

AN INVESTIGATION OF CERTAIN
CHARACTERISTICS OF ATHLETE AND
NON-ATHLETE HIGH WEIGHT GAINERS

Thesis for the Degree of M. A.
MICHIGAN STATE UNIVERSITY

Marvin A. Zuidema

1959

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AN INVESTIGATION OF CERTAIN CHARACTERISTICS OF ATHLETE AND
NON-ATHLETE HIGH WEIGHT LIFTERS

BUREAU OF EDUCATIONAL RESEARCH
COLLEGE OF EDUCATION
MICHIGAN STATE UNIVERSITY
EAST LANSING, MICHIGAN

By

Marvin A. Zuidema

A THESIS

Submitted to the College of Education of Michigan State
University of Agriculture and Applied Science
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Department of Health, Physical Education, and Recreation

1959

ACKNOWLEDGMENTS

I wish to express my indebtedness and appreciation to Dr. Henry J. Montoye for his guidance and assistance so generously given me in this research project. I am also grateful for the cooperation given me by Mrs. Norma Ray of the Tabulating Department, Michigan State University and Mr. John Van Dyke, Statistics Department, Michigan State University.

DEDICATION

to

my wife

Virginia

and infant daughter

Dawn Elaine

who went to be with

the Lord, July 30, 1958

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CHAPTER I

INTRODUCTION

Overweight is regarded as the primary health problem in the United States.¹ Much has been written on the dangers of overweight. Yet, the incidence of overweight appears to be increasing. One-fifth of the people in the United States over 30 years of age are considered overweight.² The problem has become so acute that many medical and actuarial groups are making a national attack on it. The urgency of the problem demands continued careful investigation of all phases of it.

Statement of the Problem The present study was carried on for the purpose of obtaining and comparing information on activities, habits, medical ailments, heredity and environmental conditions, and other closely related characteristics of a group of former college athletes and non-athletes who had gained considerable weight since leaving college and a comparable group of former college athletes and non-athletes who had not gained weight since leaving college.

Importance of the Study Overweight as our primary health problem needs careful study and research. Every authentic study completed in this area will aid in the fight against this national menace. Research

¹Howard A. Rush, "Overweight: Our Primary Health Problem," Readers Digest, 62: 122-4, February, 1953.

²Donald B. Armstrong, Louis I. Dublin, George M. Wheatley, and Herbert H. Marks, "Obesity and Its Relation to Health and Disease," Journal of the American Medical Association, 147: 1007-1014, November 10, 1951.

must join in the fight if the battle is to be carried forcefully forward.

The conclusions of this study may reveal new insights into the problem. They may serve to verify known facts. New channels of attack may also be opened in the fight against overweight.

Definition
of Terms

The following definitions apply to terms used in this study:

1. Athlete - A person who has earned a letter in a major varsity sport at Michigan State University.
2. Non-athlete - A person who has not earned a letter in any major varsity sport at Michigan State University.
3. High Weight Gain Group - A group of graduates from Michigan State University who have gained considerable weight since leaving college. (Their mean weight gain was 23.8 per cent.)
4. Low Weight Gain Group - A group of graduates from Michigan State University who have gained relatively little weight since leaving college. (The mean weight change in this group was -1.7 per cent.)

Limitations

The limitations of this study are as follows:

1. The data was drawn from answers to a questionnaire which was made up by the Phi Epsilon Kappa Fraternity's Committee on Longevity. In some instances the questions on the questionnaire were ambiguous.

2. The results of this thesis, as in most questionnaire studies, contained a certain number of biased answers due to the fact that the responses were on a subjective basis.

3. "Michigan State Longevity and Morbidity Study" showed a return of 55.6 per cent and 49.9 per cent of the questionnaires sent to former athletes and non-athletes, respectively.³ Since the same subjects were used in this study the limiting number of responses also affects this study.

4. This study investigated only graduates of Michigan State University. The findings were thus based on a somewhat select environmental group although the student body does come from all parts of the world.

5. Subjects were selected according to a stratified random sampling technique based on date of birth and per cent body weight change after leaving college. No consideration was taken of initial weight in college. It perhaps would have been better to stratify the sample according to initial weight in college also. This would have eliminated the possibility of any persons being placed in the high weight gain group who now were "normal" weight but who while in college were greatly underweight. The probability of this occurring is low but a few cases may have been involved.

³ Henry J. Montoye, Wayne D. VanHuss, Herbert W. Olson, William R. Pierson, and Andrew J. Hudac, The Longevity and Morbidity of College Athletes, (Phi Epsilon Kappa Fraternity, 1957), p. 8.

CHAPTER II

REVIEW OF LITERATURE

I. INTRODUCTION

There are many indications that overweight is becoming increasingly important in medical practice. More men and women are living to the ages in which adipose tissue is easy to acquire and difficult to lose. The high level of national income has permitted many persons to indulge their desire for food and drink. Recently, the high cost of protein foods has favored increased carbohydrate and high caloric food intake. Increased sedentary living has come with the mechanical age. On the other hand, a growing segment of the public is showing real interest in weight control. This appears to stem from a desire to learn and adopt changes in diet and mode of living that promise better health, longer life, and improved physical appearance.¹

The conditions favoring overweight and the growing interest in weight control have led to much study, research, and discussion. Such factors as frequency, causes, harms, prevention, and treatment have been investigated. Much has been said regarding the relationship of overweight and diseases.

In reviewing the literature no studies were found comparing the characteristics of a group of "overweight" individuals with a group of "normal" weight individuals. This was the impetus of the present study.

¹Donald B. Armstrong, Louis I. Dublin, George M. Wheatley, and Herbert H. Marks, "Obesity and Its Relation to Health and Disease," Journal of the American Medical Association, 147:1007-1014, November 10, 1951.

However, the literature does contain many references to studies involving an analysis of factors and characteristics associated with overweight and obesity. This chapter contains a review of the literature pertaining to the factors and characteristics associated with overweight.

II. NORMAL WEIGHT: OVERWEIGHT: OBESITY

In the literature the conditions of underweight, normal-weight, overweight, and obesity are distinguished. However, the criterion for distinguishing these conditions is not always agreed upon. The usual policy has been to consider all persons 10 per cent below "average" as underweight, 10 per cent above "average" as overweight, and 20 per cent above "average" as obese.^{2,3} Obesity is defined as "abnormal amount of fat on the body".⁴ There, however, appears to be no common agreement upon what the "average" or "ideal" weight is.

The most popular criterion for "average" weight has been the well known age-height-weight tables. Perhaps, the most widely used of these have been the "Ideal Weight Tables" prepared several years ago by the Metropolitan Life Insurance Company.⁵ Some of these tables also include

²Ibid.

³Harrison H. Clarke, Application of Measurement to Health and Physical Education, (New York: Prentice-Hall, Inc., 1954) p. 110.

⁴Clarence Wilbur Taber, Cyclopedic Medical Dictionary, (Philadelphia: F. A. Davis Company, 1946.)

⁵"Ideal Weights for Men", Metropolitan Life Insurance Company, Statistical Bulletin, 24:6, June, 1943. "Ideal Weights for Women", Metropolitan Life Insurance Company, Statistical Bulletin, 23:6, October, 1942.

a body type index along with the age and height indexes. These tables have the advantage of universal appeal and understanding and simplicity and economy of measurement.⁶

Pett⁷ has prepared a table of "average" weights for height, age, and sex which he recommends as a criterion for determining overweight and obesity. The table was constructed from a sample of weights, heights, and skinfold measures of 22,000 Canadian people. The author says that this table gives a better reference point in studies on overweight because it involves the "average" weights of a more representative sample than do many of the current tables now used.⁸

The use of these "average" or "ideal" weight tables has been criticized by several authors. Mayer⁹ feels they do not represent the average weights of the world's population today. Pett¹⁰ challenges their origins. Cureton¹¹ calls them "rough guides".

Prediction equations have been advocated by many as a better method of weight analysis.^{12,13} Of these Cureton's equation¹⁴ is perhaps best

⁶Clarke, op. cit., p. 110.

⁷Lionel Bradley Pett, "A Canadian Table of Average Weights for Height, Age, and Sex", Biological Abstracts, 30:5606, January-June, 1956.

⁸Ibid.

⁹Jean Mayer, "Overweight and Obesity," Atlantic Monthly, 196:69-72, August, 1955.

¹⁰Pett, op. cit., p. 5606.

¹¹Thomas Kirk Cureton, Physical Fitness Appraisal and Guidance, (St. Louis: C. V. Mosby Company, 1947), p. 141.

¹²Ibid.

¹³Clarke, op. cit., p. 110-118.

¹⁴Cureton, op. cit., p. 141.

known. Weight according to his method is predicted on the basis of calculated skeletal, muscle girth, and adipose indexes. Overweight and obesity are determined by comparing actual weight with predicted weight. The guide of 10 per cent above predicted weight as overweight and 20 per cent above predicted weight as obese can be used.

Prediction equations were originated because body build and tissue components were found to be very important in determining "average" weight. The "Ideal Weight Tables" had completely neglected body build, skeletal dimensions, and gross proportions of bone, muscle, and fat.¹⁵

The main disadvantage of prediction equations is that they demand accurate personal measuring programs. Such measuring programs are impossible in questionnaire type studies on overweight and obesity.

Mayer in 1955 reported a criterion for determining "normal" weight. In criticizing the age-height-weight tables, he says:

"Your safest guide as to what you should weigh is not a table based on the estimated weights of a selected group of fully clad professional men of a bygone era, but it is what you, yourself, weighed at the peak of your physical form, when you were about 25. At that age both your bones and your muscles have stopped growing. It is a weight that you should be able to maintain, with out undue suffering, by diet and regular exercise."¹⁶

One restriction to this criterion is cited by Mayer. He says that the weight at twenty-five may not be the proper guide for the minority of people who do not become fat as a creeping process in the middle years of life due to physical inactivity and accessibility of food, but

¹⁵Clarke, op. cit., p. 110.

¹⁶Mayer, op. cit., p. 70-71.

who were obese throughout childhood and youth.¹⁷

Mayer's criterion has the advantage of simplicity of administration, especially in questionnaire type studies. Also, each individual in this method acts as a control for himself. This eliminates many factors that otherwise might come into the picture. The criterion works nicely into the commonly used guide of 10 per cent above "average" being considered overweight and 20 per cent above "average" being obese. The "average" in Mayer's criterion would be a person's own weight when he was twenty-five.

Summary Various criteria have been used to judge normal-weight, overweight, and obesity. Usually 10 per cent below "average" is considered underweight, 10 per cent above "average" is overweight, and 20 per cent above "average" is considered obese. Different criteria have been used to determine the "average". Among these are age-height-weight tables, body build tables, and prediction equations. Recently, Mayer has recommended using a person's weight at twenty-five as his most "ideal" or "average" weight.

III. MEDICAL AILMENTS

The association of overweight and obesity with many serious physical impairments is evident from numerous studies. Zisowitz¹⁸ says that obesity is a major cause of poor health easily outranking such widely publicized menaces as smoking and drinking. The studies found

¹⁷ Ibid.

¹⁸ Milton L. Zisowitz, "Dangers and Cures of Obesity," American Mercury, 65:604-610, November, 1957.

in the literature regarding obesity and impairments mainly deal with the relationship of obesity with heart disease, high blood pressure and hypertension, arteriosclerosis and atherosclerosis, diabetes, and cancer. These studies are reviewed in this chapter.

Much study and discussion has been made on overweight and heart disease. Rush¹⁹ says heart disease, whatever its specific cause, is always aggravated by obesity. Briggs²⁰ in 1951 said that a normal heart or a heart only slightly diseased may show symptoms that are solely the expression of some extra-cardiac disease such as obesity, which condition may manifest itself in the cardiovascular system. Doyle and his associates²¹, in a recent study of 1,913 male office workers in Albany, investigated the relationship between weight and ischemic heart disease. They found that in subjects grouped according to the "Metropolitan Ideal Weight Tables" a body weight up to 39 per cent over "average" weight carried little increased risk of ischemic heart disease. However, body weights over 40 per cent nearly quadrupled the risk. In the same study, Doyle and his associates also grouped the subjects according to weight gain after the age of twenty-five. The result here showed that an increase of body weight of more than 20 per cent above the weight level existing at the age of twenty-five doubled the risk of developing heart disease.

¹⁹ Rush, op. cit., p. 122-124.

²⁰ John F. Briggs, "Reversible Forms of Heart Disease," Biological Abstracts, 25:1124, January-June, 1951.

²¹ Joseph T. Doyle, A. Sandra Heslin, Herman E. Hilleboe, Paul F. Formel, and Robert F. Kornis, "A Prospective Study of Degenerative Cardio-Vascular Disease in Albany: Report of Three Year's Experience in Ischemic Heart Disease," American Journal of Public Health, Supplement April, 1957, p. 25-32.

Chapman and his associates²² recently completed a study on weight and coronary disease. Their subjects were 2,252 civil service employees in Los Angeles. Each subject was placed in one of four weight classifications according to a weight scale based on height divided by the cube root of weight. Their results showed that among men 40-54 years of age, the incidence of coronary disease was highest in the heavy weight class and lowest in the light weight class. In the 55-70 year-age group, the incidence of coronary disease among males in the light height-weight class was similar to the incidence in the heavy class.

In viewing studies of coronary heart disease, Gubner²³ says that although too much emphasis has been put on overweight as the direct cause of coronary heart disease, the indirect relationship between the two conditions is even greater than many studies have indicated. Furthermore, he contends that statistical studies that show little difference between overweight people and the so-called average weight ones as far as heart diseases go are misleading. Millman²⁴ takes a more conservative view when he writes that obesity by itself causes no heart disease but unquestionably hastens and aggravates it. Master and Jaffe²⁵ in a study

²² John M. Chapman, L. S. Goerke, Wilfred Dixon, Donald B. Loveland, and Edward Phillips, "The Clinical Status of a Population Group in Los Angeles Under Observation for Two to Three Years," American Journal of Public Health, Supplement April, 1957, p. 33-42.

²³ Richard S. Gubner, "Bigger Link Between Weight, Heart Disease," Science News Letter, 72:406, December 28, 1957.

²⁴ Max Millman, "Weight, Heart, and Blood Pressure," Today's Health, 30:28-29, November, 1952.

²⁵ A. M. Master and H. L. Jaffe, "The Incidence of Obesity in Coronary Disease," Abstracts of World Medicine, 18:1624, July-December, 1955.

of persons with coronary heart disease found that obesity is more common in persons with coronary disease, but report that no conclusion can be drawn as to the etiological relationship between these two conditions.

Taking a somewhat reactionary view, Keys²⁶ says that a critical review of the question of the relationship between obesity and degenerative heart disease indicates that overweight alone does not account for the present high incidence of coronary heart disease in the United States. He feels the relationship of obesity to degenerative heart disease is yet to be studied adequately.

Increased blood pressure and hypertension have been linked to overweight and obesity. A study²⁷ of army officers showed that sustained high blood pressure developed among overweights at an annual rate of 4.6 per thousand as compared with only 1.8 per thousand among those of normal weight. The recent report of Master, Dublin, and Marks²⁸ based on a sample among 74,000 industrial workers showed at every age and in both sexes a steady progression in average blood pressure, both systolic and diastolic, with increase in body weight for height. In general, the largest differences were found at the older ages and among women. Schnurman²⁹ in analyzing blood pressure found a definite

²⁶ Ancel Keys, "Obesity and Degenerative Heart Disease," Biological Abstracts, 29:8262, January-June, 1954.

²⁷ Rush, op. cit., p. 123.

²⁸ A. M. Master, L. I. Dublin, and H. H. Marks, "The Normal Blood Pressure Range and Its Clinical Implications," Journal of the American Medical Association, 143:1464, August 26, 1950.

²⁹ Albert G. Schnurman, "Blood Pressure in Relation to Age, Weight, and Height. An analysis of 15,225 Blood Pressure Determinations," Biological Abstracts, 16:4245, January-June, 1942.

rise in blood pressure with respect to both age and weight, but that blood pressure was not correlated with height. Schreier³⁰ found a fall in blood pressure following reduction of excessive weight and a rise of blood pressure again after weight, previously lost, had been regained. Ramsey³¹ also reports that overweight persons are most apt to develop high blood pressure.

Levy and his associates³² found that sustained hypertension in 22,741 army officers developed in those overweight at a rate two and one-half times greater than those not overweight. Jouve and Albouy³³ distinguished between two types of obese subjects: android and gynoid. They found in the android obese person a close correlation between degree of obesity and intensity of hypertension. A study by Faber and Lund³⁴ in 1949 showed the incidence of hypertension to be much higher in obese than in normal weight subjects. In contrast to the above, Bjerkedal³⁵

³⁰Herbert Schreier, "Obesity, a Health Hazard," Today's Health, 24:110-111, February, 1946.

³¹Frank B. Ramsey, "Overweight," Today's Health, 31:13, June, 1953.

³²R. L. Levy, P. D. White, W. D. Stoud, and C. C. Hillman, "Overweight, Its Prognostic Significance in Relation to Hypertension and Cardiovascular-Renal Diseases," Journal of the American Medical Association, 131:951, July 20, 1946.

³³A. Jouve and M. Albouy, "Obesity and Cardiology," Biological Abstracts, 24:15239, January-June, 1950.

³⁴M. Faber and F. Lund, "Influence of Obesity On The Development of Arteriosclerosis in Human Aorta," Nutrition Abstracts and Reviews, 19:4985, 1949-50.

³⁵T. Bjerkedal, "Overweight and Hypertension," Abstracts of World Medicine, 23:1367, June, 1958.

at the University of Oslo found no real relationship between obesity and hypertension in a study of groups of underweight, normal-weight, and overweight individuals.

In 1951, Masters, Jaffe, and Chesky found that hypertension was more common in obese men than in those of average weight or underweight. However, they say that the exact relationship between hypertension and obesity remains obscure. Their report says:

"There is no definite evidence that obesity is causally related to hypertension. It may be that the factors resulting in hypertension also produce obesity, e.g., emotional influences, faulty metabolism, or a hormone disturbance. It is questionable that obesity is ever the sole factor in the development of hypertension, for it is quite common to find a normal blood pressure in the presence of excessive obesity. There is no doubt, however, that overweight is detrimental when the blood pressure is already elevated and that improvement usually follows a loss of weight."³⁶

The relationship of obesity to arteriosclerosis and atherosclerosis has been extensively investigated. The association between vascular change and obesity is illustrated by Wilen's³⁷ study based on autopsy material. He divided his cases into three groups according to the state of nutrition evaluated at autopsy. Considering only evidence of advanced atherosclerosis, he found that the percentage of the obese with atherosclerosis was very high. For example, at ages 45 to 54, 20 per cent of the obese showed advanced changes in the arteries as compared with 6.7 per cent of those classed as of poor nutritional status; at 65 to 74 the proportions were 45.3 per cent and 20.2 per cent, respectively.

³⁶ A. M. Masters, H. L. Jaffe, and K. Chesky, "Relationship of Obesity to Coronary Disease and Hypertension," Journal of the American Medical Association, 153:1499, December, 1953.

³⁷ Segmund L. Wilens, "The Bearing of the General Nutritional State on Atherosclerosis," Archives Internal Medicine, 79:129, February, 1947.

Coronary atherosclerosis of advanced degree was also more frequent among the obese than among the normal-weight and underweight subjects, the differences being especially great in men.

Tuttle³⁸ in her investigation of obesity shows how obesity increases blood cholesterol which in turn could be responsible for atherosclerotic changes. Gofman and Jones³⁹ found a strong positive association of lipoproteins with atherosclerosis in the human. Also, the correlation of these lipoproteins to obesity was positive. They theorized that this positive association of lipoproteins with both atherosclerosis and obesity might account for most, possible for all, of the association of obesity with atherosclerosis.

Studies show that diabetes and obesity are related. Joslin and his associates⁴⁰ investigated a large group of diabetic subjects. Using as a basis the previous maximum weight prior to onset, they found that among patients 40 and over at onset 60 per cent of the diabetics were at least 20 per cent over average weight and an additional 25 per cent moderately overweight, or a total of 85 per cent with some degree of overweight. Only 5 per cent were underweight. Adams⁴¹ reviewed 673

³⁸ Esther Tuttle, "Obesity: Psychiatric Plus Dietary Approach to Its Treatment," Biological Abstracts, 23:14362, January-June, 1949.

³⁹ John W. Gofman and Hardin B. Jones, "Obesity, Fat Metabolism, and Cardiovascular Disease," Biological Abstracts, 26:21267, July-December, 1952.

⁴⁰ George F. Baker Clinic and Metropolitan Life Insurance Company, Diabetes in the 1940's, (New York: Metropolitan Life Insurance Company, 1940).

⁴¹ Franklin S. Adams, "Obesity as a Precursor of Diabetes," Biological Abstracts, 5:7663, January-June, 1931.

case histories of diabetic patients. He found that 91 per cent were overweight and 82.9 per cent were more than 10 per cent overweight before the diabetes began.

Vila⁴² claims obesity is an excitant cause of diabetes on the basis of a study of 658 patients. He found that 80 per cent of these were obese before the onset of the disease. That all obese persons are potential diabetics is claimed by Zubiran.⁴³ Likewise, Dahlberg⁴⁴ found an association between obesity and diabetes, but he believes that obesity may be an early sign rather than a predisposing cause of diabetes. He theorizes that there is an initial stage before sugar begins to appear in the urine in which blood sugar is raised sufficiently to increase appetite and this causes the subject to put on weight.

Some speculation has been made on the relationship, if any, of cancer with obesity. In 1941, Tannenbaum⁴⁵ reported that insurance studies indicated the tendency to develop cancer was greater among overweight persons than among those of average weight or less. He also found that mice held down of food are less likely to develop cancer.⁴⁶

⁴²Oscar Vila, "Etiologia De La Diabetes Mellitus," Biological Abstracts, 19:15916, July-December, 1945.

⁴³Salvador Zubiran, "La Diabetes Functional," Biological Abstracts, 14:11466, January-June, 1942.

⁴⁴G. Dahlberg, "Fettleibigkeit Und Diabetes," Nutrition Abstracts and Reviews, 20:2780, 1951.

⁴⁵Albert Tannenbaum, "Relationship of Body Weight to Cancer Incidence," Biological Abstracts, 15:2351, January-June, 1941.

⁴⁶Miriam Z. Gross, "Why Fat People Die Sooner," Today's Health, 27: February, 1949, p. 130.

This holds true even for mice bred to be susceptible to cancer. Skinny cancer-susceptible mice get cancer, eventually, but they get it considerably later than their associates who ate all they could. A possible relationship between cancer and obesity is also indicated by McCay.⁴⁷ However, very little appears to have been written recently about obesity and cancer.

Summary Other diseases and conditions associated with obesity are also found in the literature. They are, however, not pertinent to the present study. From the literature studied it would appear that overweight (obesity) is a definite factor in certain diseases. High blood pressure, hypertension, atherosclerosis, coronary heart defects, and diabetes appear to have a greater incidence in obese than in normal-weight individuals. The etiological relationship between obesity and these diseases is not certain in all cases.

IV. SMOKING AND WEIGHT

Comparatively little experimental work on the effect of smoking on nutrition and weight has been done. What has been done seems to indicate there may well be a link between weight and smoking. What this link is, however, is not known at the present time although some conjectures have been made.

⁴⁷"Eat Less to Live Longer and To Escape Some Diseases," Science News Letter, 51:31, January 11, 1947.

It is a common observation that persons who suddenly stop smoking rapidly gain in weight. Brozek and Keys^{48,49,50} conducted a study of the change of body weight in normal men who stopped smoking. The "experimental" subjects were men who voluntarily stopped smoking and on whom weight data was available for two years before and two years after the year in which they stopped smoking. A control group consisted of smoking men matched with the experimental group as to age, relative body weight, and actual body weight during the first year of the five year period. It was found that the experimental group gained significantly greater weight in the two year period after smoking was stopped than the control group who had continued to smoke. The "t" between the mean weight changes of the two groups was 5.39 which was highly significant.

Walker⁵¹ reports a study by Koehler, Hill, and Marsh on increase in weight in smokers suffering from malnutrition. The hypothesis was that excessive smoking caused in these subjects a failure to gain weight as they should. Thus, if they stopped smoking their nutritional state should quickly improve. To test this they selected six patients, each of whom was smoking regularly fifteen to thirty cigarettes a day. They

⁴⁸"Stop Smoking and Gain Weight," Science Digest, 42:100, September, 1957.

⁴⁹J. Brozek and A. Keys, "Changes of Body Weight in Normal Men Who Stop Smoking Cigarettes," Science, 125:1203, June 14, 1957.

⁵⁰A. Keys, The Biology of Human Starvation, (Minneapolis: University of Minnesota Press, 1950), p. 830.

⁵¹J. M. Walker, "Physiological Effects of Smoking," Nutrition Society Proceedings, 12:157-160, 1953.

were told to stop smoking and were observed for periods varying from 8 to 36 weeks. Every one of the subjects began to put on weight at once, the amount gained per week being between 0.5 and 1.6 pounds, with a mean of 1.1 pounds. This gives support to the idea that there is a connection between smoking and nutrition.

Several conjectures have been made as to the cause of this increase in weight with stoppage of smoking. Brozek and Keys⁵² suggest that smoking tends "to depress the felt need for food". They base this on observations that gastric hunger contractions are checked by smoking⁵³ and that there is an increase of tobacco consumption among individuals who are on a diet.⁵⁴ If this were true, it would also be conceivable that smoking tends to reduce food intake. This definitely would have an effect on body weight.

Walker⁵⁵ also believes that smoking has an effect on food intake. He feels that tobacco lessens the appetite. The problem then remains how does tobacco lessen the appetite. The researcher says that possibly the very act of putting a pipe or cigarette in the mouth is partly responsible. Also, the faculties of taste and smell may be deranged and this causes loss of appetite. Walker, however, goes further and suggests that tobacco acts directly or indirectly on the hypothalamus resulting in a reduction of appetite.

⁵²Brozek and Keys, op. cit., p. 100.

⁵³R. C. Batterman, "The Biologic Effects of Tobacco," (Boston: E. L. Wynder, Ed., Little, Brown, 1955), p. 140.

⁵⁴Keys, op. cit., p. 830.

⁵⁵Walker, op. cit., p. 158.

Summary

Studies on the relationship of smoking to weight seem to indicate that a definite weight increase follows stoppage of smoking. It is speculated that this is due to an effect of smoking on food intake whereby a stoppage of smoking leads to increased food intake. Lessening of appetite and felt need for food may well be associated with smoking. It is furthermore conjectured that tobacco may have a pharmacological effect whereby nicotine acts directly or indirectly on the hypothalamus and causes lessen appetite.

V. ACTIVITY AND WEIGHT

The proper balance between caloric intake and energy expenditure is recognized as the most important element in the maintenance of proper weight.⁵⁶ For this reason the role and effects of activity and exercise on the maintenance of weight has been investigated rather extensively.

Mann and his associates⁵⁷ at the Harvard School of Public Health studied the role of activity on weight. They capsuled the periods of vigorous youth and sedentary middle age of the average man into a ten week testing period for four 24-year old men. The four were put on a big-meal, heavy-exercise routine, typical of young adults, and then shifted to the big-meal, light-exercise routine of many businessmen. All four subjects put on fat. After this their meals were cut back to moderate supplies of calories, commensurated with the moderate exercise

⁵⁶Jean Mayer, "Exercise Does Keep the Weight Down," Atlantic Monthly, 196:63-66, July, 1955.

⁵⁷"Food Without Exercise Makes Middle-aged Fat," Science News Letter, 67:286, April 30, 1955.

of middle-age. The subjects all stopped putting on weight. From this they concluded that too much food without enough exercise is what causes fat.

Another study on this subject was conducted in 1953 by Brozek and Keys.⁵⁸ They took two groups of men engaged in clerical and executive work. The men were alike except for the extent of exercise taken, being described as active or inactive. It was found that the active men were the heavier, but that it was their lean body mass which considerably exceeded that of the inactive men.

That sedentary occupation may well play a large part in the increased incidence of obesity is concluded from a study conducted by Mayer, Roy, and Mitra.⁵⁹ This conclusion was reached from a study of 213 workers at a jute mill in Chengail, West Bengal.

Mayer⁶⁰ commenting upon the many veterans he observed who tended to put on weight rapidly after leaving service says this is not due exclusively to a return to home cooking and peaceful atmosphere, but to a very sedentary life as well. He also believes that obesity is truly in many instances a "disease of civilization." By "disease of civilization" he means that our mode of life in the United States is such that for many individuals physical activity is depressed to

⁵⁸J. Brozek and A. Keys, "Relative Body Weight, Age, and Fatness," Nutrition Abstracts and Reviews, 23:4816, 1953.

⁵⁹J. Mayer, P. Roy, and K. P. Mitra, "Relation between Caloric Intake, Body Weight, and Physical Work: Studies in an Industrial Male Population in West Bengal," American Journal Clinical Nutrition, 4:169-175, March-April, 1956.

⁶⁰Jean Mayer, "Exercise Does Keep The Weight Down," Atlantic Monthly, 196:63-66, July, 1955.

such an extent that the sedentary state is reached and excessive calories accordingly accumulate as fat. He concluded by saying that if we want to avoid obesity, we must either exercise more or feel hungry all our lives.

Others have questioned the role of exercise in weight control. Criticism has mainly hinged on two ideas. The first is that exercise requires little energy expenditure.⁶¹ Such comments as "a person would have to climb 20 flights of stairs to prevent the energy contained in one slice of bread from being converted into fat" are often given. The other criticism is that physical activity increases appetite and often leads to a caloric intake far greater than that expended during exercise.⁶² As such, physical activity is self-defeating as a weight-control measure.

Mayer in his article "Exercise Does Keep the Weight Down" attempts to disprove the afore-mentioned criticisms. Four rebutals are given to the idea that exercise requires little energy expenditure. He says:

- "1. 'Sedentary' men need less calories than 'active' men.
2. The enemies of exercise when saying that a pound of fat can be worked off only by walking 36 hours visualize any given wearying performance as being accomplished in a single uninterrupted stretch. The energy expenditure accompanying physical activity takes place, whether the activity is performed in a day or a decade. Exercise is cumulative.
3. Energy expenditure in most types of activities where all parts of the body are moved, is directly proportional to body weight.
4. If excess body weight is such that it impairs body movement, the cost of exercise will actually increase faster than does body weight."⁶³

⁶¹Zisowitz, op. cit., p. 606.

⁶²Max Millman, "Exercise and Reducing," Today's Health, 29:14-15, May, 1951, p. 52.

⁶³Jean Mayer, "Exercise Does Keep the Weight Down," Atlantic Monthly, 196:63-66, July, 1955.

To the argument that increased physical activity leads to increased caloric intake, Dr. Mayer mentions certain animal studies. He says that studies done on rats did not show that the rats used more food when under greater activity.

Summary The role of activity in weight control has been investigated by many researchers. Most studies indicate a positive relationship. Caloric intake and energy expenditure for activity are closely tied up in weight-control. The two can not be clearly distinguished. Studies do show, however, that lessening of activity without lessening caloric intake leads to an increase in weight. Certain writers have sought to question the role of exercise in weight-control. Their statements, however, have been critized by other researchers. Thus, it would seem that the studies found in the literature do show that physical activity is important in weight-control.

CHAPTER III

METHODS OF PROCEDURE

Introduction A national study of longevity and morbidity of athletes in colleges and universities, sponsored by the Phi Epsilon Kappa Fraternity,¹ was launched in 1950. In 1953 a pilot study on this subject was undertaken at Michigan State University. The results of this study are published in "Longevity and Morbidity of College Athletes" by Montoye, VanHuss, Olson, Pierson, and Hudec.² A part of this study consisted of an analysis of certain weight characteristics of former athletes and non-athletes at Michigan State University.³ This analysis included a comparison between the athletes and non-athletes in weight in college and weight increase after leaving college. As a continuance to this, it was felt that an analysis of the characteristics of the athlete and non-athlete high weight gainers would be profitable. The present study was an attempt to analyze certain of these characteristics of high weight gainers.

The purpose of this chapter is to describe the procedure by which the high and low weight increase groups were selected and to describe the method by which certain characteristics of these high and low weight increase groups were tabulated and statistically analyzed.

¹A national professional Physical Education fraternity.

²Henry Montoye, Wayne VanHuss, Herbert Olson, William Pierson, and Andrew Hudec, The Longevity and Morbidity of College Athletes, (Phi Epsilon Kappa Fraternity, 1957), p. 1-139.

³Ibid., p. 64-71.

Source of Data The major source of the data came from a questionnaire sent to letter winners who graduated prior to 1938 from Michigan State University and to a randomly selected sample of non-athletes who attended Michigan State during these same years and who were matched according to year of graduation with the letter winners. Relatives were asked to fill out the questionnaire if the athlete or non-athlete was deceased. Some of the areas covered in the questionnaire were:

1. Weight at graduation and present weight.
2. Medical History.
3. Present state of health.
4. Economic status.
5. Marital status.
6. Smoking and drinking habits.
7. Sports participation in adult life.
8. Activity during adult life, excluding participation in sports.
9. Evaluation of athletics.
10. Military service.
11. Heredity history.

The methods and procedures used in obtaining and recording this data are reported by Montoye, VanHuss, Olson, Pierson, and Hudec.⁴

Subjects Table I gives the total number of athletes and non-athletes who responded to the questionnaire in the "Michigan State Study". Of these respondents, only the living athletes

⁴Ibid., p. 3-4.

TABLE I

NUMBER OF SUBJECTS IN THE MICHIGAN STATE STUDY
OF "LONGEVITY AND MORBIDITY OF COLLEGE ATHLETES"
PROVIDING WEIGHT INFORMATION

	Number Answering Questionnaire	Deceased	Living	Number of Living Providing Weight Data	Per cent Living Not Providing Weight Data
Athletes	628	66	562	522	7.1
Non-athletes	563	56	507	471	7.1

and non-athletes were asked to indicate their weight in college and their present weight. For the deceased athletes and non-athletes, only the weight in college was requested of the relatives, but few offered this information. When the weight in college and present weight were listed by an individual, his actual pound weight change and per cent weight change based on weight while in college were calculated.

The following procedure was used to select the high weight increase groups and the low weight increase groups based on the subjects utilized in the "Michigan State Pilot Study". The procedure involves the use of a weight criterion very similar to the one advocated by Mayer⁵ for determining underweight and overweight.

All deceased athletes and non-athletes were eliminated as no weight change information was available on them. Also, as shown in Table I, the 7.1 per cent of both the athletes and non-athletes who

⁵Jean Mayer, "Overweight and Obesity," Atlantic Monthly, 196:70-71, August, 1955.

failed to report the weight information were excluded. This left a total of 522 athletes and 471 non-athletes who reported change of weight and hence could be included in the weight change sample.

Due to the fact that a high correlation was found between weight in college and year of birth,⁶ it was felt that the available sample should be stratified according to year of birth. This was done by grouping the 522 athletes and the 471 non-athletes into 13 age intervals based on their date of birth. (Table II) Then, the number of athletes and non-athletes in each age interval reporting weight change was calculated. (Table II) The athletes and non-athletes in the age intervals were next divided according to per cent increase or decrease in weight. Finally, in each age interval the 25 per cent of athletes and the 25 per cent of non-athletes that gained the largest percentage of weight were selected as the athlete and non-athlete high weight increase groups while the 25 per cent of athletes and the 25 per cent of non-athletes that gained the least percentage of weight were selected as the low weight increase groups. These low weight increase groups included persons who had lost weight or who had retained the same weight since leaving college.

Table III shows the final breakdown of the 522 athletes and the 471 non-athletes into the high and low weight increase groups. Both the high and the low weight increase groups consisted of 250 subjects. Of these 250, 132 were athletes and 118 were non-athletes.

⁶Montoye, op. cit., p. 129.

TABLE II
NUMBER OF SUBJECTS IN AGE INTERVALS

Age Intervals	Date of Birth	Athletes		Non-athletes	
		Number Reporting Weight Change	Number to be placed in High and Low Weight Group	Number Reporting Weight Change	Number to be placed in High and Low Weight Group
1	1855-1859	0	0	0	0
2	1860-1864	0	0	0	0
3	1865-1869	2	1	1	0
4	1870-1874	2	1	9	2
5	1875-1879	15	4	14	4
6	1880-1884	24	6	24	6
7	1885-1889	33	8	31	8
8	1890-1894	41	10	41	10
9	1895-1899	63	16	53	13
10	1900-1904	72	18	63	16
11	1905-1909	103	26	84	21
12	1910-1914	109	27	100	25
13	1915-1919	58	15	51	13
Totals		522	132	471	118

TABLE III
NUMBER OF SUBJECTS IN HIGH AND LOW WEIGHT INCREASE GROUPS

Weight Groups	Athlete	Non-athlete	Combined
High Per cent Weight Increase Group	132	118	250
Low Per cent Weight Increase Group	132	118	250

Tabulation of Results Tabulation was done insofar as possible on I.B.M. sorting and computing machines. Certain information not punched on the I.B.M. cards was tabulated directly from the original questionnaires returned by the individuals in the athlete and non-athlete high and low weight groups.

Statistical Analysis The statistical analysis of the data assembled on the various characteristics of the high and low weight gain groups was made by using the "t" and chi-square tests.^{7,8} The "t" test was used as a test of significant differences in arithmetic means computed for various characteristics. This test was used on all quantitative data. The probability level of 5 per cent was regarded as statistically significant in all cases. The chi-square test was used on qualitative data. It was used when there was a need to know how the individuals distributed themselves with regard to a certain characteristic but no quantitative data was available.

⁷Elmer B. Mode, Elements of Statistics, (New York: Prentice-Hall, Inc., 1951), p. 185-209, 309-326.

⁸Quinn Mc Nemar, Psychological Statistics, (New York: John Wiley & Sons, Inc., 1955), p. 104-114, 212-240.

CHAPTER IV

AGE AND WEIGHT FACTORS

Table IV gives a summary of the present age, mean per cent change in weight, mean actual pound change in weight, mean weight in college, and mean present weight of the athlete, non-athlete, and combined high and low weight increase groups.

Since the high and low weight increase groups were selected according to a stratified random sampling technique based on the data of birth, it was suspected that the present age of the athlete, non-athlete, and combined high and low weight increase groups would be very similar. Table IV shows this to be true. The difference between the ages was so close as to be very insignificant. These results demonstrate that the stratified random sampling technique used in this study gave a very close age relationship between the high and low weight increase groups. A comparison of this type helps to validate the sampling technique.

The high and low weight increase groups were also selected according to per cent change in weight. Table V and Figure I picture the mean per cent weight change for the athlete and non-athlete high and low weight gainers in each of the 13 age intervals. As might be suspected, a wide gap exists in per cent change in weight between the corresponding high and low weight increase groups in each of the age intervals. This wide gap can also be seen when viewing the mean per cent change in weight of the high and low weight groups disregarding the age intervals. This is presented in Table IV. Table IV also shows the mean pound change in

TABLE IV
THE AGES AND WEIGHTS OF HIGH AND LOW WEIGHT INCREASE GROUPS

	Present Age	Mean % Change in Weight	Mean Pound Change in Weight	Mean Weight in College	Mean Present Weight
Athlete					
High Weight Group (N=132)	51.97	22.13	33.76	154.97	188.60
Low Weight Group (N=132)	52.05	-1.27	-2.27	171.65	169.42
"t"	.06		31.03	5.85	6.49
P	.95		.00	.00	.00
Non-athlete					
High Weight Group (N=118)	52.36	25.70	36.70	144.69	181.33
Low Weight Group (N=118)	52.28	-2.23	-3.06	157.78	153.96
"t"	.05		30.78	5.47	10.02
P	.96		.00	.00	.00
Combined					
High Weight Group (N=250)	52.152	23.82	35.16	150.12	185.17
Low Weight Group (N=250)	52.156	-1.72	-3.02	165.10	162.12
"t"	.004		43.40	7.65	11.31
P	.997		.00	.00	.00

TABLE V
MEAN PER CENT WEIGHT CHANGE IN THE AGE INTERVALS

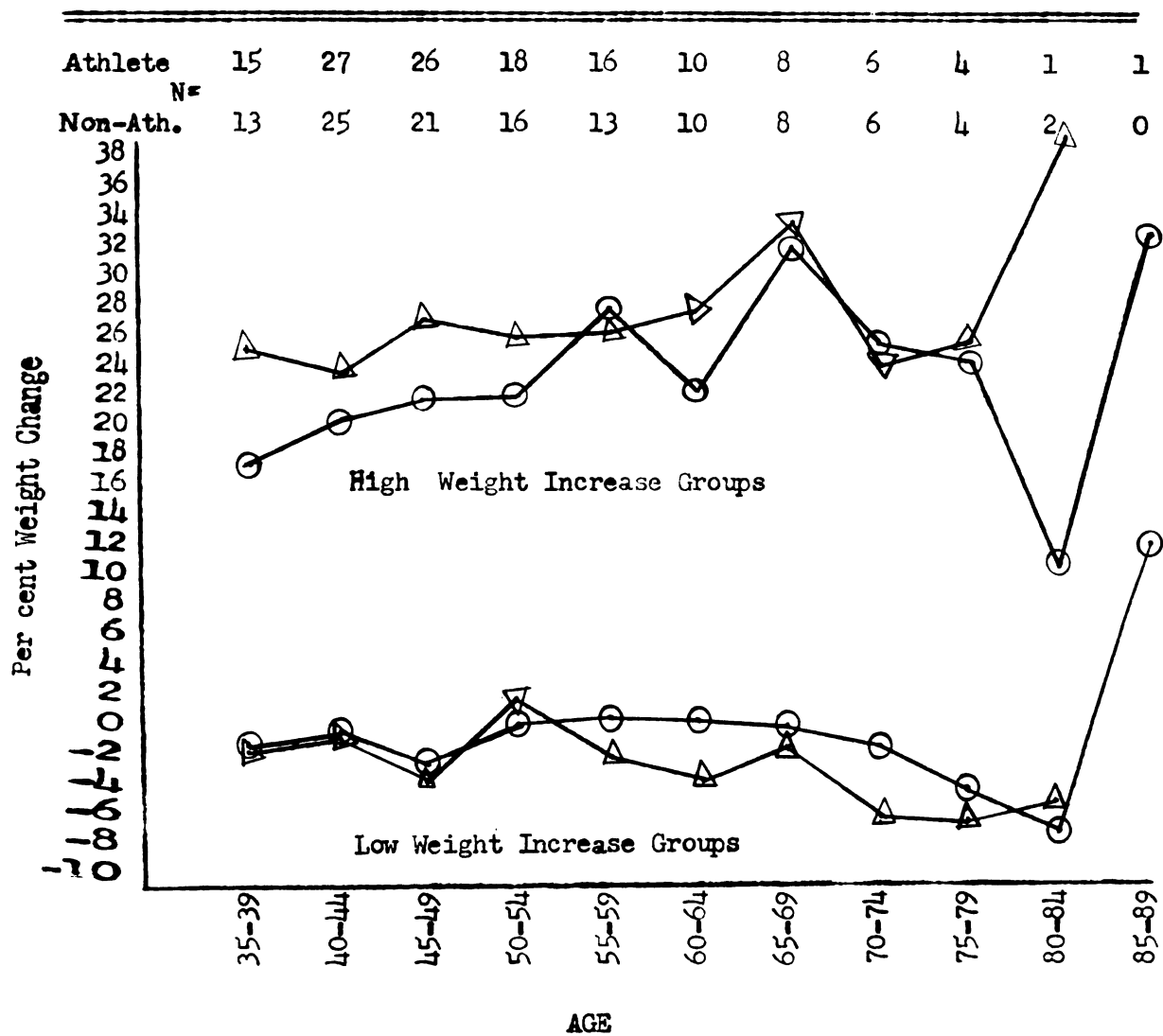
Age Intervals	Subjects			
	Athlete High Weight Group	Athlete Low Weight Group	Non-athlete High Weight Group	Non-athlete Low Weight Group
3	+32.0	+11.0	-----	-----
4	+10.0	- 9.0	+38.5	-5.0
5	+23.5	- 6.0	+24.5	-7.0
6	+24.7	- 3.3	+23.8	-6.5
7	+31.0	- 0.5	+32.9	-1.6
8	+22.0	- 0.2	+26.7	-4.7
9	+27.0	- 0.2	+25.5	-2.4
10	+21.8	- 0.5	+25.1	+0.9
11	+21.5	- 2.5	+26.3	-3.2
12	+19.9	- 0.8	+23.3	-0.9
13	+16.7	- 1.4	+24.5	-1.6
Mean Per cent Weight Change	+22.1	- 1.3	+25.7	-2.2

weight. The results here again show that the high weight increase groups have a significantly greater gain in weight.

The mean weight in college for the high and low weight groups was analyzed. The results are in Table IV. Among both the athletes and non-athletes the high weight increase groups were significantly lighter in college than the low weight change groups. This might appear to be a

FIGURE I

MEAN PER CENT WEIGHT CHANGE FOR THE
HIGH AND LOW WEIGHT INCREASE GROUPS



○ — ○ Athletes

△ — △ Non-athletes

significant factor in that the high weight groups might have been underweight in college and since have made up this deficiency. However, when we consider the age at which the individuals in the high weight increase groups acquired their additional weight, this factor does not seem significant. Increases in weight at an age after leaving college would very likely be in the form of fatty tissue. With such a large per cent increase in weight and most of this in the form of fatty tissue, the individuals, even though they might have been underweight in college, would now be overweight. The critical factor is the per cent increase in weight and not the weight in college or the present weight. This is true because the per cent change in weight indicates how much weight in relation to body size is being gained. It would, however, be interesting to compare the results of this study with a study using high and low weight increase groups which had been chosen by stratifying the sample according to weight in college as well as date of birth and per cent change in weight.

Table IV also shows the mean present weight of the athlete, non-athlete, and combined high and low weight increase groups. It can be seen that the high weight groups were heavier than the low weight groups. These differences in present weight were significant at the 1 per cent level. This is the opposite from the weight trend while the individuals were still in college. Thus, the mean weight of the high weight increase groups passed from a significantly lighter weight than the low weight increase groups while in college to a significantly heavier weight after leaving college.

CHAPTER V

MEDICAL HISTORY

The present chapter deals with the medical history of the high and low weight increase groups. A comparison between the ailments of the high and low weight increase groups seemed worthwhile in light of the common notion that people who are overweight are more susceptible to certain ailments, especially heart defects and hypertension. Because no difference in ailments was found between athletes and non-athletes in the "Longevity Study",¹ no distinction was made between athletes and non-athletes in this chapter.

Certain diseases and ailments of the high and low weight increase groups are compared in Table VI. They were found to be very similar. Chi-squares were computed in regard to these diseases and none were found significant. However, certain differences in the table do indicate that a large scale study, involving many more cases, of these medical aspects might be fruitful. With such a study it could be determined precisely whether there was a significant difference in the ailments of the high and low weight increase groups.

Table VI also presents information on certain respiratory and circulatory diseases of the high and low weight increase groups. There were so few cases of these diseases reported that no precise conclusions can be reached. From the data available, however, there seemed to be

¹Henry Montoye, op. cit., p. 36.

TABLE VI
DISEASES OF HIGH AND LOW WEIGHT GAINERS

Diseases	High Weight Gainers N=250			Low Weight Gainers N=250			X ²	P(1 df.)
	Number Respond- ing	% Yes	% No	Number Respond- ing	% Yes	% No		
Heart Defects	248	10.5	93.5	249	9.6	90.4	.11	.70- .80
Growing Pains	250	7.2	92.8	250	5.2	94.8	.86	.30- .40
Chorea	250	1.2	98.8	250	0.0	100.0	3.02	.05- .10
Rheumatic Fever (First Attack)	250	4.4	95.6	249	2.0	98.0	2.32	.10- .20
Rheumatic Fever (Second Attack)	250	1.6	98.4	250	.8	99.2	.67	.40- .50
Rheumatic Fever (Third Attack)	250	.8	99.2	250	.4	99.6	.33	.50- .60
Tonsillitis	250	29.6	70.4	250	35.2	64.8	1.79	.10- .20
Tonsils Removed	249	51.8	48.2	250	52.0	48.0	.00	.99-1.00

Respiratory and Circulatory Diseases	High Weight Gainers N=250			Low Weight Gainers N=250		
	% With Disease	Age at Onset		% With Disease	Age at Onset	
		Number Reporting	Mean Age		Number Reporting	Mean Age
Hypertension	6.4	13	50.0	6.4	8	49.3
Arteriosclerosis	.8	1	66.0	1.6	3	65.7
Angina Pectoris	1.2	0	----	1.2	0	----
Coronary Thrombosis	1.6	2	53.0	1.6	2	56.0
Diabetes	3.2	4	50.5	2.8	2	20.5
Peripheral Vascular Diseases	.4	0	----	0.0	0	----

little difference between the high and low weight increase groups in regard to these diseases. The mean age at onset is also reported, but here again there is such a limited number of cases that no conclusion can be drawn.

In filling out the questionnaire, the high and low weight groups were asked to list any "other" diseases that they had contacted during their lifetime. In Table VII a list of the diseases that were reported at least five times are given. The use of percentages was not advantageous in this table because any subject could list more than one disease. Also, the limited number of cases made statistical analysis of little importance. The high and low weight groups appear to be fairly similar in the listed diseases although the number of diseases reported by the high weight group does exceed the number reported by the low weight group.

The subjects were also asked to evaluate their present state of health. They were asked to rate their own state of health as "good", "fair", or "poor". These were gross classifications which were not defined to the subjects. The limitations of such an evaluation are recognized particularly in regard to the indefinite limits of the groupings and the possible personality difference of the subjects in admitting whether or not they have poor health. However, an analysis of such an evaluation seemed worthwhile in retrospect of how the high and low weight increase groups evaluate their own health. The results of this analysis are found in Table VIII. Chi-squares used in analysis of the data showed no significant difference between the athlete, non-athlete, or combined high and low weight increase groups in their judgement of their present state of health.

TABLE VII
INCIDENCE OF "OTHER" DISEASES REPORTED BY HIGH AND LOW WEIGHT GROUP

Diseases	High Weight Group	Low Weight Group
Typhoid Fever	10	4
Scarlet Fever and Streptococcal Sore Throat	28	31
Whooping Cough	9	5
Diphtheria	4	9
Smallpox	8	4
Measles	33	26
All other diseases classified as infective and parasitic	17	13
Influenza	10	8
Pneumonia	14	9
Ulcer of Stomach and Duodenum	8	10
Appendicitis	19	11
All "other" Diseases	83	90
TOTAL	243	220

TABLE VIII
PRESENT STATE OF HEALTH OF HIGH AND LOW WEIGHT GROUPS

Subjects	Number Responding	State of Health			χ^2 (2 df.)
		% Good	% Fair	% Poor	
Non-athletes					
High Weight (N=118)	117	83.8	16.2	0.0	3.26 (P=.10-.20)
Low Weight (N=118)	117	83.8	13.6	2.6	
Athletes					
High Weight (N=132)	132	88.6	8.3	3.1	1.53 (P=.40-.50)
Low Weight (N=132)	132	84.8	12.9	2.3	
Combined					
High Weight (N=250)	249	86.3	12.1	1.6	.60 (P=.70-.80)
Low Weight (N=250)	249	84.3	13.3	2.4	

CHAPTER VI

ECONOMIC AND MARITAL STATUS: SMOKING AND DRINKING HABITS

This chapter deals with four characteristics applicable to the individuals in the high and low weight increase groups. The characteristics are: economic status, marital status, drinking habits, and smoking habits.

Table IX illustrates the economic status of the high and low weight groups during and after college. Each respondent was asked to check whether his economic status was "satisfactory" or "unsatisfactory" (a) before and during college and (b) after college. The table shows that the non-athlete, athlete, and combined high and low weight increase groups rated themselves in better economic status after college than before college. This is not surprising considering most people after college begin their careers and usually find a certain amount of success at whatever they are doing. This would give them a certain amount of security and pride in their economic status and would lead them to give a "satisfactory" rating.

The high and low weight increase groups were very similar in their answers on economic status both during and after college. Chi-squares revealed no statistically significant difference in the athlete, non-athlete, and combined high and low weight groups. This is not surprising in view of the fact that there was no means of quantifying the results. The interpretation of the adjective "satisfactory" or "unsatisfactory" is left entirely to the individual. As a result, an income which might be considered "satisfactory" to one would not be to another. The problem

TABLE IX
ECONOMIC STATUS OF HIGH AND LOW WEIGHT INCREASE GROUPS

Status During College	High Weight Gainers			Low Weight Gainers			χ^2 (1 df.)
	Number Respond- ing	Satis- factory	Unsatis- factory	Number Respond- ing	Satis- factory	Unsatis- factory	
Non-athlete (N=118)	118	87.3	12.7	118	88.1	11.9	.036 (P=.80-.90)
Athlete (N=132)	131	90.8	9.2	128	90.6	9.4	.000 (P=.99-1.00)
Combined (N=250)	249	89.2	10.8	246	89.4	10.6	.006 (P=.90-.95)
Status After College							
Non-athlete (N=118)	118	99.2	.8	117	100.0	0.0	1.004 (P=.30-.40)
Athlete (N=132)	130	99.2	.8	129	98.4	1.6	.334 (P=.50-.60)
Combined (N=250)	248	99.2	.8	246	99.2	.8	.000 (P=.99-1.00)

is further complicated by the reluctance, perhaps, of some to indicate an "unsatisfactory" economic status.

The percentage of married and single among the athlete, non-athlete, and combined high and low weight increase groups are given in Table X. The non-athlete high and low weight groups had the same per cent married and single. The athlete high weight group, however, had 3 per cent more of its members married than the corresponding athlete low weight group. When analyzed by the chi-square this difference was almost significant at the 5 per cent level of confidence. The combined high and low weight increase groups showed a difference of 1.6 per cent with the high weight group having more married, but this difference again was not statistically significant.

The drinking habits of the non-athlete, athlete, and combined high and low weight increase groups are given in Table XI. It was found that both athlete and non-athlete low weight groups had a larger percentage of drinkers than the corresponding high weight groups. This was interesting in light of the fairly common notion that excessive drinking leads to an increase in weight. Chi-squares were run to test these differences. None were found to be significant. Therefore, from the data available, we must conclude there is no significant difference in the use of alcoholic beverages between the high and low weight increase groups.

Perhaps, a clearer picture of the drinking habits can be gained by looking at the amounts of alcoholic beverages consumed. An attempt was made to do this in the questionnaire by asking the subjects who drank to rate their consumption as (a) "moderate" or (b) "excessive". It was found that practically all the individuals rated themselves in the

TABLE X
MARITAL STATUS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS

Subjects	High Weight Group			Low Weight Group			χ^2 (1 df.)
	Number Respond- ing	Married	Single	Number Respond- ing	Married	Single	
Non-athlete (N=118)	118	97.5	2.5	118	97.5	2.5	.000 (P=1.00)
Athlete (N=132)	132	99.2	.8	131	96.2	3.8	2.73 (P=.05-.10)
Combined (N=250)	250	98.4	1.6	249	96.8	3.2	1.36 (P=.20-.30)

TABLE XI
DRINKING HABITS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS

Subjects	Use of Alcohol			χ^2 (1 df.)	P
	Number Responding	% Drinkers	% Non-drinkers		
Non-athlete					
H.W.G. ¹ (N=118)	115	67.0	33.0	.176	.60-.70
L.W.G. ² (N=118)	118	69.5	30.5		
Athlete					
H.W.G. (N=130)	130	76.9	23.1	.086	.70-.80
L.W.G. (N=130)	130	74.5	21.5		
Combined					
H.W.G. (N=250)	245	72.2	27.8	.236	.60-.70
L.W.G. (N=250)	248	74.2	25.8		

¹High Weight Group

²Low Weight Group

"moderate" classification. Some of this may have been due to the somewhat ambiguous categories and the reluctance of individuals to indicate their drinking as "excessive". Because of this it seems impossible to make any precise conclusions regarding the amount of alcohol used.

A comparison between the high and low weight increase groups in the use of tobacco is found in Table XII. The difference in percentage of smokers and non-smokers between the high and low weight groups among the athletes and non-athletes was not statistically significant. However, a trend was noted in both the athlete and non-athlete groups whereby the high weight groups had a larger percentage of non-smokers than the low weight groups and correspondingly the low weight groups had a higher percentage of smokers than the high weight groups. When the athlete and non-athlete groups were combined this difference was statistically significant at the 5 per cent level of confidence. This significant difference is interesting in light of the theory set forth by Walker³ that smoking lessens the appetite and by Brozek and Keys⁴ that smoking depresses the felt need for food. If these theories are true, smoking may well serve to hold down weight. This may explain why a significantly greater number of smokers are found in the low weight increase group. Correspondingly, it might be that persons who do not smoke have better appetites and tend to gain weight. Hence, we might expect to find less smokers among high weight gainers as was found in this study.

³ Walker, op. cit., p. 150.

⁴ Brozek and Keys, op. cit., p. 100.

TABLE XII
A COMPARISON BETWEEN THE HIGH AND LOW WEIGHT INCREASE GROUPS IN USE
OF TOBACCO

Subjects	Number Responding	% Smokers	% Non-smokers	$\chi^2(1 \text{ df.})^P$	
Non-athlete					
High Weight Group (N=118)	111	55.9	44.1	2.08	.10-.20
Low Weight Group (N=118)	115	55.2	34.8		
Athlete					
High Weight Group (N=132)	124	63.7	36.3	2.30	.10-.20
Low Weight Group (N=132)	128	72.7	27.3		
Combined					
High Weight Group (N=250)	235	60.0	40.0	4.35	.02-.05
Low Weight Group (N=250)	243	69.1	30.9		

An analysis was also made of how much the smokers in each of the high and low weight increase groups smoked. (Table XIII) The amount of tobacco used was divided into "little", "moderate", or "great deal". Chi-squares were computed to test for significant differences. Between the high and low weight gainers in both the athlete and non-athlete groups, there was no statistically significant difference. However, when the athlete and non-athlete high and athlete and non-athlete low weight groups were combined the resulting chi-square was 6.73 which was significant at the 5 per cent level of confidence. The significant trend was for the high weight group to have a larger percentage in the "little" category and a lesser percentage in the "moderate" category with the "great deal" category being approximately the same. This result follows the same path the analysis of use of tobacco showed. Not only does the high weight group have less smokers but also those who smoke

TABLE XIII

A COMPARISON OF THE AMOUNTS OF TOBACCO USED BY THE HIGH AND LOW WEIGHT INCREASE GROUPS

Subjects Who Smoke	Number Respond- ing	% Little	% Moderate	% Great Deal	χ^2 (2 df.)	P
Non-athlete						
High Weight Group (N=62)	62	25.8	50.0	24.2	2.91	.20-.30
Low Weight Group (N=75)	75	14.7	61.3	24.0		
Athlete						
High Weight Group (N=79)	79	25.3	46.8	27.9	3.85	.10-.20
Low Weight Group (N=93)	93	15.1	60.2	24.7		
Combined						
High Weight Group (N=141)	141	25.5	48.2	26.3	6.73	.02-.05
Low Weight Group (N=168)	168	14.9	60.7	24.4		

tend to smoke less. Perhaps, the weight increase of the high weight gainers can partly be explained by the fact that they take "snack breaks" while the low weight gainers take "cigarette breaks".

Table XIV offers a comparison of the method of using tobacco by smokers in the athlete, non-athlete, and combined high and low weight gain groups. Chi-squares do not reveal a significant difference, although there is a trend for both the athlete and non-athlete high weight groups to have a lesser percentage smoking cigarettes and pipes and a greater percentage smoking cigars than the corresponding low weight groups.

TABLE XIV
A COMPARISON OF METHOD OF TOBACCO USED BY THE SMOKERS IN THE HIGH AND LOW WEIGHT
INCREASE GROUPS

Subjects Who Smoke	Number Responding	Use of Tobacco					χ^2	P
		Cigarettes %	Pipe %	Cigar %	Chew Combination %			
Non-athlete								
High Weight Group (N=62)	61	63.9	8.2	9.8	1.6	16.5	3.46	.40-.50
Low Weight Group (N=75)	74	67.6	10.2	4.0	0.0	17.6		
Athlete								
High Weight Group (N=79)	79	55.7	8.9	19.0	0.0	16.4	7.87	.05-.10
Low Weight Group (N=93)	91	52.6	13.2	6.6	2.2	15.4		
Combined								
High Weight Group (N=141)	140	59.3	8.6	15.0	0.7	16.4	8.46	.05-.10
Low Weight Group (N=168)	165	54.6	12.1	5.5	1.2	16.4		

CHAPTER VII

VOCATIONAL AND AVOCATIONAL ACTIVITIES: SPORTS ACTIVITIES: EVALUATION OF ATHLETICS: MILITARY SERVICE

Participation in various forms of physical activity is an important factor to consider when studying weight gain. This chapter includes an analysis of four factors directly or indirectly associated with physical activity. These are: vocational and avocational activities, sports activities, evaluation of athletics, and military service. Although evaluation of athletics and military service are not directly associated with physical activity, the former discloses a person's general attitude towards sports activities while the latter portrays a person's "activity" during a certain part of his life. Hence, they are included in this chapter on activity.

The mean hours per day spent in "vigorous", "moderate", and "mild" vocational and avocational activities, excluding sports participation, by the athlete, non-athlete and combined high and low weight increase groups are found in Table XV. This information was derived from answers to a question asked the subjects regarding the number of hours spent per day in "vigorous", "moderate", or "mild" physical activity, except sports, at various ages in their life. The ages of participating were classified into 20-29, 30-39, 40-49, 50-59, and 60-plus. Based on these classifications, the mean hours of "vigorous", "moderate", and "mild" physical activity per day were calculated for the high and low weight groups.

Figure II offers a comparison of the combined high and combined low weight increase groups in vocational and avocational activities.

TABLE XV

COMPARISON OF HIGH AND LOW WEIGHT GAIN GROUPS IN NON-SPORTS VOCATIONAL
AND AVOCATIONAL ACTIVITIES AT VARIOUS AGE PERIODS

Mean "Vigorous" Hours Per Day	High Weight Group		Low Weight Group	
	Number Reporting	Mean Hours Per Day	Number Reporting	Mean Hours Per Day
Years Participating				
20-29				
Athlete	95	3.29	92	2.49
Non-athlete	80	2.75	91	2.71
Combined	175	3.05	183	2.60
30-39				
Athlete	90	1.83	91	2.65
Non-athlete	77	1.84	87	2.54
Combined	167	1.84	178	2.60
40-49				
Athlete	66	1.73	63	2.03
Non-athlete	65	1.25	66	2.73
Combined	131	1.49	129	2.39
50-59				
Athlete	25	1.24	30	2.07
Non-athlete	27	1.67	37	2.46
Combined	52	1.46	67	2.28
60-plus				
Athlete	11	1.64	12	1.67
Non-athlete	13	1.06	16	1.06
Combined	24	1.33	28	1.32

TABLE XV (CONTINUED)

COMPARISON OF HIGH AND LOW WEIGHT GAIN GROUPS IN NON-SPORTS VOCATIONAL
AND AVOCATIONAL ACTIVITIES AT VARIOUS AGE PERIODS

Mean "Moderate" Hours Per Day Years Participating	High Weight Group		Low Weight Group	
	Number Reporting	Mean Hours Per Day	Number Reporting	Mean Hours Per Day
20-29				
Athlete	98	2.18	96	2.64
Non-athlete	81	2.70	93	2.49
Combined	179	2.40	189	2.57
30-39				
Athlete	95	2.35	92	2.67
Non-athlete	85	3.73	91	2.87
Combined	180	3.27	183	2.77
40-49				
Athlete	68	2.68	65	2.42
Non-athlete	68	3.16	69	2.65
Combined	136	2.92	134	2.54
50-59				
Athlete	26	3.08	35	3.34
Non-athlete	29	2.45	37	3.49
Combined	55	2.75	72	3.42
60-plus				
Athlete	9	1.73	12	3.83
Non-athlete	13	1.85	16	3.75
Combined	22	1.82	28	3.79

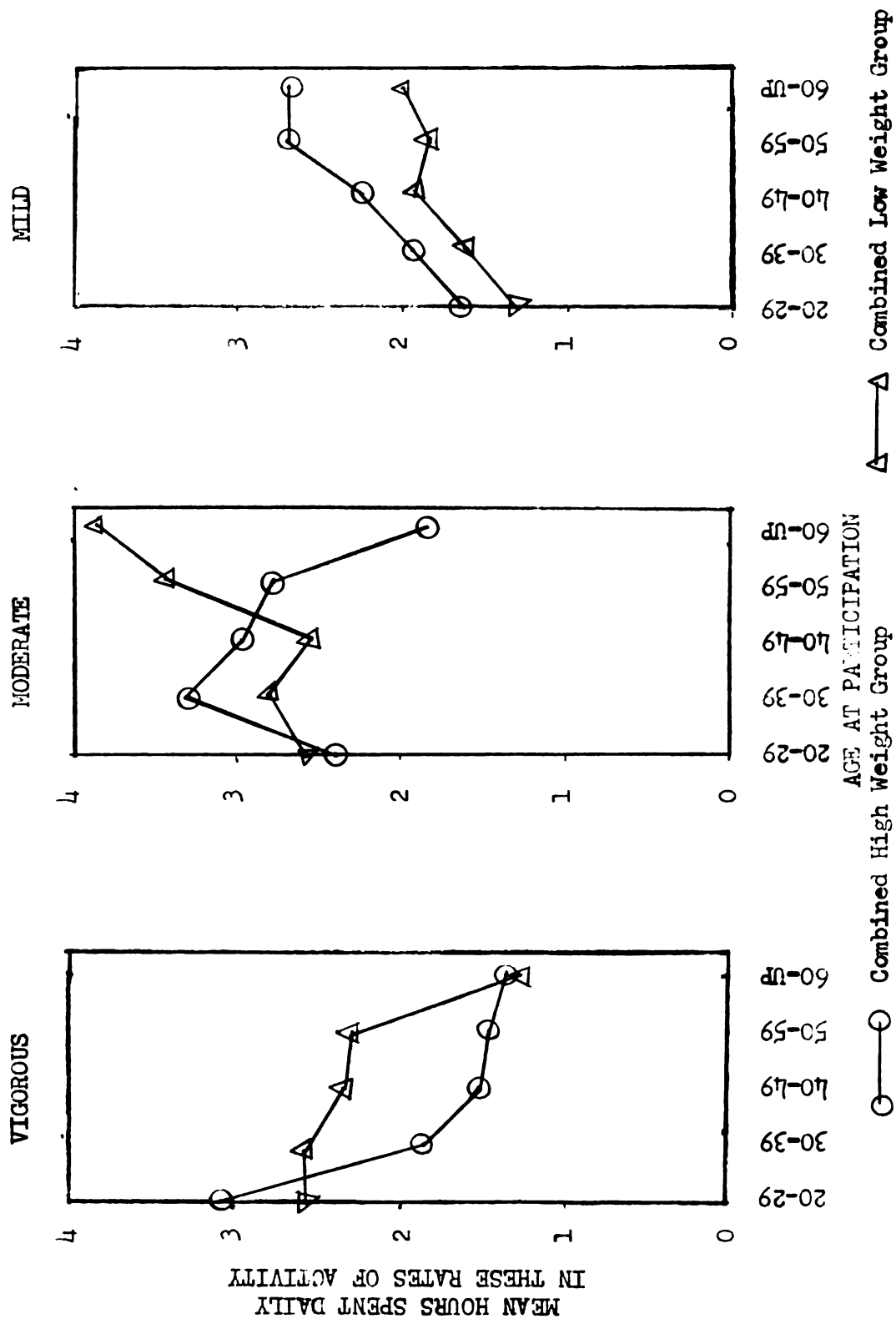
TABLE XV (CONTINUED)

COMPARISON OF HIGH AND LOW WEIGHT GAIN GROUPS IN NON-SPORTS VOCATIONAL
AND AVOCATIONAL ACTIVITIES AT VARIOUS AGE PERIODS

Mean "Mild" Hours Per Day Years Participating	High Weight Group		Low Weight Group	
	Number Reporting	Mean Hours Per Day	Number Reporting	Mean Hours Per Day
20-29				
Athlete	90	1.73	95	0.84
Non-athlete	77	1.94	91	1.80
Combined	167	1.80	186	1.31
30-39				
Athlete	86	1.86	89	1.22
Non-athlete	79	2.05	88	2.03
Combined	165	1.95	177	1.63
40-49				
Athlete	66	2.08	63	1.71
Non-athlete	68	2.37	67	2.12
Combined	134	2.22	130	1.92
50-59				
Athlete	28	2.61	31	1.74
Non-athlete	30	2.77	38	1.87
Combined	58	2.69	69	1.81
60-plus				
Athlete	10	3.00	11	2.45
Non-athlete	15	2.47	17	1.71
Combined	25	2.68	28	2.00

FIGURE II

MEAN HOURS PER DAY SPENT IN VOCATIONAL AND AVOCATIONAL ACTIVITIES BY HIGH AND LOW WEIGHT INCREASE GROUPS



The graph shows that the low weight group spent more time daily in "vigorous" activity than the high weight increase group after the age of thirty. Also, while the low weight group spent approximately the same hours per day in "vigorous" activity between the ages of 20 and 40, the high weight group decreased $1\frac{1}{2}$ mean hours per day in "vigorous" activity during these years. This is significant in light of the fact that individuals are inclined to gain their most weight during these years. Perhaps, this reduction in "vigorous" activity of the individuals of the high weight increase group is responsible for their increase in weight. This would agree with theory set forth in Mayer's article entitled, "Food Without Exercise Makes Middle-aged Fat".¹

The graph on "moderate" activities shows a dual trend. Up to the age of 40, the individuals in the high weight increase group tend to spend more hours daily in "moderate" activity than the individuals in the low weight increase group. After 40 years of age the reverse is true. Individuals in the low weight group spend more hours per day in "moderate" activity.

Mean hours of "mild" activity daily are in favor of the high weight gainers in all the age classifications. This is shown in Figure II.

In viewing the composite picture of the "vigorous", "moderate", and "mild" vocational and avocational activities, it would seem that the low weight group is more "vigorously" active than the high weight increase group.

¹"Food Without Exercise Makes Middle-aged Fat," Science News Letter, 67:286, April 30, 1955.

There are certain limitations to the above comparison. The data is not quantitative. Whether or not an activity is considered "vigorous", "moderate", or "mild" varies among individuals. What might be "vigorous" to one would not be so to another. Due to these limitations, precise conclusions cannot be given. However, the findings do seem to agree with the idea that a reduction in physical activity makes weight gain more probable.

Regular physical exercise throughout the entire life span also involves sports participation. Vocational and avocational activities are supplemented by athletic and recreational activities. An analysis of the sports participation at various ages of the athlete, non-athlete, and combined high and low weight groups is found in Table XVI and Figure III.

Table XVI pictures the percentage of the athlete, non-athlete, and combined high weight and low weight groups participating in sports activities during various age periods. The number of cases available in each age period varies because some subjects had not yet reached the upper age periods. The graph in Figure III discloses the trends in the percentage of the combined high and combined low weight groups participating in sports activities. From the table and graph, it can be seen that up to the age of 55 the high weight groups and low weight groups tend to vary in who has the highest percentage participating. However, after the age of 55 there is a decisive trend for the athlete, non-athlete, and combined high weight groups to have a higher percentage of participants. These differences in percentage participation in sports activities between the athlete high and low, non-athlete high

TABLE XVI

PERCENTAGE OF HIGH AND LOW WEIGHT INCREASE GROUPS PARTICIPATING IN SPORTS ACTIVITIES IN LATER LIFE

Subjects	AGE INTERVALS					
	Number of Cases	% Participating	χ^2 (1 df.)	P	Number of Cases	% Participating
		30-34				35-39
Athlete High	132	20.5	.20	.60-.70	117	17.9
Athlete Low	132	22.7			117	16.2
Non-athlete High	118	10.2	.17	.60-.70	105	11.4
Non-athlete Low	118	11.9			105	12.4
Combined High	250	15.6	.36	.50-.60	222	14.9
Combined Low	250	17.6			222	14.4
		40-44				45-49
Athlete High	90	17.8	.16	.60-.70	64	14.1
Athlete Low	90	15.6			64	17.2
Non Athlete High	80	12.5	1.11	.20-.30	59	11.9
Non Athlete Low	80	7.5			59	10.2
Combined High	170	15.3	.91	.30-.40	123	13.0
Combined Low	170	11.8			123	13.8
		50-54				55-59
Athlete High	46	8.7	.45	.50-.60	30	10.0
Athlete Low	46	13.0			30	10.0
Non-athlete High	43	16.3	.39	.50-.60	30	20.0
Non-athlete Low	43	11.6			30	6.7
Combined High	89	12.4	.00	1.00	60	15.0
Combined Low	89	12.4			60	8.3

Total Chi-squares for intervals up to 55-Athlete High and Low--- $\chi^2 = 1.17$ (df.=5) (P=.90-.95)
 Non-athlete--- $\chi^2 = 1.81$ (df.=5) (P=.80-.90) Combined--- $\chi^2 = 1.33$ (df.=5) (P=.90-.95).

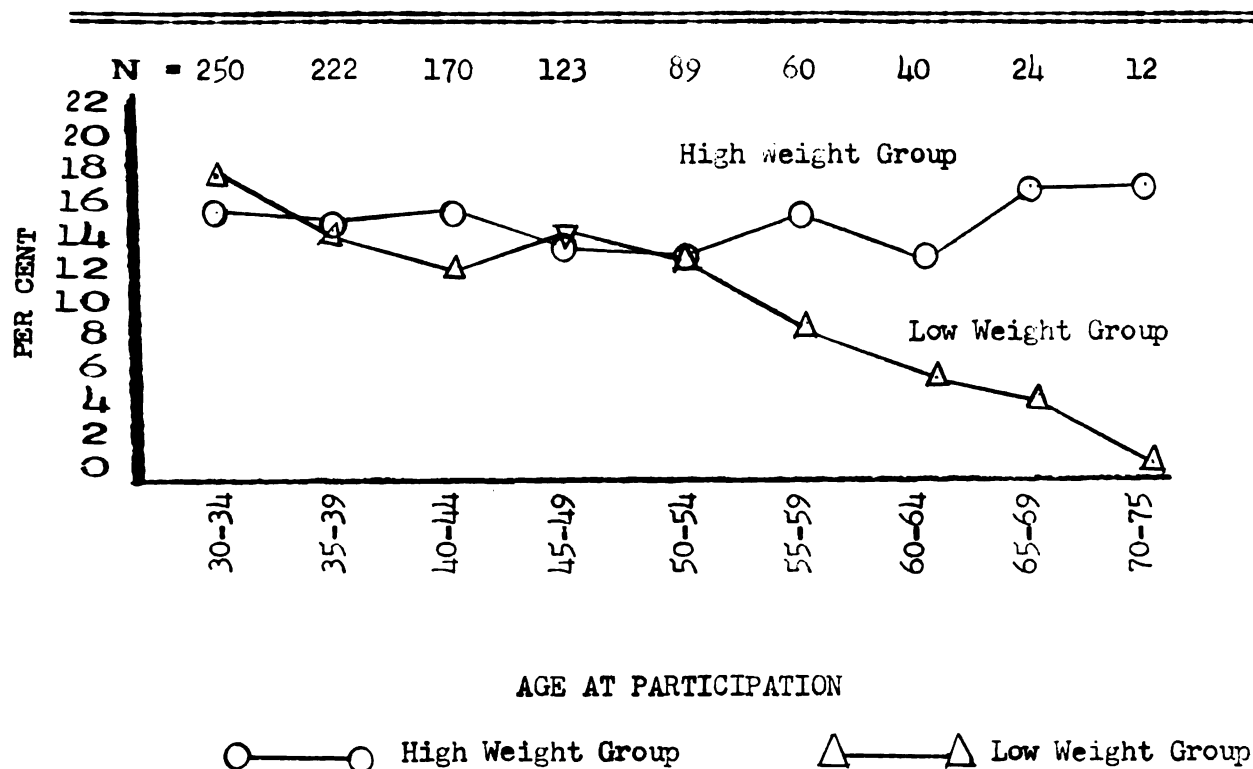
TABLE XVI (CONTINUED)

PERCENTAGE OF HIGH AND LOW WEIGHT INCREASE GROUPS PARTICIPATING IN SPORTS ACTIVITIES IN LATER LIFE

Subjects	AGE INTERVALS							
	Number of Cases	% Participating	χ^2 (1 df.)	P	Number of Cases	% Participating	χ^2 (1 df.)	P
	60-64				65-69			
Athlete High	20	10.0	.36	.50-.60	12	16.7	2.18	.10-.20
Athlete Low	20	5.0			12	0.0		
Non-athlete High	20	15.0	1.11	.20-.30	12	16.7	.38	.50-.60
Non-athlete Low	20	5.00			12	8.3		
Combined High	40	12.5	1.41	.20-.30	24	16.7	2.01	.10-.20
Combined Low	40	5.0			24	4.2		
	70-74				75-79			
Athlete High	6	16.7	1.09	.20-.30	2	50.0	1.33	.20-.30
Athlete Low	6	0.0			2	0.0		
Non-athlete High	6	16.7	1.09	.20-.30	2	50.0	1.33	.20-.30
Non-athlete Low	6	0.0			2	0.0		
Combined High	12	16.7	2.18	.10-.20	4	50.0	2.66	.10-.20
Combined Low	12	0.0			4	0.0		
	80-84				Total Chi-squares			
Athlete High	1	0.0	.00	1.00	χ^2			
Athlete Low	1	0.0			DF.			
Non-athlete High	0	---	---	----	P			
Non-athlete Low	0	---			Athlete High and Low 6.13 11 .80-.90			
Combined High	1	0.0	.00	1.00	Non-athlete High and Low 8.03 10 .70-.80			
Combined Low	1	0.0			Combined High and Low 10.88 11 .40-.50			
Total Chi-squares for intervals after 55-Athlete High and Low--- $\chi^2 = 4.96$ (df.=6) (P=.50-.60)								
Non-athlete--- $\chi^2 = 6.22$ (df.=5) (P=.20-.30) Combined--- $\chi^2 = 9.56$ (df.=6) (P=.10-.20).								

FIGURE III

PERCENTAGE OF COMBINED HIGH AND LOW WEIGHT INCREASE GROUPS
PARTICIPATING IN SPORTS ACTIVITIES IN LATER LIFE



and low, and combined high and low weight groups were analyzed by the chi-square. None of the differences in each age period were found significant. The chi-square for all age periods was also not significant. A chi-square was also computed for the comparisons up to 55 and another above 55 years of age. Neither was found significant.

An analysis of the sports participated in by the high and low groups was difficult due to the limited number of cases. Golf, tennis, swimming, softball, baseball, bowling, hunting, and fishing were listed most. Percentage participation in tennis, softball, and baseball decreased with advancing years, whereas golf and bowling were the "old age" sports. No attempt was made to compare the high and low weight increase groups in the sports.

The opinions of the athlete, non-athlete, and combined high and low weight groups regarding athletics are found in Table XVII. These opinions were interesting even though the subjective judgments of people regarding such matters must be viewed with some reservations. To facilitate analysis, the opinions were classified as "harmful", "no opinion", "beneficial", or "beneficial with reservations". "Beneficial with reservations" included all opinions that contained qualifying remarks. This classification was somewhat artificial since in all probability those who listed athletics to be "beneficial" would no doubt agree with the qualifications expressed by others. However, to facilitate analysis it was included. The results showed that the largest percentage of subjects from both the athlete, non-athlete, and combined high weight increase groups and the athlete, non-athlete, and combined low weight groups thought that athletic competition was in the main

TABLE XVII
THE OPINION OF THE HIGH AND LOW WEIGHT GAIN GROUPS
ON WHETHER ATHLETICS ARE HARMFUL
OR BENEFICIAL TO COMPETITORS

Subjects	Number Report- ing	Rating Categories				
		% Rating Beneficial	% Rating Beneficial With Reserva- tions	% Rating Harmful	% Rating No Effect	% Rating No Opinion
Athlete						
H.W.G. ² (N=132)	122	67.2	24.6	2.5	4.9	.8
L.W.G. ³ (N=132)	128	61.0	24.2	2.3	11.7	.8
χ^2		3.75	(P=.40-.50)	(4 df.)		
Non-athlete						
H.W.G. (N=118)	102	40.2	22.6	9.8	17.6	9.8
L.W.G. (N=118)	111	37.9	33.3	7.2	14.4	7.2
χ^2		3.46	(P=.40-.50)	(4 df.)		
Combined						
H.W.G. (N=250)	224	54.9	23.7	5.8	10.7	4.9
L.W.G. (N=250)	239	50.2	28.4	4.6	13.0	3.8
χ^2		2.64	(P=.60-.70)	(4 df.)		

²High Weight Group

³Low Weight Group

beneficial to its participants. Also, only a small percentage in each group listed athletic competition as harmful. To test the differences in the "categories" between the high and low weight increase groups, chi-squares were computed. None of the chi-squares were found to be statistically significant. We may conclude then that the opinions of the athlete, non-athlete, and combined high weight groups and the corresponding athlete, non-athlete, and combined low weight groups regarding whether athletics are harmful or beneficial to competitors were not significantly different.

Table XVIII gives a summary of the military service experience of the high and low weight groups. The non-athlete, athlete, and combined low weight groups had 6.9, 9.5, and 8.3 per cent, respectively, more of their members in service than the corresponding high weight groups. When these differences between the number reporting military service and number reporting no service in the athlete, non-athlete, and combined weight groups were analyzed by the chi-squares, no statistically significant differences were found to exist. However, the differences in the athlete and combined weight increase groups were close to significant with the trend being for the low weight groups to have a higher percentage of members in service.

The subjects were also asked to indicate the branch of the armed force in which they served. (Table XIX) In the athlete, non-athlete, and combined high and low weight groups a higher percentage were in the army than in the other branches of service. This, of course is to be suspected as the army receives a larger percentage of draftees than do the other branches of service. To facilitate analysis, the branches of

TABLE XVIII

MILITARY SERVICE EXPERIENCE OF HIGH AND LOW WEIGHT INCREASE GROUPS

Subjects	Number Reporting	Military Experience		χ^2 (1 df.)	P
		% Service	% No Service		
Non-athlete					
H.W.G. ⁴ (N=118)	85	57.6	42.4	.76	.40-.50
L.W.G. ⁵ (N=118)	76	64.5	35.5		
Athlete					
H.W.G. (N=132)	95	63.2	36.8	1.94	.10-.20
L.W.G. (N=132)	88	72.7	27.3		
Combined					
H.W.G. (N=250)	180	60.6	39.4	2.64	.10-.20
L.W.G. (N=250)	164	68.9	31.1		

TABLE XIX

BRANCH OF SERVICE FOR THE SUBJECTS IN THE HIGH AND LOW WEIGHT INCREASE GROUPS IN SERVICE

Subjects	Number in Service	Number Report- ing	Branch of Service			χ^2 (2 df.)	P
			% Army	% Navy	% Others		
Non-athlete							
H.W.G. ⁴ (N=118)	49	48	83.3	10.4	6.3	1.27	.50-.60
L.W.G. ⁵ (N=118)	49	49	83.7	14.4	2.0		
Athlete							
H.W.G. (N=132)	60	60	73.3	16.7	10.0	5.88	.05-.10
L.W.G. (N=132)	64	63	69.8	28.6	1.6		
Combined							
H.W.G. (N=250)	109	108	77.8	13.9	8.3	6.85	.02-.05
L.W.G. (N=250)	113	112	75.9	22.3	1.8		

⁴High Weight Group⁵Low Weight Group

service were divided up into army, navy, and "others". This "other" category included marine, coast guard, merchant marine, and "more than one". Chi-squares were run to determine if there was a significant difference between the corresponding high and low weight groups in regard to branch of service. The chi-squares were not significant in the non-athlete and athlete groups, but a trend toward the high weight groups having less in the navy and more in the "other" branches was noticed. When the non-athlete and athlete groups were combined, the difference between the combined high and combined low weight group in branches of service was statistically significant at the 5 per cent level. The trend was for the combined high weight group to have more members in the army and "other" categories and less in the navy than the combined low weight group.

Those who were in service were also asked to report their activity in service. The answer was made in the form of a choice of "vigorous", "moderate", or "mild". A summary of the result of these answers is given in Table XX. The only trend observed was for the athlete, non-athlete, and combined high weight groups to have a larger percentage of their service men rate their activity as "mild". Chi-squares, however, do not reveal a statistically significant difference in activity in service.

The mean number of years in service for the athlete, non-athlete, and combined high and low weight gain service men are found in Table XXI. The differences in years in service were very small. "t" tests do not reveal significant differences.

TABLE XX

ACTIVITY IN SERVICE OF THE SUBJECTS IN HIGH AND LOW WEIGHT INCREASE GROUPS
IN SERVICE

Subjects	Activity in Service					χ^2 and P (2 df.)
	Number in Service	Number Reporting	% Vigorous	% Moderate	% Mild	
Non-athlete						
H.W.G. ⁶ (N=118)	49	49	28.6	44.9	26.5	3.42
L.W.G. ⁷ (N=118)	49	48	22.9	62.5	14.6	(P=.10-.20)
Athlete						
H.W.G. (N=132)	60	59	32.2	52.5	15.3	.43
L.W.G. (N=132)	64	64	37.5	50.0	12.5	(P=.80-.90)
Combined						
H.W.G. (N=250)	109	108	30.5	49.1	20.4	1.99
L.W.G. (N=250)	113	112	31.2	55.4	13.4	(P=.30-.40)

TABLE XXI

YEARS IN SERVICE OF THE SUBJECTS IN HIGH AND LOW WEIGHT INCREASE GROUPS
IN SERVICE

Subjects	Years in Service				P
	Number in Service	Number Reporting	Mean Years in Service	"t"	
Non-athlete					
H.W.G. ⁶ (N=118)	49	48	3.96	.14	.89
L.W.G. ⁷ (N=118)	49	49	4.10		
Athlete					
H.W.G. (N=132)	60	59	4.47	.40	.69
L.W.G. (N=132)	64	64	4.08		
Combined					
H.W.G. (N=250)	109	107	4.24	.22	.83
L.W.G. (N=250)	113	113	4.09		

⁶High Weight Group⁷Low Weight Group

CHAPTER VIII

HEREDITY HISTORY

The heredity history of the athlete, non-athlete and combined high weight and the corresponding low weight increase groups is dealt with in this chapter. The following characteristics are considered:

1. Number of grandparents, parents, and siblings living and deceased.
2. Age of death of deceased parents and siblings.
3. Causes of death of deceased parents and siblings.
4. Ailments of parents.
5. Size of family.

The high and low weight increase groups were selected according to a stratified sampling technique based on date of birth.¹ Because of this, individuals in the high and low weight groups were matched according to present age. This enabled an analysis of heredity history without considering the factor of present age.

Table XXII presents the percentage living and deceased of the paternal and maternal grandparents of the combined high and the combined low weight increase groups. It was found that a large percentage of grandparents in both the high and low weight groups were deceased. The combined high weight increase group and the combined low weight group were found to be very similar in the percentage of grandparents living and deceased. The small differences were not statistically significant.

¹p. 27.

TABLE XXII
PERCENTAGE LIVING OF THE GRANDPARENTS OF THE HIGH AND LOW WEIGHT GROUPS

	Combined High Weight Group N=250			Combined Low Weight Group N=250			χ^2 (1 df.)
	Number Respond- ing	% Grand- parents Living	% Grand- parents Deceased	Number Respond- ing	% Grand- parents living	% Grand- parents Deceased	
Paternal Grandfather	210	1.0	99.0	196	1.0	99.0	.01 (P=.90-.95)
Paternal Grandmother	210	0.0	100.0	198	.5	99.5	1.00 (P=.30-.40)
Maternal Grandfather	213	.5	99.5	189	.5	99.5	.02 (P=.80-.90)
Maternal Grandmother	209	1.4	98.6	193	1.6	98.4	.01 (P=.90-.95)

The percentage of living and deceased of fathers of the corresponding athlete, non-athlete, and combined high and low weight increase groups is found in Table XXIII. The data showed a trend for the high weight increase groups to have a higher percentage of fathers deceased than the corresponding low weight groups. However, chi-squares did not show this trend to be statistically significant.

No concurrent trends appeared in the analysis of the data on the percentage of mothers of the high and low weight groups living and deceased. (Table XXIV) As with the analysis of the data on fathers, chi-squares do not reveal significant differences.

The high weight increase groups, especially the non-athlete group, tended to have a higher percentage of brothers living than the low weight

TABLE XXIII

PERCENTAGE OF THE FATHERS OF THE HIGH AND LOW WEIGHT GROUPS LIVING AND DECEASED

Subjects	Number Responding	% Fathers Living	% Fathers Deceased	χ^2 (1 df.)	P	Number of Fathers Deceased	% of Fathers Age at Death Known	% of Fathers Cause of Death Known
Non-athlete								
H.W.G. ² (N=118)	116	31.0	69.0	.79	.30-.40	80	100.0	93.8
L.W.G. ³ (N=118)	115	36.5	63.5			73	98.6	89.0
Athlete								
H.W.G. (N=132)	126	25.4	74.6	.32	.50-.60	94	100.0	94.7
L.W.G. (N=132)	130	28.5	71.5			93	97.8	86.0
Combined								
H.W.G. (N=250)	242	28.1	71.9	.97	.30-.40	174	100.0	94.3
L.W.G. (N=250)	245	32.2	67.8			166	98.2	87.3

²High Weight Group³Low Weight Group

TABLE XXIV
PERCENTAGE OF THE MOTHERS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS LIVING AND DECEASED

Subjects	Number Respond- ing	% Mothers Living	% Mothers Deceased	χ^2 (1 df.)	P	Number of Mothers Deceased	% of Mothers Age of Death Known	% of Mothers Cause of Death Known
Non-athlete								
H.W.G. ⁴ (N=118)	116	48.3	51.7	1.30	.20-.30	60	100.0	93.3
L.W.G. ⁵ (N=118)	115	40.9	59.1			68	98.5	88.2
Athlete								
H.W.G. (N=132)	125	43.2	56.8	.12	.70-.80	71	100.0	90.1
L.W.G. (N=132)	130	45.4	54.6			71	100.0	87.3
Combined								
H.W.G. (N=250)	241	45.6	54.4	.28	.60-.70	131	100.0	91.6
L.W.G. (N=250)	245	43.3	56.7			139	99.3	87.8

⁴High Weight Group

⁵Low Weight Group

groups. However, these differences were not statistically significant. This is shown in Table XXV.

Table XXVI, on the percentage of sisters of the high and low weight increase groups living and deceased, did not reveal significant differences. Very similar percentages were found in the combined high and combined low weight increase groups.

From this analysis of the data on percentages of kin (grandparents, parents, siblings) living and deceased, it must be concluded that there is no statistically significant differences between the athlete high and low, non-athlete high and low, and combined high and low weight increase groups in the percentages of grandparents, parents, and siblings living and deceased.

The mean age at death and the cause of death were also recorded for deceased fathers, mothers, brothers, and sisters. The percentage of high and low weight gainers offering this information is found in the Tables XXIII-XXVI. The percentages were very high in all cases.

The mean age at death of fathers, mothers, brothers, and sisters are found in Table XXVII. "t" tests were used in all cases to analyze the differences in mean age at death of the fathers, mothers, brothers, and sisters of the high and low weight increase groups. Only two "t's" were found significant at the 5 per cent level of confidence. These involved differences in age at death of the mothers of non-athlete high and low weight gainers and the sisters of athlete high and low weight gainers. The mothers of the non-athlete high weight gainers lived significantly longer than the mothers of the non-athlete low weight gainers while the sisters of the athlete low weight gainers lived

TABLE XXV
PERCENTAGE OF BROTHERS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS LIVING AND DECEASED

Subjects	Number of Brothers	% Brothers Living	% Brothers Deceased	χ^2 (1 df.)	P	Number of Brothers Deceased	% of Brothers Age of Death Known	% of Brothers Cause of Death Known
Non-athlete								
H.W.G. ⁶ (N=118)	128	78.1	21.9	.36	.50-.60	28	100.0	100.0
L.W.G. ⁷ (N=118)	148	75.0	25.0			37	100.0	100.0
Athlete								
H.W.G. (N=132)	190	77.9	22.1	.03	.80-.90	42	100.0	100.0
L.W.G. (N=132)	201	78.6	21.4			43	100.0	100.0
Combined								
H.W.G. (N=250)	318	78.0	22.0	.08	.70-.80	70	100.0	100.0
L.W.G. (N=250)	349	77.1	22.9			80	100.0	100.0

⁶High Weight Group

⁷Low Weight Group

TABLE XXVI

PERCENTAGE OF SISTERS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS LIVING AND DECEASED

Subjects	Number of Sisters	% Sisters Living	% Sisters Deceased	χ^2 (1 df.)	P	Number of Sisters Deceased	% of Sisters Age of Death Known	% of Sisters Cause of Death Known
Non-athlete								
H.W.G. ⁸ (N=118)	132	83.3	16.7	.73	.40-.50	22	100.0	100.0
L.W.G. ⁹ (N=118)	167	86.8	13.2			22	100.0	100.0
Athlete								
H.W.G. (N=132)	173	84.4	15.6	.74	.40-.50	27	100.0	100.0
L.W.G. (N=132)	189	81.0	19.0			36	100.0	100.0
Combined								
H.W.G. (N=250)	305	83.9	16.1	.01	.90-.95	49	100.0	100.0
L.W.G. (N=250)	356	83.7	16.3			58	100.0	100.0

⁸High Weight Group⁹Low Weight Group

TABLE XXVII

MEAN AGE AT DEATH OF FATHERS, MOTHERS, BROTHERS, AND SISTERS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS

Subjects	Fathers		Mothers		Brothers		Sisters	
	Mean Age	"t"	Mean Age	"t"	Mean Age	"t"	Mean Age	"t"
Non-athlete								
High Weight Group	68.36	.62	70.48	2.47	41.00	.03	42.05	.84
Low Weight Group	69.78	(P=.54)	63.84	(P=.01)	40.78	(P=.98)	35.64	(P=.40)
Athlete								
High Weight Group	66.41	1.58	66.37	.57	40.95	.55	26.11	2.97
Low Weight Group	69.75	(P=.11)	67.80	(P=.57)	38.15	(P=.58)	41.00	(P=.003)
Combined								
High Weight Group	67.31	1.58	68.25	1.28	40.97	.39	33.27	1.28
Low Weight Group	69.76	(P=.11)	65.88	(P=.20)	39.39	(P=.70)	38.97	(P=.20)

significantly longer than the sisters of the athlete high weight gainers. All the remaining "t's" were not significant. Therefore, generally no statistically significant trends were found in the mean age of death of fathers, mothers, brothers, and sisters between the high and low weight increase groups.

Tables XXVIII-XXXI contain the causes of death of fathers, mothers, brothers, and sisters. To facilitate inspection and analysis the causes of death were divided into broad classifications. The distributions of causes of death of the kin of the athlete high and low, non-athlete high and low, and combined high and low weight groups were analyzed by chi-squares. None of the chi-squares were significant at the 5 per cent level of confidence. Therefore, the distribution of causes of death of kin was not significantly different between the high and low weight increase groups.

One trend appeared throughout all the causes of death of fathers, mothers, and brothers. A greater incidence of "heart diseases" as causes of death was noticed among the kin of the high weight group. This trend was analyzed statistically by separating the cause of death of each kin of the combined high weight and combined low weight groups into "heart diseases" and "others". It was found that the percentages in "heart diseases" were higher for the high weight increase group, but that the chi-squares were not statistically significant.¹⁰ The findings even though not statistically significant do agree with studies found in

¹⁰ χ^2 (1 df.) = Fathers (1.08), Mothers (1.15), Brothers (.35), Sisters (.34). Total χ^2 = 2.93 4 df. (P=.50-.60).

TABLE XXVIII
CAUSES OF DEATH OF FATHERS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS

Causes of Death	NON-ATHLETE			ATHLETE			COMBINED		
	High Weight %	Low Weight %	N	High Weight %	Low Weight %	N	High Weight %	Low Weight %	N
Arteriosclerosis & Degenerative Heart	8.0	6.1	4	12.4	8.7	11	10.4	7.6	11
Other Heart Diseases	22.7	27.7	18	26.1	18.8	15	25.6	22.8	33
Hypertension without Heart Disease	2.7	3.1	2	1.1	3.7	3	1.8	3.4	5
Vascular Lesions of Central Nervous System	5.3	3.1	2	0.0	5.0	4	2.4	4.1	6
Cancer	13.3	9.2	6	9.0	11.2	9	11.0	10.3	15
Tuberculosis	0.0	0.0	0	4.5	2.5	2	2.4	1.4	2
Pneumonia & Influenza	8.0	10.8	7	6.7	6.3	5	7.3	8.3	12
Diabetes	1.3	3.1	2	0.0	1.2	1	.6	2.1	3
Nephritis	2.7	4.6	3	3.4	0.0	0	3.1	2.1	3
Senility	12.0	9.2	6	9.0	18.8	15	10.4	14.5	21
Accidents	8.0	10.8	7	5.6	12.5	10	6.7	11.7	17
All Other Causes	16.0	12.3	8	20.2	11.3	9	18.3	11.7	17
χ^2 (df=11)	3.50 (P=.98-.99)			19.28 (P=.05-.10)			10.13 (P=.50-.70)		

TABLE XXIX

CAUSES OF DEATH OF MOTHERS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS

Causes of Death	NON-ATHLETE				ATHLETE				COMBINED			
	High Weight %	Low Weight %	N		High Weight %	Low Weight %	N		High Weight %	Low Weight %	N	
Arteriosclerosis & Degenerative Heart	7.1	3.3	2		7.8	6.5	4		7.5	4.9	9	
Other Heart Diseases	23.2	20.0	12		26.6	22.6	14		25.0	21.3	30	
Hypertensions Without Heart Disease	5.4	3.3	2		3.1	0.0	0		4.2	1.7	5	
Vascular Lesions of Central Nervous System	1.8	3.3	2		0.0	8.1	5		.8	5.7	1	
Cancer	10.7	15.0	9		12.5	12.9	8		11.7	13.9	14	
Tuberculosis	1.8	3.3	2		6.3	0.0	0		4.2	1.7	5	
Pneumonia & Influenza	5.3	6.7	4		7.8	4.8	3		6.7	5.7	8	
Diabetes	3.6	0.0	0		6.2	8.1	5		5.0	4.1	6	
Complications of Pregnancy, Childbirth & Puerperium	0.0	8.4	5		3.1	1.6	1		1.6	4.9	2	
Senility	25.0	15.0	9		6.2	12.9	8		15.0	13.9	18	
Accidents	3.6	0.0	0		1.6	3.2	2		2.5	1.7	3	
All Other Causes	12.5	21.7	13		18.8	19.3	12		15.8	20.5	19	
χ^2 (df=11)	13.66	(P=.20-.30)			13.99	(P=.20-.30)			11.48	(P=.30-.50)		

TABLE XXI

CAUSES OF DEATH OF BROTHERS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS

Causes of Death	NON-ATHLETE			ATHLETE			COMBINED		
	High Weight %	Low Weight %	N	High Weight %	Low Weight %	N	High Weight %	Low Weight %	N
Heart Disease	21.4	14.6	6	18.6	17.4	8	19.7	16.1	14
Cancer	3.6	2.4	1	9.3	8.7	4	7.0	5.8	5
Accidents	14.3	9.8	4	11.6	10.9	5	12.7	10.3	9
Birth & Early Infancy	10.7	14.6	6	9.3	8.7	4	9.9	11.5	10
Tuberculosis	3.6	2.4	1	4.7	2.2	1	4.2	2.3	2
Pneumonia & Influenza	7.1	9.8	4	7.0	8.7	3	7.0	9.2	8
Senility	25.0	12.2	5	20.9	23.9	9	22.6	18.4	16
Suicide & Homicide	3.6	12.2	5	2.3	4.3	1	2.8	8.0	7
Other Causes	10.7	22.0	9	16.3	15.2	7	14.1	18.4	16
Total Reporting Cause of Death ¹¹	5.37	28	41	.82	43	46	3.94	71	87
χ^2 (df=8)	(P=.70-.80)			(P=.99-1.00)			(P=.80-.90)		

¹¹A small but insignificant error appears in the data whereby the causes of death exceed the number of brothers deceased.

TABLE XXXI

CAUSES OF DEATH OF SISTERS OF THE HIGH AND LOW WEIGHT INCREASE GROUPS

Causes of Death	NON-ATHLETE				ATHLETE				COMBINED			
	High Weight %	Low Weight %	N	High Weight %	Low Weight %	N	High Weight %	Low Weight %	High Weight %	Low Weight %	N	N
Heart Disease	9.1	13.6	2	11.1	13.9	3	10.2	13.8	5	13.8	5	8
Cancer	27.3	13.6	6	11.1	11.1	3	18.4	12.1	9	12.1	9	7
Accidents	4.54	4.54	1	7.4	5.5	2	6.1	5.2	3	5.2	3	3
Birth & Early Infancy	4.54	13.6	1	11.1	0.0	3	8.2	5.2	4	5.2	4	3
Tuberculosis	4.54	0.0	1	14.8	16.7	4	10.2	10.3	5	10.3	5	6
Pneumonia & Influenza	4.54	0.0	1	14.8	5.6	4	10.2	3.4	5	3.4	5	2
Complications of Pregnancy	4.54	4.54	1	3.7	5.6	1	4.1	5.2	2	5.2	2	3
Senility	4.54	18.2	1	14.8	22.2	4	10.2	20.7	5	20.7	5	12
Other Causes	36.4	31.8	8	11.1	19.4	3	22.4	24.1	11	24.1	11	14
Total Reporting Cause of Death χ^2 (df=8)	6.07	(P=.60-.70)	22	6.68	(P=.50-.60)	27	5.28	(P=.70-.80)	49	5.28	49	58

the literature regarding the relationship of heart disease and overweight.¹²

Data assembled on "ailments" of fathers and mothers of the high weight increase and low weight increase groups are found in Tables XXXII-XXXIII. Only the "ailments" of living fathers and mothers were available. The tables are merely presented for inspection as statistical analysis would be insignificant due to the limited number of cases.

A comparison of the number of brothers, and sisters of the athlete, non-athlete, and combined high and low weight increase groups is found in Table XXXIV. The athlete, non-athlete, and combined low weight groups all have a larger mean number of brothers and sisters than the corresponding high weight increase groups. "t" tests did not reveal any statistically significant differences, although several "t's" were almost significant at the 5 per cent level of confidence. Even though there were no statistically significant difference it would appear from the findings that there is a definite trend for smaller families among the high weight gainers.

This chapter has compared the "hereditary history" of the high weight increase groups with the "hereditary history" of the low weight increase groups. Although no statistically significant differences were observed, the high and low weight increase groups did vary in certain hereditary characteristics. It would be profitable to conduct another study on the "hereditary history" of high and low weight gainers to see if similar trends appear. The trends found in hereditary history,

¹²p. 8-11.

TABLE XXXII

"AILMENTS" OF FATHERS OF HIGH AND LOW WEIGHT INCREASE GROUPS

Ailments	NON-ATHLETE		ATHLETE		COMBINED	
	High	Low	High	Low	High	Low
Diabetes Mellitus	2	1	1	0	3	1
Malaria	0	0	0	1	0	1
Arteriosclerotic and degenerative heart disease	2	1	0	0	2	1
Other Diseases of the Heart	1	5	2	3	3	8
Hypertension without mention of Heart	1	0	0	0	1	0
Bronchitis	1	2	0	0	1	2
Gastritis, Duodenitis, Enteritis & Colitis, except Diarrhea of the New-born	1	0	0	0	1	0
Hyperplasia of Prostate	1	0	0	0	1	0
Congenital Malformation	0	1	0	0	0	1
Senility	1	0	0	1	1	1
All other Diseases	8	5	4	2	12	7
TOTALS	18	15	7	7	25	22
Total not Reporting	18	27	25	30	43	57
Total Number Asked	36	42	32	37	68	79

TABLE XXXIII

"AILMENTS" OF MOTHERS OF HIGH AND LOW WEIGHT INCREASE GROUPS

Ailments	NON-ATHLETE		ATHLETE		COMBINED	
	High	Low	High	Low	High	Low
Tuberculosis of Respiratory System	0	0	1	0	1	0
Malignant Neoplasm, including Neoplasms of Lymphatic and Hematopoietic Tissues	1	0	0	2	1	2
Diabetes Millitus	2	1	3	0	5	1
Rheumatic Fever	0	1	0	0	0	1
Arteriosclerotic and Degenerative Heart Disease	2	0	0	0	2	0
Other diseases of the Heart	4	2	4	2	8	4
Hypertension with Heart Disease	1	1	0	1	1	2
Hypertension without Mention of Heart	2	2	3	2	5	4
Bronchitis	0	1	0	0	0	1
Ulcer of Stomach and Duodenum	1	1	0	0	1	1
Senility without Mention of Psychosis, ill-defined and unknown causes	1	1	1	1	2	2
All other Diseases	4	1	7	5	11	6
TOTALS	18	11	19	13	37	24
Total not Reporting	38	36	35	46	73	82
Total Number Asked "Ailments"	56	47	54	59	110	106

TABLE XXIV

MEAN NUMBER OF BROTHERS AND SISTERS FOR THE HIGH AND LOW
WEIGHT INCREASE GROUPS

Subjects	Mean No. of Brothers	"t"	Mean No. of Sisters	"t"	Mean No. of Brothers & Sisters	"t"
Athlete						
High (N=132)	1.44	.48	1.31	.73	2.75	.75
Low (N=132)	1.52	(P=.63)	1.43	(P=.47)	2.96	(P=.45)
Non-athlete						
High (N=118)	1.09	1.10	1.12	1.84	2.20	1.86
Low (N=118)	1.25	(P=.27)	1.42	(P=.07)	2.67	(P=.06)
Combined						
High (N=250)	1.27	1.01	1.22	1.76	2.49	1.75
Low (N=250)	1.40	(P=.31)	1.42	(P=.08)	2.82	(P=.08)

if verified by additional study, might prove significant as a basis for
determining hereditary characteristics of overweight persons.

CHAPTER IX

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

A Study on "Longevity and Morbidity of College Athletes" was completed in 1957 at Michigan State University.¹ A part of this study included a comparison between athletes and non-athletes in weight in college and weight increase after leaving college. The data available suggested an analysis of the characteristics of the athlete and non-athlete high weight gainers. The present study was conducted with the purpose of analyzing certain characteristics of these high weight gainers.

One hundred thirty-two athletes and one hundred eighteen non-athletes of the subjects in the "Michigan State University Study" were selected as high weight gainers on the basis of their per cent weight gain after leaving college. A similar number of athletes and non-athletes who had gained relatively little weight since leaving college were selected as control groups and were matched with the high weight gainers according to year of birth. The athlete high and low weight increase groups and the non-athlete high and low weight increase groups were then compared. Analysis was performed on the following characteristics:

1. Weight in college and present weight.
2. Diseases and ailments during and after childhood.

¹Henry J. Montoyo, Wayne D. VanHuss, Herbert W. Olson, William R. Pierson, and Andrew J. Hudec, The Longevity and Morbidity of College Athletes, (Phi Epsilon Kappa Fraternity, 1957), p. 1-139.

3. Present state of health.
4. Economic status during and after college.
5. Marital status.
6. Drinking habits.
7. Smoking habits.
8. Vocational and avocational activities.
9. Sports activities.
10. Evaluation of athletics.
11. Military service.
12. Number of grandparents, parents, and siblings living and deceased.
13. Age at death of deceased parents and siblings.
14. Causes of death of deceased parents and siblings.
15. Ailments of parents.
16. Size of family.

Conclusions The following statistically significant differences were found.

1. The high weight increase group differed significantly from the low weight increase group in mean pound and mean per cent change in weight after leaving college.
2. The high weight increase group was significantly lighter in college and significantly heavier in present weight.
3. The high weight increase group had significantly less smokers than the low weight increase group.

4. Smokers in the high weight group smoked significantly less than smokers in the low weight group.
5. The high weight group spent less "vigorous" hours per day in vocational and avocational activities after the age of thirty.
6. The service men of the high weight group differ significantly in branch of service from the service men in the low weight group.

The following comparisons were not found to be significantly different.

1. There was no significant difference between the high and low weight increase groups in diseases and ailments.
2. There was no significant difference in evaluation of present health by the high and low weight increase groups.
3. There was no significant difference in economic status during and after college between the two weight gain groups.
4. No significant difference was found in the number married and single.
5. The high weight group had more non-drinkers than the low weight group but this difference was not statistically significant.
6. There was no significant difference in sport participation in later life.
7. There was no significant difference in opinion regarding

athletics as beneficial or harmful between the groups.

8. There was no difference in years in service and activity in service between the two weight gain groups.
9. There was no significant difference in the percentage of grandparents, parents, and siblings living and deceased.
10. No statistically significant differences were found in mean age at death of fathers, mothers, brothers, and sisters of the high and low weight groups except the following:
 - a. The mothers of the non-athlete high weight group lived significantly longer than the mothers of the non-athlete low weight group.
 - b. The sisters of the athlete high weight group died sooner than the sisters of the athlete low weight group.
11. There were no significant differences in the causes of death of the fathers, mothers, brothers, and sisters of the two weight gain groups.

The following trends were observed although they were not statistically significant.

1. The high weight increase group had less members with military service than the control low weight group.
2. Smokers in the high weight group tended to smoke more cigars and less cigarettes and pipes than smokers in the

low weight groups.

3. The high weight group tended to have more of its members participating in sports activities after 50 years of age.
4. The parents of the high weight group tended to have a higher incidence of deaths due to heart diseases.
5. There was a definite trend for the high weight gainers to have fewer brothers and fewer sisters than the low weight gainers.

Recommendations The recommendations that might help to better this study and future studies of this type are as follows:

1. The questionnaire should include questions on the following items:
 - a. Type of life: active, moderately active, inactive.
 - b. Amount of exercise.
 - c. Occupation.
 - d. Race.
 - e. Occurance, age of occurrence, and duration of specific diseases related to overweight.
 - f. Termination of smoking and weight change during termination.
2. A similar study should be made matching the subjects according to weight in college as well as date of birth and percent change in weight.
3. Other studies of similar nature should be made at other universities of their graduates.

4. Other studies of similar nature using a random sample of the general population from all sections of the country should be made.
5. A follow-up study to the present one should be made involving an analysis of the causes of death and age at death of the subjects in this study.

BIBLIOGRAPHY

A. BOOKS

- Batterman, R. C. Biologic Effects of Tobacco. E. L. Wynder, Ed.
Boston: Little, Brown, 1955.
- Campbell, William Giles. Form and Style in Thesis Writing. Boston,
Houghton Mifflin Company, 1954.
- Clarke, Harrison H. Application of Measurement to Health and Physical
Education. New York: Prentice - Hall, Inc., 1954.
- Cureton, Thomas Kirk, Physical Fitness Appraisal and Guidance. St.
Louis: C. V. Mosby Company, 1947.
- Keys, Ancel. The Biology of Human Starvation. Minneapolis: University
of Minnesota Press, 1950.
- McNemar, Zuiian. Psychological Statistics. New York: John Wiley & Sons,
Inc., 1955.
- Mode, Elmer B. Elements of Statistics. New York: Prentice - Hall, Inc.,
1951.
- Taber, Clarence Wilbur. Cyclopedic Medical Dictionary. Philadelphia:
F. A. Davis Company, 1946.

B. PUBLICATIONS OF THE GOVERNMENT, LEARNED SOCIETIES, AND OTHER ORGANIZATIONS

- Metropolitan Life Insurance Company. Ideal Weights for Men. Statistical
Bulletin, 24:6 (June) 1943.
- Metropolitan Life Insurance Company. Ideal Weights for Women.
Statistical Bulletin, 23:6 (Oct.) 1942.
- Metropolitan Life Insurance Company and George F. Baker Clinic. Diabetes
in the 1940's. New York: Metropolitan Life Insurance Company, 1940.
- Montoye, Henry J., Wayne D. VanHuss, Herbert W. Olson, William R.
Pierson, and Andrew J. Hudac. The Longevity and Morbidity of
College Athletes. Phi Epsilon Kappa Fraternity, 1957.

C. PERIODICALS

- Adams, Franklin S. "Obesity as a Precursor of Diabetes," Biological
Abstracts, 5:7663, Part I, 1931.

Armstrong, Donald, Louis I. Dublin, George M. Wheatley, and Herbert H. Marks. "Obesity and Its Relation to Health and Disease," Biological Abstracts, 26:5683, Part II, 1952.

_____, Louis I. Dublin, George M. Wheatley, and Herbert H. Marks. "Obesity and Its Relation to Health and Disease," Journal of the American Medical Association, 147:1007-1014, November 10, 1951.

"Bigger Link Between Weight, Heart Disease," Science News Letter, 72:406, December 28, 1957.

Bjerkedal, T. "Overweight and Hypertension," Abstracts of World Medicine, 23:1367, June, 1958.

Briggs, John F. "Reversible Forms of Heart Disease," Biological Abstracts, 25:1124, Part I, 1951.

Brozek, J., and A. Keys. "Changes of Body Weight in Normal Men Who Stop Smoking Cigarettes," Science, 125:1203, June 14, 1957.

_____. "Relative Body Weight, Age, and Fatness," Nutrition Abstracts and Reviews, 23:4816, 1953.

Dahlberg, G. "Fettleibigkeit und Diabetes," Nutrition Abstracts and Reviews, 20:2780, 1951.

"Eat Less to Live Longer and to Escape Some Disease," Science News Letter, 51:31, January 11, 1947.

Faber, M. and F. Lund. "Influence of Obesity on the Development of Arteriosclerosis in Human Aorta," Nutrition Abstracts and Reviews, 19:4985, 1949-50.

"Food Without Exercise Makes Middle-aged Fat," Science News Letter, 67:286, April 30, 1955.

Gofman, John W., and Hardin B. Jones. "Obesity, Fat Metabolism, and Cardiovascular Disease," Biological Abstracts, 26:21267, Part II, 1952.

Gross, Miriam Zeller. "Why Fat People Die Sooner," Today's Health, 27:96-97, February, 1949.

Jouve, A., and M. Albouy. "Obesity and Cardiology," Biological Abstracts, 24:15239, Part I, 1950.

Keys, Ancel. "Obesity and Degenerative Heart Disease," Biological Abstracts, 29:8262, Part I, 1955.

- Levy, Robert L., Paul D. White, William D. Stoud, and Charles C. Hillman. "Overweight, Its Prognostic Significance in Relation to Hypertension and Cardiovascular-Renal Diseases," Journal of the American Medical Association, 131:951-953, July 20, 1946.
- _____, Paul D. White, William D. Stoud, and Charles C. Hillman. "Overweight, Its Prognostic Significance in Relation to Hypertension and Cardiovascular-Renal Disease," Biological Abstracts, 21:746, Part I, 1947.
- Masters, A. M., H. L. Jaffe, and K. Chesky. "Relationship of Obesity to Coronary Disease and Hypertension," Journal of the American Medical Association, 153:1499-1501, December 26, 1953.
- _____, and H. L. Jaffe. "The Incidence of Obesity in Coronary Disease," Abstracts of World Medicine, 18:1624, July - December, 1955.
- _____, L. I. Dublin, and H. H. Marks. "The Normal Blood Pressure Range and Its Clinical Implications," Journal of the American Medical Association, 143:1464, August 26, 1950.
- Mayer, Jean. "Exercise Does Keep the Weight Down," Atlantic Monthly, 196:63-66, July, 1955.
- _____. "Overweight and Obesity," Atlantic Monthly, 196:69-72, August, 1955.
- _____. "Appetite and Obesity," Atlantic Monthly, 196:58-62, September, 1956.
- _____, P. Roy, and K. P. Mitra. "Relation Between Caloric Intake, Body Weight, and Physical Work: Studies in an Industrial Male Population in West Bengal," American Journal Clinical Nutrition, 4:169-175, March - April, 1956.
- Millman, Max. "Exercise and Reducing," Today's Health, 29:14-15, May, 1951.
- _____. "Weight, Heart, and Blood Pressure," Today's Health, 30:28-29, November, 1952.
- Pett, Lionel Bradley. "A Canadian Table of Average Weights for Height, Age, and Sex," Biological Abstracts, 30:5606, Part I, 1956.
- Ramsey, Frank B. "Overweight," Today's Health, 31:13, July, 1953.
- Rush, Howard A. "Overweight: Our Primary Health Problem," Readers Digest, 62:122-124, February, 1953.
- Schnurman, Albert G. "Blood Pressure in Relation to Age, Weight, and Height. An Analysis of 15,225 Blood Pressure Determinations," Biological Abstracts, 15:4245, Part I, 1942.

- Schreier, Herbert. "Obesity, A Health Hazard," Today's Health, 24:110-111, February, 1946.
- "Stop Smoking and Gain Weight," Science Digest, 42, September, 1957.
- Tannenbaum, Albert, "Relationship of Body Weight to Cancer Incidence," Biological Abstracts, 15:2351, Part I, 1941.
- Tuttle, Esther. "Obesity: Psychiatric plus Dietary Approach to Its Treatment," Biological Abstracts, 23:14362, Part I, 1949.
- Vila, Oscar. "Etiologia de la Diabetes Mellitus," Biological Abstracts, 19:15916, Part II, 1945.
- Walker, J. M. "Physiological Effects of Smoking," Nutrition Society Proceedings, 12:157-160, 1953.
- Wilens, Segmund L. "The Bearing of the General Nutritional State on Atherosclerosis," Archives Internal Medicine, 79:129, February, 1947.
- Zisowitz, Milton L. "Dangers and Cures of Obesity," American Mercury, 65:604-610, November, 1957.
- Zubiran, Salvador. "La Diabetes Functional," Biological Abstracts, 14:14466, Part I, 1942.

D. UNPUBLISHED MATERIALS

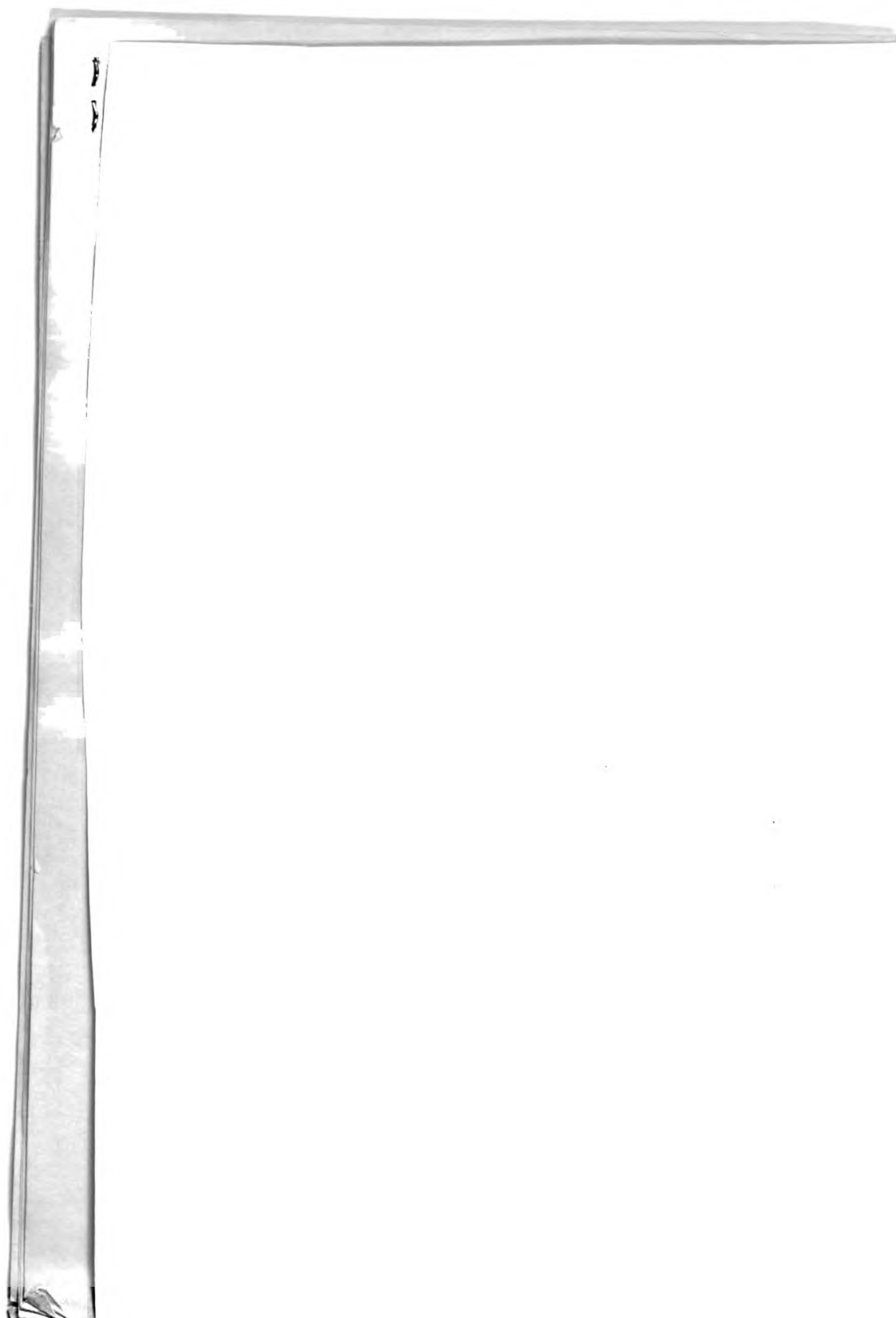
- Olson, Herbert W. "A Study of the Longevity and Morbidity of Track Athletes at Michigan State University." Unpublished Master's Thesis, Michigan State University, East Lansing, 1956.

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