excess weight might indicate the degree of relationship. Such a program must be based upon sound nutritional principles; the use of diet and exercise must be thoughtfully considered and utilized to the best advantage. Since overweight is considered to be both a medical and an educational problem, the advice of a physician should be obtained. Thus, it is well to realize that any program in educational research which is related to the health and educational potential of the student is justified only if it serves the best interests of students.

CHAPTER IV

PROCEDURE

The purpose of the study was to investigate the relationship between the loss of excess weight and the motor performance ability of college women. To accomplish this purpose a plan for organized weight control was devised and administered by the investigator. This plan was designed to be subjected to analysis for possible inclusion in future programs of physical education. The weight loss program, fifty-one days in length, was based on dietary restriction and prescribed exercise. It was determined that a motor performance battery should be administered also as a measure of a change in general motor ability. In addition, certain anthropometric measurements and measurements of circulatory function were chosen as indices of physiological condition on the basis of their relationship to the physiology of overweight. By virtue of its design, the program was supervised cooperatively by the author's study adviser from the Department of Physical Education and the College Physician at The Woman's College of the University of North Carolina.

Approval of the design of the program was obtained from the College Physician before proceeding to the selection of subjects.

Selection of Subjects

The subjects selected were twenty-two students enrolled as graduates or undergraduates at The Woman's College of the University of North Carolina. All roomed and boarded on the campus. Ages ranged from

eighteen to twenty-two years. The average age was 19.2 years. The average poundage above the upper limit of the optimum weights (as measured by the Willoughby-Turner method of ankle girth equivalents) for the group was 11.5 pounds.

The investigator had had no previous experience in diet therapy, clinical nutrition nor psychological counseling. It was, therefore, deemed desirable to limit participation in the program, with one exception, to subjects manifesting "simple" overweight (ten to twenty-five per cent overweight) and exclude the so-called "obese" who were over twenty-five per cent of their optimum weight pattern. This decision was based upon the premise that weight control therapy for the obese often requires psychological therapy, a technique which was beyond the scope of the investigator's experience. It was also held that the student with the "simple" overweight problem would probably benefit more physically and psychologically from the program of relatively short duration. For a student only eighteen pounds overweight a loss of sixteen pounds would be a realizable goal, after which some change in motor performance might be expected; whereas, in the case of the student sixty pounds overweight, the loss of sixteen pounds would be a start but the eight-week program might not be a long enough period of time in which to establish new eating patterns. Nor would the loss be sufficient to justify expectation of a change in motor performance. The one exception made to this selective sample was a subject fifty pounds overweight who joined the study at the request of the College Physician.

The names of some of the possible subjects were obtained by random screening of records at the College Infirmary, referral by the College Physician to the program, and suggestions from the members of the faculty of the Department of Physical Education. Some students approached the author to request that they be included in the study.

The newer (1960) "Tables of Desirable Weight for Height" of the Metropolitan Life Insurance Company, as published in the Journal of the American Medical Association (25) were used for the initial screening. The values of desirable weight for women of selected height and medium build were selected as the criteria upon which to judge whether or not a subject was overweight. The selection of the "medium frame" as a constant eliminated the necessity for empirical judgment of build. Students of small, medium, and large build were to be screened by the same table of values. Age, another variable, had to be taken into consideration since for girls eighteen to twenty-five, one pound of weight for height is deducted for each year under twenty-five. Therefore, the screening tables were set up in an effort to minimize the effect of differences in age and build. The value determined as the lower limit of the overweight range for a given height was set at a weight ten per cent greater than the lowest desirable weight for that height. The upper limit for "simple" overweight for a given height was set at twenty-five per cent greater than the highest desirable weight for that height. It was thought that such a range would allow sufficient discrimination of both small and large builds and variance in age, while limiting the selection to the "simple" overweight condition.

Orientation

After selecting the students who were to be approached about the study, each candidate was interviewed by the author. For those students who wished to participate, a pre-study interview was conducted; a copy of the form used can be found in the Appendix. The pre-study interviews and medical records of the candidates were reviewed by the College Physician and her written approval obtained for each subject. At this time files were set up for the material pertaining to each subject.

On Friday, February 3, 1961, a meeting was held with all the consenting participants. At this time the outline of the weight loss plan was presented. Simple physiology of weight loss and basic principles of nutrition were explained as a phase of the re-education of the student to good eating habits. Several hints for aids in reducing effectively, which might be termed physiological and psychological "props," were suggested, such as, the use of saccharine instead of sugar, eating slowly and changing one's activity when hunger might have been induced by boredom. Orientation for the motor ability and physiological tests was conducted. The importance of meeting the weekly schedule was emphasized. The participants were asked to begin the diet on Monday, February 6, 1961, and report to the testing center on Tuesday, February 7, 1961, for the first testing session and lesson in the exercise program. An outline of the lecture was included in the Appendix.

Dietary Control

The Director of the Dining Halls made the weekly menus available

to the author on the Friday immediately preceding the week to start on Monday.

The author selected from these menus a diet of approximately 1400 calories per day. It was extremely difficult to estimate caloric values for the foods which students were offered, due in part to the method of preparation which utilized many fat exchanges, and the variation in the size of portions. Judging that most of the students acting as subjects had a caloric requirement greater than 2400 c. (because they were supporting excess weight and, therefore, required more calories to maintain the body weight), a decrease to 1400 calories was thought to be reduction enough. This withdrawal of calories would result in a caloric deficit of 1000 calories per day, resulting in a weekly deficit of 7000 calories and the loss of two pounds of body fat weekly. Careful attention was given to the choices offered to insure the inclusion in the diet of the proper balance of essential nutrients; this was facilitated by the use of the method described in the table constructed by Turner. (36)

The food choices which were prescribed were entered on forms for each day according to food groups. The week's diet was then presented to the College Physician for approval. This approval being granted, the diets were then duplicated and distributed to each subject. Students were asked to check those items appearing on the diet which they ate, mark through those items which they omitted, and write in any additions or substitutions which they made in the diet. The printed copy was to be returned to the author. A copy of the forms used for analysis of the

menu and a sample diet menu are contained within the Appendix.

Exercise Program

The exercise program was designed with regard to the following objectives:

1. Moderate exercise was indicated to improve body function and increase the level of energy expenditure.
2. The exercise was to be progressive in the amount of strength and endurance required, thus attempting to avoid muscle soreness.
3. A range in the degree of difficulty of the exercises was designed to challenge the student without discouraging her.
4. A variety in form, rhythm and manner of execution was thought to be important.
5. The exercises, done as directed, were to require no special equipment.
6. The period of activity was to last from twenty to thirty minutes daily.
7. Most of the subjects manifested the greatest deposits of fat on the hips and thighs. Since a working muscle cannot support fat, more emphasis was placed upon leg muscle exercises which would work and increase the tonus in those muscles. Exercises improving the tone of abdominal muscles were deemed important also.
8. Directions were to be simple though precise.

The exercises were taught to the subjects in a class situation on Monday evenings. At this time instructions, in printed form, for the execution of the exercises were given to each participant that she might refer to the instructions each day as she exercised. Therefore, at the end of the program the subject had a copy of the exercises for an eight-weeks reducing program in her possession. This exercise program is outlined in the Appendix, with the specific exercises described. The class

situation gave the investigator an opportunity to give individual instruction, check on individual and group progress, and answer questions of common concern.

Weight Assessment

The hour following the exercise class each Monday evening was designated as the time for one of the semi-weekly weighing sessions scheduled with each subject. The other weighing session was from eight to nine o'clock on Thursday evenings, the students coming at appointed times throughout the hour. Subjects were dressed in regulation gymnasium costumes for weighing; shoes were removed. All subjects were weighed on the same scales and at approximately the same time at each session by the author. Twice during the study, Tuesday evenings were substituted for the Monday sessions due to conflicts on the College Calendar. At these sessions individual progress was often discussed; this was also a time when individual problems could be presented.

Counseling

In addition to weighing sessions, a private interview was scheduled with each student weekly. It was not always necessary nor possible for the subject to keep this interview schedule due to unavoidable schedule conflicts. Whenever necessary, the private interviews missed were made up at future dates or at one of the semi-weekly weighing session appointments. When illness was reported, the author obtained a release from the College Physician before proceeding with studies on the subject.

Testing

On Tuesday, February 7, 1961, the subjects met for the second time at the testing center. It was on this date that the motor ability tests

were to be administered. The test administrators were senior physical education major students, all of whom had had previous experience in test administration. They were assisted by student scoring assistants.

The participants met first as a group at which time they were instructed relative to the order of the testing procedures.

The subjects were to report first to a room in which was located a spring balance scale. They were attired in official gymnasium costumes, with shoes removed. Subjects stepped onto the scale and faced the balance arm of the scale, keeping weight distributed evenly on both feet. The weight was determined to the nearest $1/4$ pound by the test administrator and read to the recording assistant. This technique was used throughout the course of the study. The subject then faced away from the balance arm of the scale. She was asked to assume her best posture and her height was recorded to the nearest $1/4$ inch from a sliding rod scale on the balance scale. From the weighing station, the subject moved to the photographing area.

A Polaroid camera loaded with 3000 speed 10 second black and white film and equipped with an electronic flash was used to take a full face, full length portrait of each subject. Participants were allowed to wear clothing of their own choosing. The same photographer took all the photographs. After leaving the photographing area, the students were directed to change into gymnasium costume and tennis shoes, and report to the motor performance testing area.

To ascertain motor ability, the three-item Scott Motor Ability Battery (31) had been chosen on the basis of the availability of equip-

ment, high coefficients of reliability and validity, the facility of administration and the availability of local norms.

The first test item in the battery was an Obstacle Race. Students were required to wear tennis shoes. The administrator explained the test and demonstrated, in general, the manner in which the race was to be run. No specific "coaching hints" were given. The following instructions were read to the subject:

Start in a back-lying position on the floor with heels at the restraining line. On the signal, "Ready, Go," get up and start running toward the black pole. As you come to each square on the floor, step on it with both feet. Run twice around the pole, turn back to the two poles with the cross bar, go under the cross bar, get up on the other side, run to the farthest blue line and continue running between the two lines until you come to the farthest line for the third time. (31:344)

The score was the number of seconds required to run the course, recorded to the nearest .1 second. Since the test administrator was aided by a recording assistant, two subjects could be timed at staggered intervals using two stop watches.

As the subjects finished the Obstacle Race they moved directly to the Basketball Throw item. Here the test administrator explained the test but did not demonstrate. Subjects received the following instructions:

Start anywhere you wish behind the throwing line, but do not step on or across the line when throwing. Throw in any way you wish, three consecutive times. The score is the distance (to nearest five foot marking) from the throwing line to the spot where the ball touches the floor. Only the longest throw counts. (31:346)

The score was recorded onto the student's score card and she progressed to the Broad Jump item.

Students were allowed to perform this test with tennis shoes removed. The test was explained but not demonstrated. The instructions read were:

Stand on the take-off board with feet parallel, toes may be curled over the edge of the board. Take-off from both feet simultaneously; jump as far forward as possible.
(31:347)

Subjects were warned that the score would be recorded from the edge of the take-off board to the nearest part of the body, even if balance were lost. The best of three trials to nearest inch was recorded for the student and she was asked to return her score card to the author.

On Wednesday, February 8, 1961, the subjects returned to the testing center. They were scheduled to arrive at ten-minute intervals; they had been previously oriented to the procedure. The following physiological measurements were taken: pulse rate, systolic and diastolic blood pressure, measurement of subcutaneous fat and weight.

After the subject had waited quietly in the adjoining room at least five minutes, the subject entered the testing area and sat quietly in a chair for one full minute. At the end of the rest period her radial pulse was counted three consecutive times for one full minute each. All readings were timed with a stop watch. Scores were reported to a recording assistant. The mean of the three scores was the value to be used in calculation.

Next, the subject moved to the blood pressure testing station. She sat quietly in a chair for two or three minutes. The blood pressures were taken with the Tycos sphygmomanometer by the following auscultatory method:

1. The compression cuff was placed around the subject's left arm next to the skin. It was snapped into place so that the arrow marked "left arm" was over the brachial artery.
2. The bell of the stethoscope was placed over the brachial artery and the inflating bulb was attached to the tubing leading to the compressing unit in the cuff.
3. The cuff was then inflated with air by means of the bulb until all sounds were inaudible with the stethoscope. The air was then slowly released from the cuff using the exhaust thumb screw at the neck of the inflating bulb.
4. As soon as the sounds became audible again the reading on the manometer dial was noted as the systolic pressure.
5. The exhaust of air from the cuff was continued until the sounds changed from clear to "muffled." The reading on the manometer dial was again noted, and the diastolic pressure recorded.

Three consecutive readings were taken to insure consistency of measure.

The pressures were recorded by the recording assistant.

The subject then proceeded to the station where measurements of the fat component in the subcutaneous layer of the skin were to be taken. The spring tension calipers were used. The calipers were held in the right hand, with the index finger supporting the instrument. A fold of skin and subcutaneous fat was taken between the index finger and thumb of the left hand. The calipers were applied to the fold of skin and held steadily. The point of the measuring arm was held on the guide line. Readings were taken in centimeters. Three readings were taken at each site and the middle reading recorded where there was a difference.

The following sites were selected for measurement of subcutaneous fat layers; these are adaptations of measurements as done by Woods:(40)

1. A transverse fold taken 6 inches to the right of the naval.
2. A transverse fold taken obliquely two-thirds of the way from the right nipple to the anterior axillary fold.
3. A longitudinal fold at the olecranon process and distal to the head of the femur on the dorsal side.
4. A horizontal fold taken obliquely at the tip of the right scapula; standing, good posture.
5. A vertical fold taken 2 cm above the right patella; subject standing weight even.
6. A longitudinal fold taken six inches from the head of the femur on the dorsal side of the right thigh; subject with foot on a seventeen inch stool.

After these measurements were taken the subject was weighed according to the procedure previously described; the weighing marked the end of the testing for that evening.

During the week of February 13, 1961, subjects were asked to substitute their weekly interview for an appointment on the evening of the 14th, 15th or 16th. At this time measurements for the Willoughby-Turner (38) method of the calculation of the optimal weight by ankle girth equivalents were to be taken. Two subjects missed appointments and the measurements were taken at later dates.

All measurements were taken by the author with the sliding wooden calipers calibrated in inches and tenths and a tape measuring in inches and fractions to one eighth. The fractions were converted to decimal scores for purposes of calculation. The measurements which were taken were:

1. Standing height.--Previously measured.
2. Chest width.--The subject stood in good postural position facing the tester. The sixth rib was determined. The

calipers were placed with the arms held lightly against the ribs; the subject inspired normally several times and the midpoint value was taken as the reading.

3. Bi-iliac width.--The subject stood on a chair; weight evenly distributed on both feet. The iliac crests were located and the sliding calipers, held horizontally, pressed firmly against the widest part of the crests.
4. Bitrochanteric width.--The subject stood on a chair; weight evenly distributed on both feet. The point over the heads of the trochanters was noted and the calipers applied horizontally with firm pressure.
5. Wrist girth.--The subject was asked to flex elbow so that the wrist was held in front of waist with hand in pronation. The measurement was taken between the heads of the radius and ulna and the hand over the bones of the wrist. Right and left wrists were measured and the average taken as the final measurement.
6. Ankle girth.--The student was standing in good postural position. The measurement was taken above the malleolae. Both ankle girths were taken and the average taken as the final measurement.

Optimum weights were calculated according to the method described in Fundamentals of Movement (38) using the tables reproduced in that book.

On March 24, 1961, a letter announcing the final dates and times for post-study testing was distributed to the subjects. The evening of Monday, March 26, 1961, was the time when the second testing of the Motor Ability Battery was carried out. The same procedure outlined for the first administration of the test items was followed; the same test administrators performed the second test administration. Photographs were repeated. The students, with one exception, wore the same clothing for the second photograph. The same photographer took the pictures the second time.

On the following evening, Tuesday, March 27, 1961, the tests of physiological function were repeated. The same procedures and techniques were employed by the same investigators and recording assistants. On this date the subjects were also asked to fill in a questionnaire reporting practices which they had observed during the program and evaluating the study from the subject's view point. A copy of this questionnaire appears in the Appendix.

Material from the post-study questionnaire, data gathered from the testing procedures, photographs and the information collected at the interviewing sessions were evaluated by the author. This supplemental information appears in the form of the case studies found in Chapter V.

CHAPTER V

CASE STUDIES

All of the subjects for this study were admitted to the program on the basis of criteria which limited the population from which the subjects were to be selected. There were, therefore, many likenesses within the group. All were women graduate or undergraduate students who roomed and boarded on the campus. Most carried a normal course load in academic work. Only one student could have been classified as being obese by virtue of the fact that she was more than twenty-five per cent overweight.

It was possible to determine many things about the group as a whole. The age range was from eighteen to twenty-two years; the mean age was 19.2 years. The average extra poundage calculated with reference to body type was 11.5 pounds.

The students' reactions to the program were nearly uniform. With one exception the subjects indicated that the program had been a worthwhile one for them. In all cases but one, students stated that they would recommend a similar program to another student, if the program were offered again. Only one student indicated that she did not learn anything more about dieting and weight control than she had known at the outset. The average weight loss, excluding the score of the one subject who gained weight was 8.5 pounds.

Yet, with all these likenesses, there were variations in individual needs and reactions to specific aspects of the program. There were dif-

ferences in build and body type within the group. Weight loss trends were dissimilar; success was not met to the same degree by all. Some of these differences were best demonstrated by the aid of photography; photographs of subjects on the first and fiftieth days appear in the Appendix. Case studies provided another tool to a better understanding of the implications of this study and the individuals behind the statistics.

Case No. 1

Subject No. 1, a nineteen-year old sophomore, was 5 feet 6½ inches tall and on the first day of the program weighed 135 pounds. She contacted the author about the program and stated that she believed she should weigh 118 pounds. She obtained a statement from the College Physician and was admitted to the program. The upper limit of her desirable weight was found to be 131 pounds when measured by the ankle girth equivalent method.

Regular exercise for Subject No. 1 consisted of participation in nightly exercises and her physical education class in golf. For relaxation and recreation, she indicated that walking, swimming or bridge playing would be likely choices.

Where food was concerned, the subject seemed to be influenced by emotional "sets." She remarked that she liked to eat, but that she was "sometimes not hungry, depending upon (her) frame of mind." She reported that she had met with success in previous attempts to diet.

From analysis of the diets which she returned to the author, it was noted that Subject No. 1 did not adhere closely to the prescribed

diet. This was more evident in the latter half of the study. She spent most weekends off campus where the temptation to break the diet was keen. She was inclined to add desserts to the menu when eating on campus and to overeat when away.

The student did not come to all of the exercise classes; however, it could be established through interviews that she was executing the exercises correctly and regularly. She reported soreness in her back and through her waist during the second week. Exercises were performed with a group of other students; she found this most satisfactory.

Summary.--Subject No. 1 remained in good health throughout the course of the study. She lost slowly and steadily until the weighing session on the twenty-fourth day when her low weight of $131\frac{1}{2}$ was reached. This represented a loss of $3\text{-}3/4$ pounds: this is the weight which Subject No. 1 should never have exceeded. Through the fifth, sixth, and seventh weeks of the study, she regained slowly. During the eighth week she began to lose again, her net loss by the last day of the program being $2\frac{1}{2}$ pounds.

The subject indicated that her hip measurements were smaller by one inch at the end of the program. Her greatest motivation to maintain weight loss was to be able to wear clothes which she had once been able to wear.

Subject No. 1 stated that the program was not worthwhile for her because she had broken the diet on weekends, but that she would recommend this type of program to others since "it seemed to be successful for most people."

There was a decrease in motor ability "T"-score of five points for this subject as judged by comparison of her score with local norms.

Case No. 2

Subject No. 2, a nineteen-year old sophomore, was 5 feet 5 inches tall and weighed 143 pounds on the first day of the program. She was contacted by the author as a result of the screening of the records at the College Infirmary. After ankle girth equivalent measurements had been taken, the upper limit of her desirable weight was found to be 138 pounds.

The lowest weight which this girl had maintained at her present height was 118 pounds; this had been in the tenth grade. Her weight had climbed steadily since that time; a gain of seven pounds had taken place in the last three years. She indicated that reducing was "sort of an obsession" with her and the subject thought that her ideal weight was 125 pounds. She was under the care of her home physician for the weight problem and was taking thyroid at his prescription. Subject No. 2 asked her physician for permission to participate in the study and received his written consent.

The regular physical exercise in which this student participated was physical education bowling class which met twice weekly. A member of the College Band and the College Choir, the subject chose music as her source of recreational activity.

Although the subject was away from the campus many weekends, only once did she report that she failed to keep reasonably close to the diet. This occasion was at the end of the fifth week. Subject No. 2 used very

good judgment in food choices when she did not eat in the dining hall. When eating on campus, she reported following the diet closely. She always used saccharine as a sugar substitute.

A schedule conflict prevented the subject from attending many of the exercise classes. She exercised regularly, however, and indicated the few times that she failed to do the exercises. She did not experience muscular soreness from participating in the exercise program. She stated that it was easier to do the exercises with someone else, and since her roommate was also in the program, exercise was easily accomplished.

Summary.--Subject No. 2 remained in good health throughout the study. Dieting on the program did not affect her normal schedule nor her normal pattern of living except in the realm of food habits.

By following the diet and changing her eating habits, Subject No. 2 reached a net loss of 8-3/4 pounds between the first and last days of the study. This loss was at a rate of one to two pounds per week until the end of the fifth week when she broke the diet and re-gained three pounds. After returning to the scheduled diet, loss during the sixth, seventh and eighth weeks of the program again progressed at a rate of one to two pounds weekly.

The subject's clothing size changed to the next smaller size as a result of her weight losses. She planned to continue losing, attributing the desire to lose more weight to her appearance, health and ability to participate in sports.

Subject No. 2 indicated that she would recommend this type of

program to others because it worked "without being very painful." The subject also stated that the program was worthwhile to her because it proved to her that it was possible to lose weight while eating in the dining hall.

Although Subject No. 2 thought she would be able to perform better in sports, her scores for the second performance of the motor ability battery showed no change.

Case No. 3

Subject No. 3 was a sophomore nineteen years of age. The student was 5 feet 5 inches tall and weighed 139 pounds at the beginning of the program. She was contacted by the author as a result of the screening of records at the College Infirmary. The upper limit of her desirable weight was found to be 132 using ankle girth equivalent measurements. The subject indicated that she would have liked to have weighed between 125 and 130 pounds.

She had tried dieting before but always chose the "crash" type diets which resulted in ill health. Subject No. 3 had been gaining constantly for three semesters.

The subject liked to eat, and commented that she would have "eaten a lot more if (she had had) time." The hardest thing for her in adjusting to the diet was giving up desserts.

The student was taking a class in modern dance in physical education, and because she liked to dance she used this activity as a source of recreation and relaxation.

This subject was very careful in following the diet. During one

week she substituted crackers for the fruit snacks, but finding that she then gained weight, she stopped this practice. She experienced a hungry feeling several evenings but resisted the temptation to break the diet.

Subject No. 3 came regularly to the exercise classes and was an interested participant. She experienced some soreness from doing the exercises; however, she continued to exercise nightly.

Summary.--Subject No. 3 had a noticeable posture problem marked by a forward head and rounded shoulders. It appeared that this condition was being improved as a result of the program, both from the exercises and the loss of weight. Counseling with regard to this problem was given; the subject was receptive to the counseling offered. Many of her weekly evening interviews were missed, but the time at weighing sessions was often used for counseling purposes.

The subject lost eight pounds. The weight loss progressed steadily at a rate of $1\frac{1}{2}$ to 2 pounds per week, until the end of the third week when a "plateau" of loss was reached and a slight increase in weight occurred. By the end of the fourth week the pattern of loss had been re-established, and the subject continued to lose until the end of the study. The rate of loss for the second half of the program was at about 1 to $1\frac{1}{2}$ pounds per week.

As a result of these losses this girl's clothing size changed to nearly one size smaller. She remarked, also, that as a result of the reducing program, she had felt better participating in general activities, "had a better disposition and looked better." She wished to keep her weight down; the strongest motivation for maintenance of her weight loss was "for health reasons."

Subject No. 3 had confidence in the planning of the diet and would have recommended a similar program to someone else. She stated that the program was "not too hard" on anyone.

For Subject No. 3 there was recorded an increase of ten points on the "T"-scale for the second performance of the motor ability battery.

Case No. 4

A twenty-year old senior was Subject No. 4. She had contacted the author previous to the selection of subjects and asked to be included in the study. Since she was 5 feet 7½ inches tall, and weighed 155 pounds, she was admitted to the program. The upper limit of her desirable weight was assessed by ankle girth equivalent and found to be 132 pounds. Before this measurement the student had set her desired weight at 130 pounds.

Since reaching her full height, the least which this subject had weighed was 139 pounds. She had realized a slow gain until the summer of 1960 and then had gained rapidly at summer camp. She liked to eat, and often ate snacks of cookies, fruit and coffee.

This student engaged in no regular exercise, beyond walking to class. All her classes were lecture sessions. Her choice of recreational activities was reading.

Before joining the program, Subject No. 4 rarely ate breakfast. After she joined the program, she went to breakfast regularly. This subject was very conscientious about following the diet and noting any substitutions or additions to her menu. Sometimes it was difficult for her to resist eating something sweet in the evenings, but her roommate

and friends helped her to avoid eating anything not on the diet.

She participated in the exercises as directed often adding some exercises from the ones assigned for the weeks before. The first week she experienced some muscular soreness. The soreness did not persist as the exercise load increased. She commented that she and other subjects in the study exercised together, thus making the task easier. Subject No. 4 was regular in her attendance at class sessions.

Summary.--Subject No. 4 was in good health during the study. Her net weight loss for the program was nine pounds. This loss was patterned in three stages. The first stage was a loss of $4\frac{1}{4}$ pounds in the first four weeks at a rate of one pound per week. The second stage was a plateau period during which time her weight varied about $\frac{3}{4}$ of a pound up, then down, for about one week. After this, a third stage occurred, this stage yielding a steady loss of $4\frac{1}{2}$ pounds for the sixth, seventh and eighth weeks combined.

Subject No. 4 reported a change in clothing size to approximately one size smaller. She indicated appearance as one factor in her desire to maintain weight loss, and health, and family and friends' pleasure at her appearance as other important factors.

The student noted that she had definitely learned more about diet and weight control. She thought that as a result of this knowledge she realized the importance of sound nutritional balance and exercise in weight control. Therefore, she indicated that she would have recommended a similar type of program to other overweight students.

Subject No. 4 recorded an increase in motor performance ability of three points between the first and second administrations of the battery.

Case No. 5

Subject No. 5 was an eighteen-year old freshman whose name had been suggested to the author by a faculty member from the Department of Physical Education. The student's weight on the first day of the study was $176\frac{1}{2}$ pounds; she was 5 feet $5\frac{1}{4}$ inches tall. The desirable weight for this student as measured by the ankle girth equivalent method was set with 131 pounds as the upper limit. The student wished to weigh less than 145 pounds.

The subject indicated that she ate "from habits" which were poor. Four years before the beginning of the study she had weighed 135 pounds, and the gain to the overweight condition had been marked by a steady increase. She ate between meals occasionally and ate heavily at meal-time.

Her regular exercise consisted of a physical education class meeting twice weekly. Periods of recreation or relaxation were devoted to playing cards.

The subject was reliable in reporting her eating habits. She followed the diet closely when on campus; her habit was to skip some items at about one meal weekly. She ate off campus most weekends.

The student did the exercises regularly and was faithful in her attendance at the weekly classes. Sometimes she found that she was too tired to do the exercises, but not often. During the sixth week her legs were sore from the exercises. At no other time did she mention muscular soreness.

Summary.--Subject No. 5 lost $8\frac{1}{2}$ pounds in the fifty-day period. Her rate of loss was characterized by a rapid loss in the first week of

$3\frac{1}{2}$ pounds followed by a gain of $1\frac{1}{2}$ pounds in the second week and a re-establishment of the loss pattern in the third week. At the fifth week another temporary halt in the loss pattern occurred. The seventh week again marked a slight increase; the eighth week showed a recurrence of the loss pattern. Subject No. 5 tended to re-gain on weekends when she was eating off campus.

The subject was in good health during the program.

A change in clothing size occurred; the change was from a dress size 18 to 16. For this reason, and also for the sake of pleasing family and friends, Subject No. 5 wished to maintain her weight loss.

The student believed that the program had been worthwhile for her because it helped her realize the principles of sound nutrition in diet therapy and to reject fad schemes. She believed that this was important to learn and thus would have recommended such a program to another student.

There was an increase of two points on the "T"-scale for the second motor performance score over the first score for this subject.

Case No. 6

Subject No. 6 was an eighteen-year old freshman whose name was referred to the author by a faculty member in the Department of Physical Education. She was 5 feet $3\frac{1}{2}$ inches tall and weighed 155 pounds on the first day of the study. The student estimated that she should weigh about 120 pounds. Measurement by ankle girth equivalent revealed that the student's desirable weight would be not more than 134 pounds.

This student had had a weight problem since grammar school.

Throughout high school years she had weighed as much as 160 pounds. By dieting during the summer of 1960 she had reduced to 145 pounds. But when she entered college, she began to regain the weight. She liked to eat and found in this a source of "something to do." She often indulged in snacks in the evenings, eating such things as candy, "stuff from home," and carbonated beverages.

The subject was enrolled in a beginning tennis class in physical education which met twice weekly. Other regular exercise was limited to walking to class; all her classes were in the same building. During times of relaxation and recreation she preferred to play cards or ping pong.

Subject No. 5 tended to cut down the diet beyond what was prescribed because she did not believe that she would lose weight unless she did so. She added to the diet only once. She found it difficult to avoid sweets.

The student was regular in her attendance at the class meetings, never missing one session. She did the exercises as directed but preferred to do them alone during the week. Occasionally she substituted one exercise for another in the week's plan. When performing some of the side stretching exercises she complained of having had muscular soreness.

Summary.—When first approached Subject No. 6 was hesitant about joining the program. After she decided to try the idea she was one of the most faithful members. She lost 15 pounds between the first and last days. Her pattern of loss was marked by a slow start, only one pound the first week, but after that, a continuing downward trend occurred. The

rate of her loss was from two to two and a half pounds weekly. Not once did she stop losing and maintain or re-gain.

Subject No. 6 did not complain of ill health. She was, however, dissatisfied at first with her slow rate of loss in the first week. Counseling was often most appropriate at weighing sessions. This girl was very pleased with the progress which she had made. She noted that her clothing size had changed and that her greatest motivation to maintain her weight loss would be her appearance and the happiness which her weight loss brought to her family and friends. Subject No. 6 stated that she would recommend a similar program to another student.

The general motor ability score achieved by the subject on the second administration of the test represented an increase of five points on the "T"-scale of scores using local norms.

Case No. 7

Subject No. 7 was a twenty-year old sophomore who had contacted the author and requested that she be permitted to participate in the study. She was 5 feet 2 inches tall and weighed 130 pounds at the beginning of the program. When measured by the ankle girth equivalent method, it was determined that her desirable weight would be 115 pounds or less. The subject had previously estimated that her ideal weight would be from 115 to 118 pounds.

The student indicated that she had tried before to diet and control her weight. She usually succeeded for the first week, but then found that her will power failed.

A swimming class twice weekly was the basis for most of the

student's regular exercise. She indicated that during times of relaxation and recreation she preferred to read or write letters.

The subject liked to eat and often snacked on apples, cookies and candy; she continued to eat snacks after joining the reducing program, but only those indicated on the menu. Her habit was to omit items more often than to add items.

She performed the exercises alone. She was consistent in the following of the schedule. A schedule conflict prevented her from attending the classes on Monday evenings; however, she made an effort to clarify points which she might not have understood. During the first two weeks, she experienced muscular soreness; after this time, she did not mention any further discomfort as a result of muscular exercise.

Summary.---Subject No. 7 lost $9\frac{1}{2}$ pounds while participating in the study. She failed to lose during the first week. Her weight losses after the first week were constant at a rate of $2\frac{1}{2}$ pounds through the second and third weeks. During the fourth and fifth weeks her weight pattern showed signs of considerable fluctuation, but toward the end of the fifth week she was able to re-establish a satisfactory weight loss pattern at a rate of about two pounds weekly.

This student remarked that her continued state of good health and even an improvement in her general condition were the most important phases of the program for her and were also her greatest motivation for maintaining her weight loss. One of her comments with reference to this point was, "I have more energy and can get more done."

Although she did not indicate that appearance was a deciding factor in her weight consciousness, it was noted that her clothing size

changed from 12-13 to 10-11.

Subject No. 7 indicated that she would recommend such a program to another overweight person as a healthy way to lose weight.

The subject's second motor performance ability score for the test battery chosen was higher than the first. The increase was one of four points on the "T"-scale using local scores.

Case No. 8

Subject No. 8, an eighteen-year old freshman, was contacted at the suggestion of a faculty member from the Department of Physical Education. She was 5 feet 6 inches tall and weighed 158 pounds. The estimate which she indicated as her ideal weight was 135 pounds. Assessment of desirable weight by the ankle girth equivalent method, however, showed that her weight should never exceed 160 pounds. It is the opinion of the author that this case was an example of an instance in which the ankle girth equivalent did not indicate a "logical" weight for the subject. Because the subject had very large ankles and a wide rib cage, equivalent measurements were not truly representative of her physique.

The subject did not eat breakfast in the dining hall, except occasionally, before the program started. She liked to eat but did not care for dining hall food. This led to eating habits which did not provide for well balanced meals. She was gaining constantly.

Her regular exercise was described as participation in a physical education class two times per week. She chose to play cards during recreational time.

The subject was inconsistent in her eating habits. It was diffi-

cult to obtain menus from her; and her manner toward remaining strictly with the diet tended to be uncooperative. She disliked a great many foods, and had a tendency to skip some meals altogether.

She did not exercise as directed many times, although she came regularly to the exercise classes. She gave various reasons for the inconsistencies: illness and tiredness were two of the most frequent reasons. She "substituted" sport activities for the regular program of exercises.

Summary.—Subject No. 8 spent a total of nine days in the College Infirmary during the time of the study. The College Physician stated, however, that the student's illness could not be attributed to her participation in the weight loss program in that the diet was sound and the exercises moderate.

This student finished the study weighing $9\frac{1}{4}$ pounds less than she had weighed at the beginning of the program. Her weight loss pattern was inconsistent. The first and second weeks she lost weight rapidly at the rate of $2 - 2\frac{1}{2}$ pounds per week. She was absent for both weighing sessions of the third week. When she returned on the fourth week, she had re-gained to the weight recorded for the beginning of the second week. Then for the fourth, fifth and part of the sixth week her pattern of loss was consistent; she was losing at a rate of two pounds per week. After an absence from weighing sessions during the latter part of the sixth week and all of the seventh week, Subject No. 8 recorded continued loss in the eighth week. On the last day of the study it was noted that she was re-gaining.

She thought that the program was worthwhile because it afforded her an external discipline for her will power. She would have recommended a similar type of weight loss program to another overweight person. Her greatest motivation for maintaining weight loss was an interest in her appearance. This was her primary reason for wishing to reduce.

It is the opinion of the author that this student was unduly concerned about her weight. From the high index of desirable weight obtained by the ankle girth equivalent measurements, it was possible to state that this student had a relatively large build and ought to weigh more than the average person of her same height. Perhaps she did need to weigh considerably less than the desirable weight predicted by equivalent measurements, but more than that she needed to reconstruct her eating habits to include good nutritional balance. This need was not fulfilled by this study in spite of prescribed menus and continued counseling toward this end.

This subject did not perform as well on the second administration of the motor performance test as she had on the first administration. Her lower score of two points on the "T"-scale might have been indicative of her general physical condition.

Subject No. 9

Subject No. 9 was a sophomore, nineteen years old. This student was the one member of the group who was more than twenty-five per cent over her desirable weight. She was 5 feet $2\frac{1}{2}$ inches tall and weighed 204 pounds. Her desirable weight as measured by ankle girth equivalents was found to be not more than 156 pounds. Because of the very great extent

of her overweight, the 156 pound estimation of her ideal weight might have been unnaturally high. After a loss of the first fifty pounds, it would have been recommended to take the equivalent measurement again. This student was suggested as a possible subject by a member of the faculty of the Department of Physical Education; the College Physician advised that she be retained in the study even though she was more than twenty-five per cent overweight. Subject No. 9 would make no estimate of the amount which she would like to have weighed.

Subject No. 9 had been overweight for many years. She had tried dieting but with little success; once she had lost thirty pounds but was unable to control her weight at that level. She loved to eat and often ate candy, crackers and carbonated beverages between meals.

The student was participating in a physical education class in body mechanics twice weekly which formed the basis for her regular exercise. When an opportunity for recreation or relaxation arose, she usually chose to play cards.

The student was careful to follow the diet as prescribed. When she reported "breaking" the diet, this deviation was in the form of omission of some items. She was encouraged to omit only the "optional" items. The subject used an artificial sweetner as a sugar substitute.

The first week the subject reported muscular soreness "all over," as a result of the exercise program. After the first week, the muscular soreness did not re-occur. The exercises were difficult for her to perform at first, but with the support of her roommate, who was also a participant in the study, she was able to overcome this difficulty. She

was always present at the exercise classes.

Summary.--Subject No. 9 remained in good health throughout the course of the study. She remarked at the end of the study that she had felt that it had been a "safe" way to reduce.

Her weight loss to the last day of the program was 17 pounds. Weight, once lost, was not re-gained. The loss was at a rate of almost three pounds per week for the first two weeks. Then, this trend leveled off to a rate of two pounds weekly for the next two weeks. At the fifth week she reached a "plateau" during which she lost only one-half pound. For the sixth, seventh and eighth weeks, her pattern of loss had returned to a rate of $2\frac{1}{2}$ pounds weekly.

In spite of the marked weight loss, her clothing size did not change. Still, she reported that appearance was a primary factor in influencing her desire in continuing the weight loss pattern started. Concern for her health also motivated Subject No. 9 to continue on a program of weight control. Utilizing the principles learned in the program, she planned to continue to lose weight and to try to control her weight thereafter.

As a result of her experiences, she stated that she would recommend this type of program to another overweight person, remarking that, "It is easier when you have company."

This subject recorded a lower general motor performance ability score on the second administration of the battery. The one point lower score was determined by comparison of the two general scores to "T"-scales of performance based upon local norms.

Case No. 10

Subject No. 10 was a nineteen-year old freshman who requested to join the study. She weighed 126 pounds and was 5 feet 3 inches tall. On the advice of the College Physician, she was allowed to participate. The subject estimated that her ideal weight would be about 118 pounds. Measurement by the ankle girth equivalent method indicated that the upper limit of her desirable weight was 124 pounds.

The student had attempted to diet before, but had had no real success with regard to control of weight loss. She enjoyed eating, and often ate fruit or candy between meals.

She was taking golf classes twice weekly in physical education and playing basketball in the intramural program. She liked to participate in sport activities, draw and paint in leisure time.

Until the last two weeks of the study, the subject followed the diet carefully when on campus. She had a tendency not to diet on the weekends when she was away from the campus. This made it necessary for her to recondition her appetite level several times during the study.

She was fairly regular in participating in the exercises as directed. Sometimes schedule conflicts kept her from attending the exercise classes. She was conscientious about the clarification of points which she might not have understood as a result of her absence from class.

Summary.—Subject No. 10 finished the program weighing 4-3/4 pounds less than she had at the beginning of the study. Her pattern of weight loss was characterized by constant fluctuations indicative of her

inability to stay on the diet on weekends. She lost weight during the first week of the program. The second week of the program Subject No. 10 gained; toward the end of the second week her weight began to go down again, and remained the same through the third and fourth weeks. Her weight fluctuated up and down throughout the fifth, sixth and seventh weeks. The beginning of the eighth week marked a downward trend in the pattern.

The subject remained in good health during her participation in the study. She tried to eat the foods on the menu to insure nutritional balance.

The student's clothing size did not change, but she indicated that her clothes did not fit as snugly as they had previously. Personal appearance seemed to be the key motivational factor toward the desired weight loss. It is the opinion of the author that the subject's concern should not have been directed toward further loss as much as toward prevention of weight gain.

There was an increase of one point in general motor performance ability noted after the study for this subject by comparison of the first and second "T"-scores on the battery.

Case No. 11

This student was a first semester senior who was twenty-one years old. Subject No. 11 was 5 feet $5\frac{3}{4}$ inches tall and weighed 152 pounds when the study was initiated. She estimated that her desired weight would be about 135 to 140 pounds. Measurement by the ankle girth equivalent method indicated that her highest desirable weight would be 145

pounds. She became interested in the program because her roommate was a participant in the study.

Subject No. 11 participated in no regularly scheduled program of exercise. All of her courses were "reading courses"; she was not taking physical education.

This subject had at one time been greatly overweight. About two years before the time of the study she had reduced to the weight of 152 from a weight of about 170 pounds. She had been successful in maintaining the former weight loss, although she claimed to "live to eat."

The subject followed the diet very nearly as prescribed. She ate something of almost everything, although she remarked during the second week that she did not eat all of each portion as her appetite had "disappeared."

She exercised with other students who were in the study and often performed more exercises than the amount required. She experienced muscular soreness from exercises which required lateral bending from the waist. She indicated a preference for group exercise programs and was never absent from class.

Summary.--Subject No. 11 lost $14\text{-}3/4$ pounds while participating in the program. She lost constantly at a rate of about two pounds per week from the first week through to the last day of the study. She indicated that toward the end of the program it became more difficult for her to stay with the diet. Since she weighed 138 pounds, seven pounds less than the upper limit of her desirable weight, when the program was concluded, it was not difficult to understand why this temptation arose.

The subject's clothing size was reduced from a 15-16 to a size 12. Yet, at the same time, the student remained in good health. Her general outlook remained stable. In her own words, "Normal things make me happy; normal things make me angry."

She found that dieting with the group motivated her to stay with the diet and exercise program. She noted that the group diet was easier to follow, and thus would have recommended a similar program to others. The factors which would motivate her to keep her weight down were reasons of health, concern for appearance, and the encouragement of family and friends.

She believed that the program had been worthwhile for her, and that without such a program she "would not have lost as much weight."

The second "T"-score of general motor performance ability was higher by six points over the first score for this subject.

Case No. 12

Subject No. 12 was a twenty-two year old graduate student. She volunteered to act as a subject for the program. She was 5 feet $2\frac{1}{4}$ inches tall and weighed $139\text{-}\frac{3}{4}$ pounds on the first day of the program. The subject estimated her ideal weight as 125 pounds. Assessment of desirable weight by the ankle girth equivalent method fixed the upper limit of her desirable weight at 132 pounds.

The student's regular exercise consisted of a long swimming session twice weekly. She also taught five physical education classes. The subject preferred swimming and reading to other recreational pursuits.

This subject was concerned about her weight, although she had never been on a supervised diet. She liked to eat, yet rarely ate between meals.

The subject followed the diet as directed most of the time. She tended to omit items rather than to add items to the menu. She was absent from the campus for one week; except for that time, the student was careful to record changes which she made in the diet.

Subject No. 12 was exempt from the exercise class. It was possible to determine that she was exercising as directed. Occasionally she substituted a mile swim for the regular exercise period. She stated that she never experienced muscular soreness as a result of the exercise program.

Summary.—Subject No. 12 was in good health throughout the study.

She lost nine pounds while participating in the program. During the first week she lost only $3/4$ pound; the second week this weight was re-gained. During the third week she began to lose at a rate of two pounds per week; this trend continued through the fourth, fifth, and sixth weeks. For the seventh week, the subject was absent from weighing sessions. When she returned to the regular schedule, it was noted that her loss had continued its steady pattern.

In spite of her loss of weight, the subject did not note a change in clothing size; she did mention, however, that her clothing was beginning to fit loosely. She counted appearance as a motivational factor in desiring to control her weight. She was also concerned about her weight

for professional reasons, thinking that she could better teach weight control and fitness when able to control her own weight problem.

The subject stated that she believed that the program had been worthwhile for her and for others. She thought that she had established new eating patterns with a new emphasis on nutritional balance. As for the group, she believed that the subjects found it easier to participate in a dieting program when they had others working with them and trying to accomplish the common goal.

Subject No. 12 recorded a "T"-scale rating of general motor performance ten points lower than that of the first administration on the second administration of the test.

Case No. 13

The name of the subject, an eighteen-year old freshman, was first obtained when the student herself approached the author. The subject was under the care of a physician, and was taking a thyroid prescription. She obtained her physician's consent, and was admitted to the program. The student was 5 feet $2\frac{1}{2}$ inches tall and weighed 129 pounds. She did not appear overweight. She believed that her best weight would be 115 pounds. An assessment of desirable weight showed that her desirable weight aim should have been to remain always under 130 pounds.

She liked to eat, but reported that she had found good success with reducing with the help of the prescribed thyroid. She often ate such things as crackers, candy and carbonated beverages between meals.

For relaxation, Subject No. 13 usually played cards. Her regular exercise was gained in physical education class.

When she was placed on the restrictive diet, the most difficult thing for her to do was to give up evening snacks. She was not regular in the return of the diet charts to the author; perhaps this occurred because she had a tendency to skip meals, especially when eggs were being served. She also spent many weekends away from the campus.

She experienced soreness in the muscles of the arms and legs as a result of the exercise program. She stated that she had performed the exercises as described, and when she attended class this fact was demonstrated. She attended class about half the time.

Summary.—Subject No. 13 weighed $5\frac{1}{4}$ pounds less on the last day of the study than she had on the first day. Her pattern of loss was irregular. She lost at a rate of two pounds per week until the middle of the second week; at that point she began to re-gain slowly. She was absent from the weighing sessions during the third week. The student was present for one weighing session during the fourth week; at that time she had re-established a pattern of weight loss. During the fifth week she began to re-gain weight, and she remained at the weight recorded for the fifth week through the sixth week, also. Subject No. 13 did not report for the weighing sessions of the seventh week, but by the eighth week she had begun to lose again. A slight rise in weight was again evident at the beginning of the eighth week. This pattern of loss might have been indicative of an inability to eat as directed.

Even in recording so small a loss in poundage, the subject reported that her clothing size had changed to two sizes smaller. It was the estimation of the author that such a claim was less an actuality

than a desire. The subject was greatly concerned about control of her weight and appearance was an unusually strong motivational factor for this student. The student remained in fairly good health throughout most of the study although she spent two days in the College Infirmary.

Subject No. 13 reported that she felt better and believed that she looked better as an outcome of the study. She thought that she had benefited from the study.

This subject's general motor ability index, measured by the "T"-score for local norms, was lower at the second testing than at the first. The difference was one of four points on the "T"-scale.

Case No. 14

This student, an eighteen-year old freshman, was suggested as a subject by a faculty member from the Department of Physical Education. She was 5 feet 2 inches tall and weighed $132\frac{1}{2}$ pounds when the study began. She estimated an ideal weight of 115 pounds; measurement by ankle girth equivalent fixed the upper limit of her desirable weight at 129 pounds.

The student described a history of a weight control problem. Her weight problem had started at age 11. She reported weighing 160 pounds at one time since gaining her full height. Subject No. 14 also noted that she had been losing for the three months previous to the study at a rate of almost three pounds per month.

She thought that she ate compulsively, and that depression brought on hunger. She did not care for dining hall meals and rarely ate breakfast.

The author found that Subject No. 14 was reluctant to return her menu forms for analysis. After obtaining the forms it was evident that the subject followed no set pattern in regard to the menu. Sometimes she ate everything, sometimes she added to the menu; she continued to skip meals, particularly breakfast. It was the opinion of the author that the subject ignored the menu suggestions, tended to "cheat," and then felt guilty.

The subject's regularly scheduled exercise was in the form of freshman physical education major activity courses, meeting several times weekly. Thus, having had a high exercise level previously, she experienced no muscular soreness from doing the exercises. She was present at the exercise classes most of the time, but was rarely properly dressed for activity.

Summary.—Subject No. 14 missed eight of the sixteen weighing sessions. On four of these occasions she was under care at the College Infirmary. When she did report for weighing, it was noted that her weight was steadily increasing. She finished the program weighing $6\frac{1}{2}$ pounds more than she had weighed at the beginning. One period of loss was recorded; this loss of weight occurred during the second week of the program.

After the close of the study, the subject visited her family physician. The subject later reported to the author that her physician had prescribed for her a thyroid medication.

In spite of her gain in weight, the subject did not indicate that her clothing size had changed. She noted that the influence of family

and friends' opinion would have motivated her most to loss of weight.

The subject found it most difficult to "stick to" the diet; yet, she thought that she would recommend a similar program to another overweight person.

The student's score on the composite score of general motor ability, computed by the regression equation, was twelve points higher on the "T"-scale at the second testing than it had been at the first testing.

Case No. 15

Subject No. 15, a junior twenty years of age, contacted the author and requested to be included in the study. She was 5 feet $4\frac{1}{2}$ inches tall and weighed 140 pounds on the first day of the study. The upper limit of her desirable weight, when measured by ankle girth equivalents, was found to be 137 pounds. Her estimate of her ideal weight was 125 pounds.

The subject stated that she rarely ate at times other than meal-times, but that she ate heavily at meals. She remarked that she "took out (her) frustrations on food." To the best of the author's observations, she was a remarkably even tempered person.

Regular exercise was described as walking to class and working in six or seven laboratory sessions per week. Concerts, lectures and forums on campus formed the basis for her extra-class activities of a recreational nature.

The subject had been on a variety of diets in an effort to control her weight. The various plans did not seem to work. She found it diffi-

cult to resist adding to the menu, especially in "foods labs." She readily admitted breaking the diet; she omitted some items; added others.

Subject No. 15 said that she had enjoyed the exercise program and planned to continue this phase of the program as a tool in weight control. She remarked that she had had muscular soreness in her legs at various times. She was regular in her attendance at class exercise periods. The subject and her roommate exercised together, although the roommate was not making an effort to lose weight. This plan was very satisfactory for the subject.

Summary.---The subject was able to maintain a loss of only 1-3/4 pounds. She lost more than this at various times during the study, but was unable to stabilize her losses. The first week she lost only one pound; this pattern was repeated for the second week. During the third and fourth weeks she gained weight. She lost three pounds the fifth week; re-gained the sixth week; and lost weight again the seventh week. The eighth week another rise in weight was recorded.

Although the subject's weight loss was not marked, she reported that her clothing size had changed from size 18 to size 16. This report seemed dubious. The student did not indicate appearance as an influential factor in the control of her weight. Reasons of health as motivational factors were most important to the subject.

The student, studying dietetics in the home economics major, did not conclude that the type of program offered was best for her needs. She believed that the period of diet frustration was extended over too long a period of time. She indicated that psychologically it was easier

for her to control her weight by skipping entire meals, usually lunch, than to follow a "cut down" diet.

Subject No. 15 recorded a higher "T"-score of general motor ability for the second testing session. This higher score was marked by an increase of twelve points on the "T"-scale; weighing for general motor ability was by the regression equation suggested by Scott (31) and using local norms.

Case No. 16

Subject No. 16 was a twenty-year old junior who asked the author to be included in the program. She was 5 feet 6-3/4 inches tall and weighed 158 pounds on the first day of the program. She estimated that her best weight would be 140 pounds or less. Measurement of ankle girth equivalents fixed the upper limit of her desirable weight at 134 pounds.

The student liked to eat. She had had a more acute weight problem previously and had lost 20 pounds in the summer of 1959 to reach the weight of 158 pounds.

A member of the campus synchronized swimming club, she swam at least once a week regularly, and during some weeks of the program more often than once weekly.

She did not adhere closely to the prescribed diet; frequently, she omitted items on the menu. However, she did report conscientiously most deviations from the diet.

This subject and her roommate did the exercises together with another participant in the study. The subject often did more than the prescribed amount of exercise. She complained of muscular soreness in

the lower back from exercises requiring lateral bending from the waist.

Summary.—Subject No. 16 had recorded a net loss of $11\frac{1}{2}$ pounds on the last day of the study. During the first part of the study her loss rate was slow, though steady, and she had lost only four pounds by the end of the third week. Then, with only one slight break in the pattern, she lost four more pounds in the next two weeks. This loss was followed by a small increase in weight; a slight decrease; and then the maintaining of the decrease at a "plateau" of loss for the sixth and seventh weeks. After a stay in the College Infirmary of one night, her weight was recorded as $3\frac{1}{2}$ pounds below the "plateau" level for the last day of the program.

A clothing size change of one and one-half sizes was recorded. This student indicated that appearance ranked most important as the factor influencing her to control her weight. Good health was also regarded as an important factor.

The subject noted that she had definitely learned more about weight loss and dieting than she had known previously and that this knowledge would help her in the control of her weight problem.

Subject No. 16 had a higher "T"-score of general motor ability for the second testing session. Her score improved to eight points higher on the second administration of the test.

Case No. 17

Subject No. 17 was a nineteen-year old sophomore. She contacted the author about the program after learning about the study from a friend of hers who was a participant. The student weighed $130\text{-}3\frac{3}{4}$ pounds

and was 5 feet 4 inches tall. She estimated that her best weight would have been from 117 to 120 pounds. Assessment of her weight by the ankle girth equivalent measurement method fixed the upper limit of her desirable weight at 121 pounds.

This student enjoyed eating and liked all types of foods. She rarely ate between meals. Previously a weight loss program had been carried out under the supervision of her physician; she had been able to maintain the new weight.

She was engaged in active exercise only in her physical education tennis class. Reading formed the basis for other leisure time pursuits.

Subject No. 17 followed the diet very nearly as directed. She noted the foods which she added or omitted. During the second half of the program she was instructed to omit more carbohydrates from her diet.

The student exercised regularly and as directed. She and another participant in the program exercised together; they preferred to have companionship. After the first two evenings of exercise, the subject noted some muscular soreness. Subject No. 17 was seldom absent from the exercise class.

Summary.—The final weight loss for Subject No. 17 was $6\frac{1}{2}$ pounds. Her pattern of weight loss was irregular. During the first week a loss of one pound was recorded; then, over the first weekend the weight was re-gained. Through the second and third weeks a loss of two pounds per week was noted. When the fourth week was reached, the loss was stabilized and no further weight loss occurred until the beginning of the sixth week. The subject began to lose more quickly, and during the seventh week the

lowest weight for this subject (eight pounds below the starting weight) was reached. With the eighth week, a re-gaining trend was observed.

Subject No. 17 indicated that concern for her health was the primary factor in motivating her to control her weight. She believed that as a result of the study she felt more active, and was in better physical condition than she had been. The student rated appearance second as an important factor. She stated that her clothing size had changed to the next smaller size; she felt that she looked better.

The student thought that the program had been worthwhile for her. She would have recommended this type of program to another student because she felt that she had benefitted as a participant.

The subject's general motor ability performance score was higher on the "T"-scale of comparison on the second administration of the test battery. However, the score was higher by only three points on the "T"-scale.

Case No. 18

Subject No. 18 was an eighteen-year old freshman. She approached the author about the study, and since she was 5 feet 7 inches tall and weighed 166 pounds, she was admitted to the study. She estimated that her desirable weight would have been 130 - 135 pounds. Measurements by ankle girth equivalents placed the upper limit of her weight range at 166. It was felt that the ankle girth equivalent assessment of weight did not give an accurate picture of the student's build because the ankle measurements were quite large.

She stated that she preferred to sleep in the mornings rather than

go to breakfast. Otherwise, she would have preferred to eat rather "than do most things."

She was taking physical education; this was the basis for her regular exercise. During times of relaxation she usually played bridge.

The student usually omitted several items on the menu every day. She did not believe that this was "breaking" the diet.

Subject No. 18 was fairly regular in her attendance at the exercise class sessions. She did the exercises as directed. Her room-mates stated that they did the exercises with her. This seemed to motivate the subject to exercise every evening.

Summary.--Subject No. 18 lost $9\frac{1}{2}$ pounds. The first three weeks she lost steadily at the rate of two pounds per week. At the beginning of the fourth week a gain was recorded; this weight was lost during that week. At the beginning of the fifth week another gain in weight was recorded. Once the loss pattern had been re-established at the beginning of the sixth week, the subject did not break the loss pattern again.

The subject indicated that appearance and the opinions of family and friends would influence her most to maintain her lower weight. Her clothing size changed from a dress size fourteen to size twelve.

She stated that the most difficult thing for her to do in connection with the program was to "give up sweets." Yet, she would have recommended a similar program to others who were overweight.

Subject No. 18 had a slightly higher general motor performance score on the second administration of the test battery. Her score on the "T"-scale rose one point.

Case No. 19

Subject No. 19 was a sophomore nineteen years of age. She was 5 feet 8½ inches tall and weighed 178 pounds. She judged that her best weight would have been about 150 pounds. Measurements by ankle girth equivalent showed that her weight should have never exceeded 155 pounds.

The subject stated that she did not often eat between meals, but that she ate big meals. She also remarked that when depressed or angry she tended to overeat. She had dieted previously with success.

She and her roommate were usually fairly active. With her roommate she exercised in the evenings; the subject also liked to play tennis.

Changes or substitutions within the menu were this subject's habit. She did, however, record all these changes, and referred to such alterations in the plan as "breaking" the diet. She also omitted some items occasionally.

The subject was not regular in her attendance at the weighing sessions on Thursday evenings, but she came regularly to the exercise class. She performed the exercises correctly in class. She mentioned some muscular soreness in her legs after the first few evenings.

Summary.—The subject lost weight at the rate of 1½ to two pounds per week until the fourth week. At that point a temporary "plateau" occurred and the weight did not change. Beginning with the fifth week, the weight decreased until the end of the seventh week when a re-gaining trend began to be evident. During the eighth week the subject re-established the loss pattern. The final loss was of 10 pounds

below the starting weight.

The subject commented that health and appearance were two factors which would influence her to maintain her weight losses. Her clothing size had changed almost one complete size. She felt that she had learned to diet without endangering her health, and that she had been motivated to continue the weight loss program. She was now convinced that "crash" diets were not as effective as "cutting down," for most people.

Subject No. 19 recorded a score on the "T"-scale of comparison that was slightly higher for the second administration of the motor performance test. The rise in her score for the battery was one of four points on the "T"-scale compiled of local norms.

Case No. 20

The subject, a second-year student nurse, was nineteen years old. She was 5 feet 5½ inches tall and weighed 141 pounds. She thought that she should have weighed 125 - 130 pounds. Ankle girth equivalent measurements fixed her highest weight at 142 pounds.

The student had had a weight problem formerly, and during the summer two years previous to the study had reduced her weight from 152 to 130 pounds. She liked to eat, and often ate candy, crackers and carbonated beverages between meals.

The subject was taking a course in modern dance in physical education. She also was playing on an intramural basketball team.

Subject No. 20 was married; she went home almost every weekend during the study. She ate only those things on the menu which she liked. When away from the campus, she was not careful in her choice of foods.

Subject No. 20 and her roommate, also a participant in the study, exercised together. Subject No. 20 was not regular in her attendance at exercise classes due to a conflict in her schedule. Although she helped her roommate with the exercises, Subject No. 20 did not always exercise each evening. She stated that she had experienced muscular soreness only for the first few days.

Summary.--Subject No. 20 lost 10 pounds during the study. Her loss of weight was slow but uniform. She did not re-gain once a loss was established. Once, during the fifth week, she failed to continue the loss pattern; by the next week the pattern of loss had been re-established.

Her clothing size did not change, but her skirts became too large due to her loss of weight. She rated appearance as a factor which would have motivated her to maintain her weight loss. Health was also an important factor to her, and she mentioned the fact that she had remained in good health through the course of the study. The student indicated that family and friends' opinions motivated her to remain at her lowest weight.

She stated that the group project had made the task of dieting easier. And that she would have recommended this type of program to another overweight person because "it was both safe and effective."

Subject No. 20 recorded the same score on both administrations of the motor performance ability test. Scores had been recorded on a "T"-scale of performance scores using local norms.

Case No. 21

Subject No. 21 was a junior twenty years of age. Her weight was 136 pounds; her height, 5 feet 6 inches. She thought that she should have weighed from 125 to 130 pounds. Assessment of her weight by the ankle girth equivalent method showed that the upper limit of her desirable weight should be 139 pounds. She contacted the author and requested to be included in the project.

She had elected a course in physical education; she was taking body mechanics. The student engaged in no other regular exercise.

Although she talked as though she were quite concerned about her weight "problem" during the pre-study interview, it was noted that she had never been able to stabilize a weight loss once established. She liked to eat, and ate between meals frequently.

She followed the diet very well when she was on campus, but she was away from the campus for her meals a great deal. It was difficult for her to give up candy and cookies in the evening.

The subject followed the exercise program very well. She did not complain of muscular soreness after the first week. The student was regular in her attendance at the class sessions. She and another study participant performed the exercises together.

Summary.--The subject was able to maintain a loss of only two pounds. This amount was lost very slowly. During the fifth week the student lost an additional two pounds, but this loss was not maintained.

Subject No. 21 was pleased with the program in spite of her small degree of loss. She believed that she had learned a great deal about

diet and weight control. She reported that her clothing size had changed from a fifteen to a thirteen. This report seemed dubious. Appearance and good health were the greatest motivational factors which helped her to stay with a diet program. She stated that the most difficult thing for her to accept had been the avoidance of candy.

The subject's motor performance score was lower on the second administration of the motor performance tests. The decrease was one of three points on the "T"-scale.

Case No. 22

The subject was a junior twenty years old. Her name was suggested to the author by a member of the faculty of the Department of Physical Education. The student weighed 132 pounds and was 5 feet 3 inches tall.

She participated in the program about five days. She felt that her extra-curricular schedule would have kept her from participation in the full program.

CHAPTER VI

PRESENTATION AND ANALYSIS OF DATA

The purpose of the study was to investigate the relationship between the loss of excess weight and the motor performance ability of college women. As an additional factor it was necessary that a plan for organized weight control be devised and administered. This plan was designed to be subjected to analysis for possible inclusion in future programs of physical education. In Chapter V, Case Studies, many individual differences among the subjects were presented. It was also the concern of the investigator to analyze the patterns of group change manifest in motor performance ability and physiological functioning. To accomplish this aim, selected data were collected during the study and treated statistically by the author.

Collection and Preparation of Data

The subjects were weighed and a battery of motor performance tests were administered on the second day of the study. Physiological measures of subcutaneous fat distribution and circulatory function were taken on the third day of the study. The condition of the subjects on the second and third days of the study was defined as Condition I. The subjects were weighed on the fiftieth day when the motor performance ability battery was re-administered. Measurements of subcutaneous fat distribution and circulatory function were taken on the fifty-first day of the study. The condition of the subjects on the final two days of the study was defined as Condition II.

Although the "final" weight to which reference was made in the Case Studies was determined on the fifty-first day of the study, the weight recorded on the fiftieth day of the study was used for purposes of calculation in all statistical techniques. It was thought that the weight recorded on the fiftieth day was the more accurate determination of Condition II. This belief was based upon the fact that it was on the second and fiftieth days that motor performance tests were administered, and that comparisons of performance and weight were most accurate when the two variables had been measured under the same conditions.

For purposes of calculation, the "T"-scores of performance on individual test items of the motor performance ability battery were derived from tables in Scott. (31) The raw scores for all motor performance items were combined in the regression equation $2.0 \text{ basketball throw} + 1.4 \text{ broad jump} - \text{obstacle race}$. (31) "T"-score values were obtained by comparison of the score resulting from the regression equation with a "T"-scale constructed from 520 case scores obtained on the three-item battery administered at The Woman's College of the University of North Carolina, 1952. This "T" value represented the general motor ability score.

The measurement used in calculations of the subcutaneous fat distribution was an average of measurements taken at selected sites.

For purposes of calculation, the pulse rate score was derived from the average pulse rate counted three consecutive times for one full minute at each counting.

Calculations with regard to the systolic and diastolic blood pressures were based upon the pressures recorded after three consecutive readings with the sphygmomanometer.

Statistical Procedure

The data collected for Condition I and Condition II were measures of: weight, General Motor Ability, individual motor ability test items, the average of the subcutaneous fat deposits at selected sites, pulse rate, systolic blood pressure, and diastolic blood pressure. The significance of each measure was determined by the use of Fisher's "t" test for the significance of difference between correlated means. The formula utilized was:

$$"t" = \frac{Md}{\sqrt{\frac{\sum x^2d}{n(n-1)}}$$

The concept of the null hypothesis was employed in the determination of the levels of confidence for the analysis of the significance of the "t" value. The following statements of null hypothesis were constructed with regard to "t" values related to the significance of the means:

1. That there would be no statistically significant difference between weights recorded for Condition I and those recorded for Condition II.
2. That there would be no statistically significant difference between scores of General Motor Ability recorded for Condition I and those obtained for Condition II.
3. That there would be no statistically significant difference between scores on the Obstacle Race item obtained for Condition I and those recorded for Condition II.

4. That there would be no statistically significant difference between scores obtained on the Broad Jump item for Condition I and those recorded for Condition II.
5. That there would be no statistically significant difference between scores recorded for the Basketball Throw item for Condition I and those obtained for Condition II.
6. That there would be no statistically significant difference between values obtained from the subcutaneous fat distributions as measured for Condition I and those obtained for Condition II.
7. That there would be no statistically significant difference between values obtained for the pulse rate for Condition I and those obtained for Condition II.
8. That there would be no statistically significant difference between values obtained for systolic blood pressure for Condition I and those recorded for Condition II.
9. That there would be no statistically significant difference between values recorded for Condition I and those obtained for Condition II for diastolic blood pressure.

The technique used as a measure of the degree of relationship between motor ability and weight loss was the Pearson Product-Moment Method of Correlation symbolized by "r." The formula employed was:

$$"r" = \frac{\sum (x-y) - C_x C_y}{\sigma_x \cdot \sigma_y}$$

The concept of the null hypothesis was used to determine the level of confidence of the significance of "r." The following null hypotheses were constructed with regard to the significance of the "r" values:

1. That there would be no statistically significant relationship between the loss of excess weight and the change in General Motor Ability performance at Condition II.
2. That there would be no statistically significant relationship between the loss of excess weight and the score on the Obstacle Race at Condition II.

3. That there would be no statistically significant relationship between the loss of excess weight and the change in score of the Broad Jump item of the motor performance test at Condition II.

The results of the computation of the formula for the "t" test of significance were compiled in Table I.

The results of the computations of the formula used for the Pearson Product-Moment Method of Correlation were compiled for Table II, page 84.

Interpretation of the Null Hypotheses, "t"

In light of the findings presented in Tables I and II, some interpretations were made in regard to the statements of the null hypotheses relevant to the "t" values of the significance of the means.

With regard to the null hypothesis that there would be no statistically significant difference between weights recorded for Condition I and those recorded for Condition II, the "t" value of 7.3251 was found to be greater than the 2.845 value of "t" at the .01 level of confidence. Therefore, the null hypothesis was rejected. Thus, it could be determined that the weight loss by the group was probably not due to chance factors and the program of diet restriction and exercise level increase had been effective in the loss of weight by the subjects. This finding is the generally accepted concept of weight reduction in the fields of medicine and nutrition. (14)

With consideration for the null hypothesis that there would be no statistically significant difference between scores of General Motor Ability recorded for Condition I and those recorded for Condition II,

TABLE I
 THE VALUES FOR FISHER'S "T" TEST OF THE
 SIGNIFICANCE OF CORRELATED MEANS

Variable	Md.	"t" Value	% Level of Confidence
Weight change	7.7976	7.3251	.01
General Motor Ability Condition I to II	2.2857	1.8755	
Obstacle Race Condition I to II	-7.2381	3.9291	.01
Broad Jump Condition I to II	-3.4762	3.1096	.01
Basketball Throw Condition I to II	- .238	.6432	
Subcutaneous Fat Distribution Condition I to II	.52208	5.1814	.01
Pulse Rate Condition I to II	1.6666	.6413	
Systolic Pressure Condition I to II	4.1500	2.4311	.05
Diastolic Pressure Condition I to II	10.7000	6.7812	.01

TABLE II

THE VALUE OF "R" FROM THE
PEARSON PRODUCT-MOMENT METHOD OF CORRELATION
WEIGHT TO ITEMS OF THE
MOTOR ABILITY BATTERY AND GENERAL MOTOR ABILITY

Variables	"r" Value	% Level of Confidence
Loss of Weight to General Motor Ability	.0926	
Without subject who gained	.2017	
Loss of Weight to Speed of ability to run Obstacle Race	.0702	
Loss of Weight to Distance of ability to Broad Jump	.272	

the "t" value of 2.845 was necessary for rejection of the hypothesis at the .01 level of confidence. The "t" value obtained by calculation was 1.8755, and the null hypothesis was accepted. This finding was judged to be expected in light of Wessel's work in that area, for which similar results were determined. (42)

With consideration for the null hypothesis that there would be no statistically significant difference between scores on the Obstacle Race item obtained for Condition I and those recorded for Condition II, a "t" value of 3.9291 was found to be statistically significant at the .01 level of confidence. The null hypothesis was, therefore, rejected. The factors influencing this change were unknown. An increase in leg power of the subjects might have occurred as a result of the exercise program. Self-motivation on the second administration of the test might have been a factor. The total state of the individual with regard to her condition of physical fitness might have changed as a result of the nutritional program and regular exercise.

With regard to the null hypothesis that there would be no statistically significant difference between scores obtained on the Broad Jump item for Condition I and those recorded for Condition II, the "t" value of 3.1096 was found to be significantly higher than the 2.845 value of "t" required to reject the hypothesis at the .01 level of confidence. The null hypothesis was rejected. The significant changes in the performance of the Broad Jump item might have been due to learning on the part of the subject, increased leg power, the general physical condition of the subjects or increased motivation on the second adminis-

tration of the test items. Scott (31) pointed out that the broad jump was related to leg strength; that factor, and that of increased motivation on the part of the individual subject, was regarded by the author to be the most important factors in the performance.

With regard to the null hypothesis that there would be no statistically significant difference between scores recorded for the Basketball Throw item at Condition I and those obtained for Condition II, a "t" value of 2.086 was required for rejection of the hypothesis at the .05 level of confidence. Since the "t" value was .6432, the null hypothesis was accepted. This lack of a significant change had been expected due to the fact that none of the girls had been sufficiently overweight through the shoulder girdle region for their excess poundage to have created mechanical impedimentation at the joint or within the muscles. In contrast, however, the subjects tended to be overweight through the region of the hips and legs. Perhaps it could be surmised, then, that loss of weight does not increase the ability of an individual to give impetus to an external object, such as a basketball; whereas, it might have influenced the ability of the subject to move herself, as in broad jumping.

With consideration for the null hypothesis that there would be no statistically significant difference between values obtained from the subcutaneous fat distributions as measured for Condition I and those obtained for Condition II, the value of "t" of 5.1814 was calculated. Since a value of "t" of 2.861 or greater was required for the rejection of the null hypothesis at the .01 level of confidence, the null hypothesis

was rejected. The changes in the mean values at the six sites selected for measurement were interpreted as indicative of a possible change of physiological state on the part of the subject as a result of the weight loss program. (14) Loss of weight has been found to have a relationship to loss of subcutaneous fat. But, it was also thought by the investigator that a large margin of error in measurement might have occurred. This error might have occurred as a result of the inexperience of the investigator with the technique used, although the same technique and the instruments were used for both conditions. In addition, the instrument was recalibrated once for use in other research work, which might have affected scores obtained for this study.

With regard for the null hypothesis that there would be no statistically significant difference between values obtained for the pulse rate at Condition I and those obtained at Condition II, a "t" value of .6413 was calculated and found to be not statistically significant at the .05 level of confidence and the null hypothesis was accepted. It was ascertained that, although the condition of overweight causes a strain on the circulatory functions (14), the degree to which the subjects as a group were overweight was not sufficient to expect a change in pulse rate. There is also a wide range of pulse rates which can be "normal" or related to good physical condition. The time required for the pulse rate to return to normal after exercise is a more significant measure of physical condition than the simple counting of the pulse rate. (15) Such measurements of circulatory efficiency were not taken in this study.

With regard for the null hypothesis that there would be no statistically significant difference between values obtained for systolic blood pressure at Condition I and those recorded at Condition II, a "t" value of 2.093 or greater was required for the rejection of the null hypothesis at the .05 level of confidence. Since a "t" value of 2.4311 was obtained for the mean value, the null hypothesis was rejected. Higher blood pressure was noted by Deaver (9) to be one of the physiological disadvantages of overweight, thus a lowering of the systolic pressure due to loss of weight might have been expected. There was some doubt on the part of the investigator that so great a decrease in blood pressure could have been due to the relatively small losses of weight. Perhaps the more relaxed state of the subject on the evening of the second testing might have influenced the decrease. It might have been assumed that greater the familiarity with the instrument and the procedure at the second testing might have encouraged greater physical and emotional "relaxation" on the part of the subjects. If this were so, then the blood pressure readings might have been influenced.

Considering the null hypothesis that there would be no statistically significant difference between values recorded for the Condition I and those obtained for the Condition II for diastolic blood pressure, the "t" value of 6.7812 which was significant at the .01 level of confidence caused the null hypothesis to be rejected. The same factors which had influenced the measurement of the systolic blood pressures were thought to have influenced the diastolic blood pressures.

Interpretation of the Null Hypotheses, "r"

With regard to the null hypothesis that there would be no statistically significant relationship between the loss of weight and the change in General Motor Ability performance at Condition II, the "r" value of .433 was required for rejection of the null hypothesis. The "r" value of .0926 caused the null hypothesis to be accepted. The "r" value of .2017 was obtained for the group when the score of the one subject who gained weight was excluded from calculation; this value was still not statistically significant.

With regard to the null hypothesis that there would be no statistically significant relationship between the loss of excess weight and the score of the Obstacle Race at Condition II, the "r" value of .0702 was not found to be statistically significant at the .05 level of confidence, and, therefore, the null hypothesis was accepted.

With regard to the null hypothesis that there would be no statistically significant relationship between the loss of excess weight and the change in score of the Broad Jump item of the motor performance test at Condition II, the "r" value of .272 was found to be not statistically significant at the .05 level of confidence and the null hypothesis was accepted.

The findings of the "r" values of relationship indicated that there might be some possible relationship between physical performance condition and the loss of weight by the subjects. However, on the basis of the data collected for this study, it was not possible to establish which factors influenced most this supposed relationship, if indeed it were a reality.

CHAPTER VII

CONCLUSION

Leading nutritionists believe that the problem of overweightness among the population may be the most serious health problem today. (3) This problem is recognized by practitioners within the field of medicine. Educators, too, should realize this problem, and should seek to work with professional health service personnel toward amelioration of the problem.

This paper has dealt with the problem of overweight as it might affect the work of the physical educator in his attempt to physically educate the individual. The question of overweight has been reviewed with reference to the physiological and psychological disadvantages which the condition poses for the individual. Basic understandings in nutrition have been presented; reference has been made to current theories and practice in the field of treatment of the obese. The role of exercise in obesity has been explored and its importance noted. These are fundamental knowledges which the physical educator must gain as he seeks to correlate the objectives of his discipline with those of the medical profession where the question of health is raised.

The physical educator might well say that he realizes that it is usually neither wise nor lovely to be overweight. He might also assert that psychological and physiological deterrents to health could be accompanied by inefficiency in motor skill. The movement-conscious physical educator is, therefore, concerned with exploring the question of the motor ability of the overweight student. The experimental design

of this paper was concerned with a problem which required an investigation of possible relationships between the loss of excess weight and the motor performance ability of college women.

The program was carried out under the direction of the Department of Physical Education and Student Health Services at The Woman's College of the University of North Carolina. Twenty-two subjects, approved by the College Physician, were the participants in an eight-week weight loss program based upon dietary restriction and exercise.

The students were placed upon a diet which restricted their caloric intake by approximately 1000 calories per day. All students ate in the College Dining Hall. They participated in an exercise program designed to increase their daily exercise level and the use of certain muscle groups.

Individual and group counseling was used to help in the fulfillment of an educational objective of the program. That objective was that the student should understand how weight loss occurred and what her desirable weight should have been according to her body type. Height-weight tables were used in the assessment of desirable weight. Ankle girth equivalent measurements were also used, and were considered the more specific measure.

The Scott Motor Ability Battery (31) was administered at the beginning of the program and re-administered at the close of the study. Clinical measures of physiological condition were also taken at these times. The condition of the subjects at the beginning of the program was defined as Condition I; the condition of the subjects at the close

of the study was described as Condition II.

At the conclusion of the program the investigator noted certain trends among the results. Such trends were of course influenced by the patterns of performance of the individual subjects.

The subjects were able to lose weight on a diet selection from the College Dining Hall constructed with regard for nutritional balance, and based upon a diet of approximately 1400 - 1600 calories per day. The rate of loss seemed to be related to the degree of overweightness of the subject. Those overweight to the greatest extent lost most uniformly and at the greatest rate of loss per week. It has been suggested that the motivation for the more overweight subject was greater and, therefore, her will power stronger. It must also be realized that the more overweight individual experienced a more drastic reduction in average daily intake. The average amount lost was 8.5 pounds total loss, excluding the weight change of the one subject who gained on the program. It is the opinion of the author that the subject who gained did not follow the program as designed.

Counseling proved to be an effective tool in the program. Through the use of this technique the investigator was able to approach the educational goal which had been set. That goal had been one of acquainting the student with nutritional principles and the physiology of weight loss. It was the estimation of the students that they had learned something about weight loss and diet which they had not known before the study. The counseling sessions also provided an opportunity for evaluation of the estimated weight for build which was determined by

each subject before the program. Comparisons of these estimates on the part of the subjects with height-weight tables and assessment of weight for build by the ankle girth equivalent method showed that most of the students realized with fair accuracy their desirable weight.

With regard to the tests of general motor ability it was found that significant changes in ability occurred. Improvement was shown in individual items which were primarily dependent on leg power, but improvement was not noted in the item involving shoulder girdle strength. It has been suggested that the lack of improvement in the basketball throwing item which requires shoulder and arm strength might have been due to the fact that the subjects were, for the most part, not overweight in the shoulder region, but they were overweight in the hips and legs. Therefore, changes in performance might not be expected for items which depend primarily upon the function of muscle groups from which little weight loss occurred.

In spite of significant changes in performance of the skills and significant loss of weight, the degree of relationship between loss of weight and motor performance was not found to be statistically significant. It is the opinion of the author that increased leg power through exercise and the motivation to improve the previous score were most important factors in the changes in motor performance displayed by the group.

Measures of physiological function showed that the changes in the physiological state of the group between Condition I and Condition II were typical of persons losing excess weight. (39) Pulse rates did not

change significantly; changes in blood pressures and subcutaneous fat distribution were significant at either the .01 or .05 level of confidence.

The factors which students most often indicated as motivational factors in their desire to lose weight were a desire to improve their appearance and concern for their health.

In this connection, the wisdom of the inclusion of a weight loss program in the physical education program was discussed by the author with the College Physician. The College Physician indicated that if coordinated with Health Services, the wisdom of a weight loss program designed by the Department of Physical Education might be justified. She remarked that the author of this paper was able to give the students more individual attention with regard to a specific diet and an exercise program than Health Service personnel would have time to render to each student. The College Physician also pointed out that in a situation in which special dietary facilities were supervised by the Health Service this would be the preferred method of dietary control, and that the role of the physical educator would then become one of providing prescribed exercise and perhaps aid in the motivation of the student to lose weight.

In light of the enthusiastic response which the subjects showed for the program, and the support and confidence shown by the College Physician in this study, it is the opinion of the author that the program of weight loss was a success. Further work might be justified in the study of the nutritional status of students and its relationship to their motor ability and efficiency.

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OLD DO

SIN TRES

APPENDIX

10

AMIRAL



Subject No. 1. Feb. 7, 1961



March 27, 1961



Subject No. 2. Feb. 7, 1961



March 27, 1961



Subject No. 1. Feb. 7, 1961



March 27, 1961



Subject No. 2. Feb. 7, 1961



March 27, 1961



Subject No. 3. Feb. 7, 1961



March 27, 1961



Subject No. 4. Feb. 7, 1961



March 27, 1961



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March 27, 1961



Subject No. 7. Feb. 7, 1961



March 27, 1961



Subject No. 8. Feb. 7, 1961



March 27, 1961



Subject No. 9. Feb. 7, 1961



March 27, 1961



Subject No. 10. Feb. 7, 1961



March 27, 1961



Subject No. 11. Feb. 7, 1961



March 27, 1961



Subject No. 12. Feb. 7, 1961



March 27, 1961



Subject No. 11. Feb. 7, 1961



March 27, 1961



Subject No. 12. Feb. 7, 1961



March 27, 1961



Subject No. 13. Feb. 7, 1961



March 27, 1961

Subject failed to
return photograph



Subject No. 14. Feb. 7, 1961

March 27, 1961



Subject No. 15. Feb. 7, 1961



March 27, 1961



Subject No. 16. Feb. 7, 1961



March 27, 1961



Subject No. 17. Feb. 7, 1961



March 27, 1961



Subject No. 18. Feb. 7, 1961



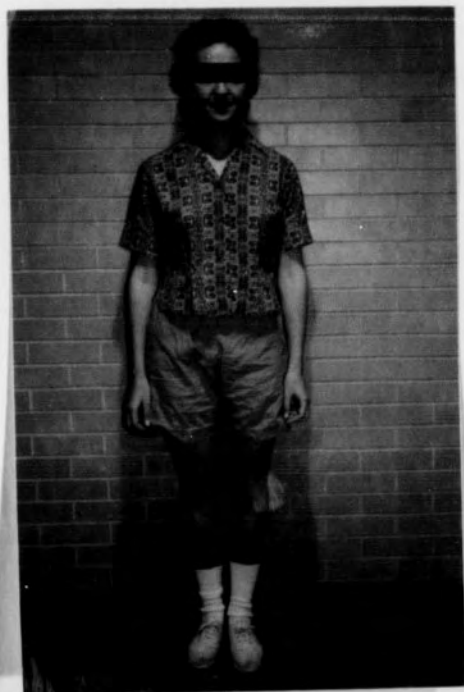
March 27, 1961



Subject No. 19. Feb. 7, 1961



March 27, 1961



Subject No. 20. Feb. 7, 1961

March 27, 1961



Subject No. 21. Feb. 7, 1961



March 27, 1961

Subject failed to
return photograph

Subject dropped pro-
gram Feb. 12, 1961

Subject No. 22. Feb. 7, 1961

March 27, 1961

PRE-STUDY INTERVIEW

Date: _____

Name: _____ Year: _____

Res. Hall: _____ Room: _____ Tel.: _____

Student willing to part.: _____ How contacted: _____
 Student's estimate of height: _____ Weight: _____
 Student's expectations of weight loss: _____ Weighing time: _____
 Student's roommate or friend: _____

FOOD HABITS

1. Eats in College dining hall: (1) (2) (3) meals daily. Reasons for skipping meals _____
2. Works in College dining hall: (yes) (no) _____
3. Eats often between meals: (yes) (no) what? _____
4. Meal times _____
5. Other times during the day when hungry: _____
6. Particular food dislikes: _____
 (Allergies) _____

7. Particular food likes: _____

8. Attitude toward food: _____

DAILY LIVING

1. Hours sleep per night: _____ (avg.) Rests: (well) (poorly) _____ explain
2. Relaxation and recreation: _____

3. Exercise (regular): _____
4. Class schedule: _____
5. Study schedule: _____

OTHER

Student restricted in physical education? _____
 Under care of College or other physician? _____
 Extent: _____
 Previous history of diet therapy: _____

Remarks:

1. Approval College Physician _____ Date _____

Orientation Discussion

February 7, 1961

Introduction

A. The purpose of the program

1. As a study of what happens in weight loss
2. As an effort to help students lose weight

B. Related physiology

1. Law of the Conservation of Energy
2. Appetite
3. What happens in weight loss
4. The effects of exercise

C. "Tricks"

1. Saccharine
2. Eating slowly
3. Conversation helps
4. Drink a great many liquids
5. Change of activity when bored

D. About the diet

1. Related nutrition
 - a. Balance of nutrients
 - b. Eat everything but do not add
2. Mimeographed copies

E. About the exercise program

1. Classes
2. Copies of directions
3. Performance at home

F. Weighing sessions

G. Interviews

H. Instructions for testing

1. What to wear

2. Bring books to study

3. What to expect

a. Kinds of tests

b. How long it should take

FOOD RECORD

NAME: _____ WEEK: _____

DAY OF WEEK: _____

Breakfast: (Kind and amount eaten)	Lunch: (Kind and amount eaten)	Supper: (Kind and amount eaten)
fruit: _____	salad: _____	_____
cereal: _____	veg.: _____	_____
main dish: _____	_____	_____
bread: _____	meat: _____	_____
jellies: _____	bread: _____	_____
syrup: _____	soup: _____	_____
sugar: _____	sugar: _____	_____
cream: _____	cream: _____	_____
butter: _____	butter: _____	_____
other: _____	dressings: _____	_____
_____	gravies: _____	_____
beverage: _____	jellies: _____	_____
_____	relishes: _____	_____
Snacks:	dessert: _____	_____
_____	beverages: _____	_____
_____	other: _____	_____
_____	_____	_____
_____	_____	_____

MENUS FOR THE WEEK OF
March 20, 1961

NAME:

HALL:

MONDAY March 20, 1961

Cherries	Peach and Pineapple Salad	Tossed Salad
Scrambled Eggs	Cheese sandwich	Sweet Potatoes
Toast - Butter*	Beef Broth and Tomatoes	Green Beans
Skim milk	Skim milk	White Mt. Roll (1)
Coffee or Tea	Tea	Coffee or Tea

Snacks: 2 servings Fruit

TUESDAY March 21, 1961

Orange juice	Jellied Fruit Salad	Cole Slaw
Choice of cereals (not pre-sweetened)	Green Peas	Spinach
Bacon	Barbecued Hamburger	$\frac{1}{2}$ Serving Potatoes
$\frac{1}{2}$ teas. sugar	1 Bun	Choice of Lamb or Halibut
Choice of Milk	Skim milk	1 Biscuit
Coffee or Tea	Tea	$\frac{1}{2}$ Pat Butter*
		Coffee or Tea

Snacks: 1 serving Fruit

WEDNESDAY March 22, 1961

Tang	Tossed Salad	Waldorf Salad
1 Egg	Brussel Sprouts	Corn
1 Muffin	Chipped Beef Casserole	Green Beans
$\frac{1}{2}$ Pat Butter*	1 Roll	Roast Beef no gravy
Skim milk	$\frac{1}{2}$ Pat Butter*	1 Muffin
Coffee or Tea	No Dressing	$\frac{1}{2}$ Pat Butter*
	Apricots - no juice	No Dressing
	Tea	No Gravies
		Skim milk
		Coffee or Tea

Snacks: 1 serving Fruit

THURSDAY March 23, 1961

Blended Juice	Cole Slaw	Grapefruit and Cucumber Salad
Choice of Cereals	Baked Beans	Cauliflower
Link Sausage	2 Frankfurters	$\frac{1}{2}$ Serving Tomatoes
$\frac{1}{2}$ Pat Butter*	1 Bun	Veal cutlet-no sauce
Skim milk or Whole milk	Relishes as desired	1 slice Raisin Bread
	Skim milk	$\frac{1}{2}$ Pat Butter*
	Tea	Coffee or Tea

Snacks: 1 serving Fruit

*Optional

WEEK OF MARCH 20, 1961

FRIDAY March 24, 1961

Grapefruit Sections
 Scrambled Eggs
 1 Muffin
 ½ Pat Butter*
 Skim milk
 Coffee or Tea

Fresh Fruit
 Squash
 Tuna Cheese Bun
 Ice Cream
 Tea

Frozen Tomato Cream
 Rice
 Peas and Carrots
 Choice of Shrimp or
 Chicken
 Coffee or Tea

Snacks: 1 serving Fruit

SATURDAY March 25, 1961

Prune Juice
 Hot Cereal
 Sausage
 Skim milk
 Coffee or Tea

"Vitamin" Salad
 Green Beans
 Corned Beef Hash
 Navy Bean Soup
 Tea

Applesauce
 Black-eyed Peas
 Broccoli
 Spareribs
 Skim milk
 Coffee or Tea

Snacks: 1 serving Fruit

SUNDAY March 26, 1961

Orange Juice
 Choice of Cereals
 Bacon
 Skim milk or whole milk
 Coffee or Tea

Cole Slaw
 Apple Wedges
 Mashed Potatoes
 Baked Ham-No Sauce
 1 Biscuit
 Ice Cream
 Coffee or Tea

Carrots, Celery,
 Olives
 Chili Con Carne
 ½ Ham Sandwiches
 Skim milk
 Coffee or Tea

Snacks: 1 serving Fruit

*Optional

WE WILL NOT MEET MONDAY MARCH 20 -- due to the Mass Meeting that night.

WE WILL meet Tuesday March 21, 1961, instead. Please come at 7 o'clock if you can.

Thanks,

Sally Robinson

EXERCISE PROGRAM OUTLINE

WEEK I

Running in Place-(2 min.)
 Toe Reach-(10)
 Side Stretches-(10)
 Leg Swings-(10)
 Abdominal Curls-(10)

WEEK II

Deep Knee Bends-(10)
 Arm-Shoulder Resistance-(10)
 Leg Swings-(20)
 Abdominal Curls-(10)
 Rag Doll-(10)

WEEK III

Abdominal Curls-(16)
 Toe Touches-(10)
 Modified Push-ups-(8)
 Side Stretches-(12)
 Running in Place

WEEK IV

Toe Touches-(16)
 Modified Push-ups-(8)
 Jumping Jacks-(14)
 Body Bends-(4)
 Choice

WEEK V

Running in Place
 Leg Swings-(12)
 Abdominal Curls-(15)
 Leg-Lift and Cross-Over-(10)
 Body Bends-(4)

WEEK VI

Leg-Left and Cross-Over-(10)
 Swan-(10)
 Deep Knee Bends-(10)
 Alternating Toe Touches-(12)
 Abdominal Curls-(15)
 Trunk Rotation-(12)

WEEK VII

Running in Place
 Swan-(12)
 Alternating Leg Lifts-(15)
 Trunk Rotation-(12)
 Abdominal Curls-(18)
 Arm-Shoulder Resistance-(8)

WEEK VIII

Students had choice of
 exercises to last twenty
 to thirty minutes.

EXERCISES

The following are descriptions of the exercises used in the eight-week weight loss program. The exercises were listed in the order in which they appeared on the program outline. The descriptions were written in the form of instructions to students.

Running in Place.--Assume an erect standing posture. Run in place at a rate of 120 steps per minute for one minute. Be sure that your toes touch the floor first and that your weight is taken on the balls of the feet. At the end of the first minute stand and rest for one minute. Then, repeat the exercise at a rate of 132 steps per minute for one minute.

Toe Reach.--Assume a sitting position on the floor with the legs extended in front in a "V" shape. Without bending the knees, reach forward with the left arm to touch the left hand to the right toes. Alternate reaching right and left to a count of four. Perform six the first night and add two each evening until ten repetitions have been reached; maintain the rate of ten repetitions.

Side Stretches.--Assume a good standing posture then place the feet shoulder width apart. Bend to the right as if to touch the right ankle with the right hand. The left arm should "follow" overhead, thus aiding in balance. Keep the pelvis in proper alignment and maintain good balance. Reach four times to the right; then four to the left, each change of direction being one repetition of the exercise. Perform six Side Stretches on the first evening and add two performances of the exercise until ten repetitions have been reached.

Leg Swings.--With a partner assisting, or with other support, swing your right leg forward into an extended position in front. Keep your left leg straight and point right toes. Swing the right leg back turning the right knee outward while keeping the lower part of the right leg parallel to the floor. This is a two count exercise. One count is assigned to the forward portion of the swing; one to the backward portion. Perform ten times with each leg on the first evening and add two repetitions each on the following evenings until sixteen repetitions have been reached.

Abdominal Curls.--Start in a back lying position on the floor with the feet on the floor near the hips. A partner should hold your feet securely at the ankles. The exerciser is to place her hands on the back of her shoulders. From this position, raise to a sitting position so that the elbows touch the knees. Return to the floor carefully. One performance is counted for each time you sit up and return to the starting position. The exercise is repeated six times the first evening with the addition of two repetitions for each of the following evenings until ten repetitions have been reached.

Deep Knee Bends.--Assume a good standing posture and place hands on the hips. This is an exercise performed in twelve counts. On counts one and two lift your heels off of the floor so that the weight of your body is taken onto the balls of the feet. Bend at the knees and lower the body toward the floor for counts three, four, five and six. On counts seven, eight, nine and ten raise the body to the position at count two. With counts eleven and twelve lower the heels to the floor. Keep your back straight and hips in line throughout the entire exercise.

This exercise is to be repeated six times on the first evening; two additional repetitions are to be performed each evening until the level of ten repetitions has been reached.

Arm-Shoulder Resistance.--The exercise is performed with a partner. The partner kneels behind the "exerciser" who is sitting cross-legged on the floor. The "exerciser" assumes a good sitting posture and places her hands behind her head so that the elbows extend in front. The kneeling partner offers resistance for eight counts while the sitting partner attempts to bring her arms back to a position in which the elbows are extended to the side. The kneeling partner is to let the sitting partner "win." The exercise is repeated with the kneeling partner in front; this time she tries to resist the sitting partner in her effort to bring her arms forward. Start with six repetitions and work up to ten repetitions by adding two more each evening.

Rag Doll.--Stand with the feet twelve to eighteen inches apart. Reach upward with both hands as high as possible; then, bend forward from the waist and swing the hands toward the floor. The swinging movement is to be relaxed, but the balance maintained. At the bottom of the downward swing start a bouncing movement from the hips for the six count rhythm: "Swing, bounce, bounce, bounce, and up and rest." Start with six repetitions of the exercise and continue to add performances of the exercise until a rate of ten repetitions has been reached. This rate is to be maintained.

Toe Touches--hurdle position.--Assume a hurdle position sitting on the floor (one leg extended in front; one leg bent at the knee and turned to the side). Reach forward toward the toes with both hands; bend from

the hips. The reach should be with a bouncing motion to a four count rhythm. Bounce right four times and left four times for the completion of one repetition of the exercise. Repeat the exercise four times the first night and add two repetitions each night until ten repetitions have been reached. Maintain this rate.

Modified Push-ups.--With knees bent assume a front leaning position with the arms extended in front of the body. The hands should be just below the shoulders with the fingers pointing forward; the back should be straight. Bend the elbows and lower the body toward the floor--keeping the back straight; this is count one. Count two is the return to the starting position accomplished by extending the elbows. Start with three Modified Push-ups and add one each evening.

Jumping Jacks.--Start with a good standing posture. Hands should be at the sides and the feet together. From this position, jump feet to side into wide stride position and clap hands overhead. This is the position for count one of this two-count exercise. Count two occurs when you return to the starting position. Start with eight repetitions of the exercise and work up to fourteen, adding one each evening.

Body Bends.--Assume a good standing posture; place hands on hips. Bending from the waist lean backward with a bouncing motion. There should be four distinct bending movements for the first series of backward movements. Now, bend laterally to the right with a bouncing motion for four distinct counts; repeat in the forward direction; repeat laterally to the left. Return to the position for the backward bend; bounce back twice. Repeat as before, continuing in new two count pattern. Repeat again with a one count motion. Perform this exercise once the first

evening and add one more repetition each evening until four repetitions have been established; maintain this level.

Leg-Lift and Cross-Over.--Assume a back lying position on the floor. Extend your arms to the side. This is a four count exercise. On the count of one lift right leg, knee extended and toes pointed, to the vertical position. On count two lower the right leg toward the floor on the left side as if to touch the fingers of the left hand. On count three raise the leg to the position for count one. Return leg to starting position on count four. Repeat with the left leg. Alternate right and left legs. Start with six repetitions for each leg and add one each evening until ten are reached.

Swan.--Assume a front lying position on the floor. Extend the arms to the side with the palms downward. This is a slow four count exercise. On count one lift the head and chest as far from the floor as possible. Hold this position for a slow count of two and three; return to the lying resting position of count one for count four. The return should be smooth and controlled. Start with five repetitions and increase the amount to ten; maintain this rate.

Deep Knee Bends--two count.--Stand in good posture. Place hands on hips. Bend knees so that you are in squat position. Keep your back straight, head up and weight evenly distributed. It may be necessary for some to use arms for balance by extending them to the side. Work to the point of having hands on hips as quickly as possible. The squat is count one; the return to the standing position is count two. Start with six repetitions of the exercise and add one each evening until ten repetitions have been established.

Alternating Toe Touches--standing. Assume a good standing posture. By bending at the hips reach to touch the toes of the left foot with the right hand. Return to good standing posture and repeat the exercise, this time reaching with the left hand to touch the toes of the right foot with the right hand. This is an exercise performed in four counts. Counts one and three occur when the hands touch the toes; counts two and four are designated for the return to the upright posture. Start with six complete repetitions of the exercise and work up to twelve.

Trunk Rotation.--Assume a good standing posture, then shift your feet about ten or twelve inches apart. Raise arms to the front and, keeping hands in the same horizontal plane, rotate trunk to the side with the arm on the same side "leading." This is count one. Return to the starting position on count two; rotate to the opposite side for count three; return to the front for count four. Perform eight repetitions of the exercise the first evening. Work up to twelve by adding two repetitions each evening.

Alternating Leg Lifts.--Assume a back lying position on the floor. Extend your arms to the side. This is a two count exercise. On count one lift the right leg to a vertical position. On count two begin to lower the right leg and raise the left leg so that they pass in the air. Count one repetition of the exercise for each time the right leg reaches the highest point. Start with eight repetitions of the exercise and work up to fifteen.

March 21, 1961

Dear _____,

Monday, March 27, 1961, and Tuesday, March 28, 1961, have been designated as the dates for the final testing sessions of my study.

Please be making your plans now to attend a testing session on each of those evenings.

On Monday, March 27, we will meet in room 22 Coleman at _____ p. m. Wear a gym suit and sneakers that night. On Tuesday evening, March 28, please come to room 22 Coleman at _____ p. m. Wear a gym suit, but bring the clothes with you in which you had your picture taken at our first meeting in February. Also bring that first picture.

Please be prompt. If any conflict should arise, get in touch with me as soon as possible.

Thank you - all,

Sally Robinson

223 South Spencer
Ex. 311

POST STUDY QUESTIONNAIRE

Physical Educ. 494

Name:

Class:

Please answer each question. Answer the questions without concern about a "right" or "wrong" answer. Every response is correct, if it is sincere.

Do you feel that the program was worthwhile for you? _____

Why, or why not?

What was the most difficult thing for you to do?
(Such as give up sweets, "stick to it"; exercise.)

Would you recommend this type of program to someone else if it were being offered again? _____

Why, or why not?

Did you stick to the diet as prescribed? _____

Describe how closely you followed directions: ate everything; skipped some things; added some things. How often did you break the diet when on campus? As a rule: 1 meal per week, two, three, etc. _____

Were you ever in the infirmary during the program? _____
If so, why and for how long? _____

Did you ever feel cross and/or unhappy because you were hungry? _____
If so, please describe situation.

Has your clothes size changed? _____ If yes, how much? _____

Were you ever sore from having done the exercises? _____
If so, describe.

Did you exercise every night as directed? _____ If not, explain.

Do you think that you understand anything more about weight loss and dieting than you did at the start? _____

What factors would influence you most to keep your weight down now?
(a) health; (b) appearance; (c) family or friends; (d) other (name)

Typed by
Elizabeth Booker