APPRAISING BODY BUILD OF COLLEGE WOMEN: PHYSICAL ANTHROPOMETRY AND SHELDON SOMATOTYPE

Thesis for the Degree of M. A.
MICHIGAN STATE UNIVERSITY
Nancy Winkler Bartlett
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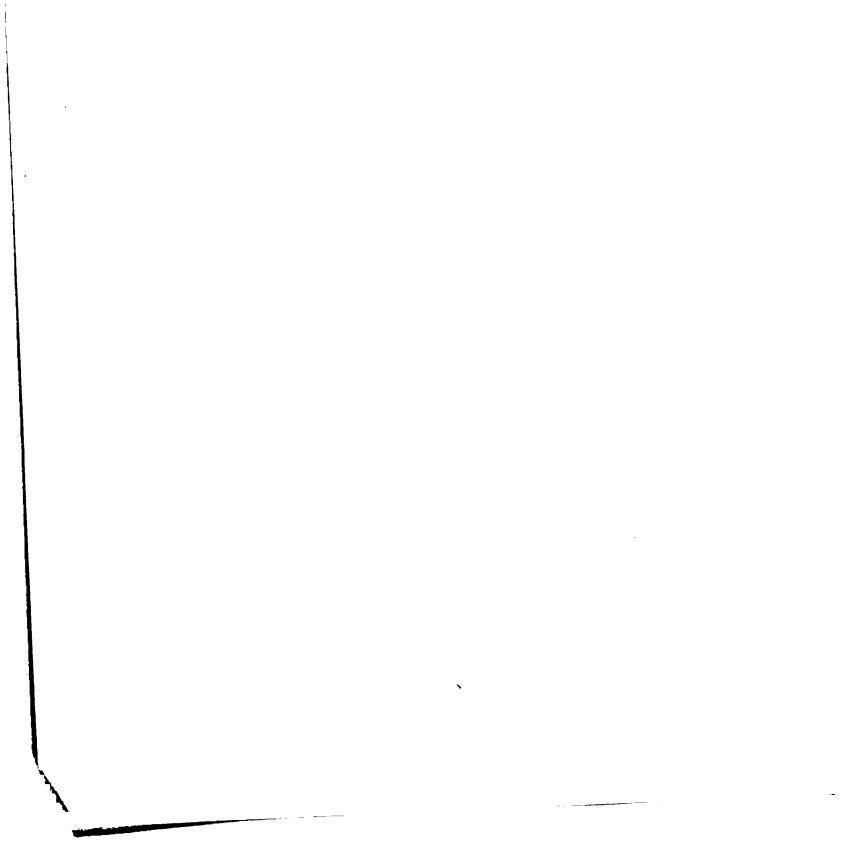

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By

Nancy Winkler Bartlett

AN ABSTRACT OF A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
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Department of Health, Physical Education, and Recreation

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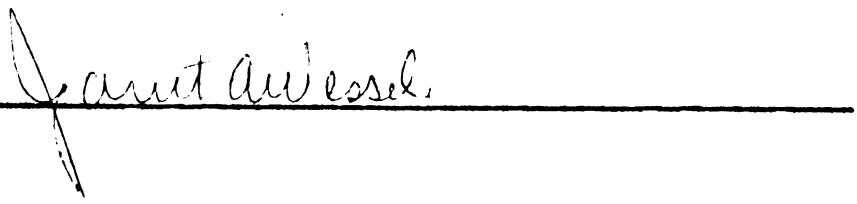
Approved 

ABSTRACT

APPRAISING BODY BUILD OF COLLEGE WOMEN: PHYSICAL ANTHROPOMETRY AND SHELDON SOMATOTYPE

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Statement of Problem

It was the intent of this study to devote systematic effort to improve the visual and photographic appraisal of body build of college women by:

1. Appraising body build on the basis of Parnell's and Sheldon's somatotypes and to determine the degree of agreement associated with such estimates.

2. Assisting in the development of an album of photographs of college women which will serve as a visual guide and reference.

Methodology

Data were collected on 80 women enrolled in physical education instructional classes at Michigan State University. The methods used for determining somatctypes were Parnell's objective method (M.4 chart) and Sheldon's subjective rating technique on positive slides (three views of each

person) by one expert. The agreement between the two somatotype estimates was represented by the product-moment correlation coefficients: +.77 in endomorphy, +.34 in mesomorphy, and +.90 in ectomorphy.

Twelve silhouettes of different somatotypes were made into slide form with three views of each somatotype on one slide.

Conclusions

1. Parnell's method is applicable to college women.
2. The Parnell and Sheldon techniques were in poorer agreement when the more extreme body types were compared.
3. A partial album of silhouettes were prepared. At this time there is an unsufficient number for use.

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CHAPTER I

INTRODUCTION

It is commonly known that no two women's physiques are exactly alike. Equally obvious is the fact that human physique, size, shape and composition tend to undergo change in varying degrees from birth to death in health and disease, in physical work or exercise.

However, more important problems are these: the relationship between normal function and body structure; effects of exercise and occupational physical activity; changes in illness; etiology of degenerative disease; the course of growth and aging; physical performance level and individual differences; appraising nutritional status; and the role of human physique in the likes and dislikes of man and its effect upon the behavior of man. The description of one's biological potential takes on a dynamic meaning when correlated with other areas of life, personality, health and fitness.

To focus on these problems it is essential to learn some means of classifying human physiques and give quantitative expression to these variations which are exhibited.

The groundwork is then laid for investigation of the interrelationship of somatotype, susceptibility to disease, and personality.

The problem of classification of human physique has been a problem since antiquity. Scarcely a single generation in recorded history has failed to probe some aspect of it. Many methods have been proposed for classifying physiques. Despite repeated failures of these methods, the idea of classifying human physique size, external form, and internal form of composition has persisted. While the emphasis in the last few years is on direct body measurement as indicators of body composition, the visual approach cannot be bypassed.

The system of body typing most influential in the last two decades was developed by W. C. Sheldon (1940-1954).[1] Physique is characterized in terms of three components rated on a scale from one to seven. These components (endomorphy, mesomorphy and ectomorphy) are derived for inspectional study of photographs.

External form depends, in part on body composition and since it is more readily accessible than internal

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[1] W. H. Sheldon, S. S. Stevens, and W. B. Tucker, The Varieties of Human Physique (New York: Harper Brothers, 1940).

architecture, it makes sense to examine somatoscopic rating critically. It may be possible to develop a system of somatoscopic ratings and measurements made on standardized photographs which will be based on and evaluated by objective criteria of adipose, muscular and skeletal masses. A step in this direction was developed by Parnell.[1] Parnell's scheme is aimed to approach as closely as possible to Sheldon's estimates of somatotype. The somatometric data should help to provide more precise definition of the components and add objectivity that is lacking when photographs are used alone.

Descriptive studies and useable materials of body build classification on so called normal young women is meager except for standard anthropometric measurements. A few descriptive German studies have been reported. However, the fact is emphasized that only one study by Bullen was found that tried to systemize the making of somatotypes frequent of women. The need of a normal female series is evident.

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[1] R. W. Parnell, Behavior and Physique (London: Edward Arnold Limited, 1958).

Statement of Problem

It was the intent of this study to devote systematic effort to improve the visual and photographic appraisal of body build of college women by:

1. Appraising body build on the basis of Parnell's and Sheldon's somatotypes and to determine the degree of agreement between such estimates.

2. Assisting in the development of an album of photographs of college women which will serve as a visual guide and reference.

Definition of Terms

Somatotype. Somatotype is the patterning of the morphological components of the human physique as expressed by the three numerals.

Constitution. Constitution is the total biological make-up found in an individual.

Sheldon's Components. A component is defined in terms of those aspects of morphological variation which differentiate one of the extremes of human physical variants from the others.

1. Endomorphy. Endomorphy is the relative predominance of soft roundness found throughout the various body regions.

2. Mesomorphy. Mesomorphy is the relative predominance of muscle, bone, and connective tissue in the body.

3. Ectomorphy. Ectomorphy is the predominance of linearity and fragility in the body.

Ponderal Index. Ponderal index as used in this study is the ratio of height divided by the cube root of weight.

Limitations of Study

Sample. The study was limited to eighty college women ages 17-22 years. No attempt was made to determine the nutritional or health status of the subjects.

Procedures. There was difficulty in assessing fat and muscle when taking measurements. The calipers used measured in tenths rather than hundredths of centimeters. Three different prints of each subject were taken. With the available equipment it was not possible to obtain three views of the human body on the same film. Only one subjective rating was made using inspectional criteria (anthroposcopy).

CHAPTER II

REVIEW OF LITERATURE

Throughout history people have believed in the existence of some kind of association between the physical make-up and biological patterns. In Aristotle's time the successful judging of character of body form on lower animals by experts was also applied to man.

Development of the use of anthropometry branched into many areas including those of anatomy, physiology, psychology, anthropology and others. This definition of constitution showed the wide range covered.

> Constitution - the sum total of the morphological physiological characters of an individual, with additional variables of race, sex, and age, all in large part determined by heredity but influenced in varying degress by environment factors, all of which when integrated and expressed as a single biological entity, fluctuate in varying degrees over a wide range of "normality" and occasionally cross an arbitrary boundary into "abnormality" or pathology.[1]

Development of Constitution Concept

Knowledge of body constitution went through three

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[1] W. B. Tucker and W. A. Lessa, "Man: A Constitutional Investigation," Quarterly Review of Biology, 15:287, September, 1940.

stages. The first emphasis was on the humoral aspect. During this stage Hippocrates classified in two distinct types: one, long and thin (habitus phthisicus) and the other short and thick (habitus apopleticus).[2] At the close of the eighteenth century and the start of the nineteenth century the emphasis changed to phrenology or analysis of character by the shape of the skull which was used to connect intellectual capacity, talents, and disposition with morphology. F. J. Gall (1757-1828) and J. C. Spurzheim (1776-1832)[3] were the best known anatomists of their time. They believed that mental traits could be determined by the shape of the head. Late in the nineteenth century followed the third emphasis or rise of the scientific method composed of classification, measurement and correlation by Beneke, di Giovanni, and Viola which put an end to the reliance on phrenology.

History of Anthropometria

Anthropometria was first mentioned in the literature by Jonannis Sigismundi Elsholzuis in 1654 when he established

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[2] Ibid., p. 265.

[3] Antonio Ciocco, "The Historical Background of the Modern Study of Constitution," Bulletin of the Institute of the History of Medicine of Johns Hopkins University, 4:25, January, 1936.

a method of taking measurements of the body. These were found in his doctoral dissertation from the University of Padua under the title, Anthropometria.[4]

Two hundred years later, Quetelet, a great Belgian mathematician and astronomer (1796-1874) did the same thing, thinking he was the first. He was the first though to study man's measurements statistically in 1871.[5]

Early Studies and Methods

Beneke, a German pathological anatomist, was the first to measure the internal organs. He also studied the relation of the organs and their variations to size, association to age and disease, and to two body types in 1878 and 1881.[6] The Italian anthropologist, di Giovanni continued Beneke's work by listing other diseases associated with the two body types. In 1885, di Giovanni set up three combinations of body build. One of his most important contributions was the use of more exact methods of determining body build for use in anthropometry.[7]

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[4] Ibid., p. 29.

[5] Tucker, op. cit., p. 266.

[6] Ibid., p. 268.

[7] Ciocco, op. cit., p. 30.

Viola, a loyal student of di Giovanni, followed in this area by developing a morphological index which included eight trunk-abdominal measurements and the length of one arm and one leg. Along with Viola, Pende helped to carry on di Giovanni's work which exists today. Next was Sante Naccarate,[8] a student of Viola, who was able to show a positive although low relation between intelligence and temperament.

Methods of approach in the study of human morphology varied also. Two of these were somascopic and somametric.[9] Somascopic referred to observational classifications of different types. Somametric was used interchangeably with anthropometric.

Some people using somascopic methods included: Sigaud, MacAuliffe, Thoöris, Troisvèrvre, and Kretschmer. Kretschmer,[10] a German scientist, studied the relationship between physique and mental disease and introduced the clinical method of investigation. Kretschmer revived the

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[8] E. F. Zeigler, "Implications of the Study of Body Types for Physical Education," Journal of Health, Physical Education and Recreation, 19:24, April, 1948.

[9] Tucker, op. cit., pp. 411-12.

[10] E. Kretschmer, "The Experimental Method Treated As an Instrument of Psychological Investigation," Character and Personality, 3:175-80, 1933.

Greek terms of pyknic (compact) and asthenic (without strength) and reintroduced the athletic (the French idea of a third type). His classification of the above three types was made by listing the mean of the following measurements: height, weight, shoulder width, chest, stomach, hips, forearm (circumference), hand (circumference), calf (circumference), and leg (length).[11]

Somametric or anthropometric methods, of which measurements and indices were found to be advantageous, were adopted in scientific studies. The whole morphological make-up was found by the use of these indices. Anthropologists use indices to express relative proportions of physical features. Montessori's ponderal index $(3\sqrt{\frac{\text{height}}{\text{weight}}})$[12] developed in 1913 is still in use today as a method of quick assessment of body build. In 1923 Davenport[13] studied hereditary factors of body build. He used five classifications ranging from very slender to very fleshy. In 1929 he developed an index of $\frac{\text{weight}}{\text{height}^2} \times 1000$.

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[11] Sheldon, op. cit., p. 23.

[12] Maria Montessori, Pedagogical Anthropology (Philadelphia: Frederick A. Stokes Company, 1913).

[13] C. B. Davenport, Anthropometry and Anthroposcopy (Baltimore: Waverly Press, 1927).

Recent Studies

Matiegka[14] of Czechoslovakia determined anthropometrically the extent of different tissues, especially bone, muscle, and skin with the subcutaneous tissue. His purpose was finding a method for determining physical efficiency that would be used in a clinical situation.

Behnke[15] used a quantitative classification of body build which was based on eleven circumferences and eight diameters. Anthropometric ratings for each of the components (fat, muscle, skeletal) are found by using a formula. In comparison with Sheldon he described body configuration in quantitative terms. Measurement of circumferences and diameters was used to make estimates of the size of gross components. Numbers were then assigned according to the measurements taken. The examination took approximately five minutes and was clinically applicable to adults and children although seldom used.

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[14]Jindrich Matiegka, "Physical Efficiency," American Journal of Physical Anthropology, 22:431-37, June, 1948.

[15]Albert Behnke, "Quantitative Assessment of Body Build," Journal of Applied Physiology, 16:960-68, November, 1961.

Conrad and Ott[16] determined somatotype by a new index which they developed. It was calculated from twice the sum of the shoulder width plus the circumference of the hand plus the circumference of the underarm in proportion to the average body height of the population. This index was used with the metric index composed by Stromgren. The index ranged from the pyknomorphic to the leptomorphic type. This method was based on exact measurings and was apparently easy to apply.

In the 1920's Sheldon became impressed with the work of Maccarti and Kretschmer. Sheldon set out to make a methodical approach in the study of human physique with his main interest being that of the relation of human physiques to behavior. Sheldon and his associates classified human physiques in three types according to primary aspects or components of body composition. Man's physique characterized in these three components (endomorphy, mesomorphy and ectomorphy) were rated on a scale from one (minimum) to seven (maximum). The components were derived from an inspectional study of photography.[17]

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[16] Excerpta Medica (New York: The Excerpta Medica Foundation, 1957), p. 321 citing K. Conrad and B. Ott, "The Somatometric Determination of Constitution Types," Annales Universitatis Medizin-Medicine (Saarbreucken: Universitaet des Saarlandes, 1954), 2/4:275-285.

[17] Sheldon, op. cit., Chapter 4.

Sheldon's method has been the most accepted one to date. Sheldon found the 76 somatotypes observed in men were present in women when this method was used on 25,000 shadow pictures of women.[18]

Tanner[19] worked with procedures to standardize the technique of Sheldon, the pose of the subject, and construction of a measure of androgyny. He was particularly interested in the pose. The photographic standardization consisted primarily of turning the hand so it was parallel to the body rather than at right angles.[20] Stiffening of the arm aided in determining the mesomorphic component more accurately. The reliability of photographic appraisal was found to be as good in some cases and better than anthropometric measurements in other cases. Reliability coefficients of 0.83 were found for the first two components and 0.92 for the third when the ratings cover the full range of the scale by Tanner.[21]

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[18] Ibid., pp. 66-67.

[19] J. M Tanner, "Current Advances in the Study of Physique, Photogrammetric Anthropometry and an Androgyny Scale," The Lancet, 1:574-79, March, 1951.

[20] C. W. Dupertuis and J. M. Tanner, "The Pose of the Subject for Photogrammetric Anthropometry, with Especial Reference to Somatotyping," American Journal of Physical Anthropology, 8:43, March, 1950.

[21] J. M. Tanner, "The Reliability of Anthroposcopic Typing," American Journal of Physical Anthropology, 12:261-82, June, 1954.

The advantage of photographs with somatotyping was that a permanent record was made. The advantages of a 35 mm camera included: film was less expensive; equipment was easily movable; film could be sent by mail or stored easily. The main disadvantages were the initial cost of the camera, and making enlargements on a negative which was poor because of distortion. Special non-shrinking paper must also be used with these prints.

Working with photography Tanner and Weiner[22] found that a F.24 aerial camera fitted with a 20 inch focal lens did a good job. This camera held fifty feet of film 5-1/2 inches wide which took 5" by 5" pictures of fifty people (three views to a frame) per magazine with enlargements made exactly to scale. The main disadvantage was size. It had to be transported on a truck and placed in a permanent set-up. Gaven, Washburn and Lewis[23] also worked with photography for anthropometric purposes by using a Keith copying camera which took two exposures and made 5" by 7" pictures.

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[22] J. M. Tanner and J. S. Weiner, "The Reliability of the Photogrammetric Method of Anthropometry, with a Description of a Miniature Camera Technique," American Journal of Physical Anthropology, 7:145-86, June, 1949.

[23] J. A. Gavan, S. L. Washburn, P. H. Lewis, "Photography: An Anthropometric Tool," American Journal of Physical Anthropology, 7:331-51, 1950.

Parnell's scheme, combination of physical anthropology and photography, was an approach to provide a more precise definition of the components and add objectivity that is lacking when photoscopy is used alone.[24] He tried to correspond as closely as possible to Sheldon's estimate of somatotype. Parnell used the terms of fat, muscularity and linearity instead of Sheldon's endomorphy, mesomorphy and ectomorphy. On the chart were scales for height, weight, ponderal index, standard scales for two bone sizes, the bicondylar measurements of humerus and femur, and two girths of the biceps and calf muscle. Lastly, were scales for three skinfold measurements of subcutaneous fat and the total of these three fat measures. From this chart fat and linearity were plotted easily while muscularity involves more work. The procedure with a M.4 chart was completed in approximately five minutes.

The M.4 chart, set up for men, may also be applied to women. The chart has been plotted on 671 women. Findings show the M.4 distribution to be more endomorphic and less mesomorphic than that by Sheldon. Parnell also set up a M.4 chart for eleven year olds. Parnell's eventual

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[24] Parnell, op. cit.

aim was the development of a constitutional index which was determined genetically.[25]

Cureton has modified Sheldon's technique by using subjective rating of each component on a scale from1-7 which may be used as a quick method of general body typing.[26]

Studies on Women

Descriptive useable material on so-called normal healthy women has been scarce. Few studies have been made of possible correlations of body build of women with motor ability. One study based on pictures taken directly from Sheldon's method attempts to systematize the making of somatotype judgment by development of a level for morphological description of women. Groundwork has been laid for studies investigating the relations of somatotype to immunity and disease, psychological attributes, nutrition, performance and fitness level.

Bullen,[27] Rees[28] and Hatlestad[29] worked specifically

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[25]Ibid., p. 25.

[26]Thomas Kirk Cureton, Physical Fitness Appraisal and Guidance (St. Louis: Mosby, 1947), Chapter 4.

[27]A. K. Bullen and H. L. Hardy, "Analysis of Body Build Photographs of 175 College Women," American Journal of Physical Anthropology, 4:37-65, March, 1946.

[28]Linford Rees, "A Factorial Study of Physical Constitution in Women," Journal of Mental Science, 96:619-32, July, 1950.

[29]S. L. Hatlestad, "The Determination and Measurement of Body Build in College Women," Research Quarterly, 4:60-75, December, 1940.

on somatotyping methods applicable to women. Rees[30] did a factorial study on 200 neurosis patients checking the intercorrelations of 15 anthropometric variables to find a useful objective method of assessing body build. Those variables which correlated highest were: stature, symphysis height, chest and hip circumference. Hatlestad[31] correlated twenty-two indices with body build. Those ratios which proved highly valid for college women were chest girth/height and leg length/chest girth. Bullen and Hardy[32] have tried to objectify Sheldon's method. They used a check list for checking off characteristics of the five regions of the body for determining the strength of each component. This method was more objective than Sheldon's rating method.

Also limited are studies on women comparing somatotype with motor ability. Working with junior high school aged girls, Burley, Dobell and Farrel[33] found a low degree of relationship between flexibility and power, and also a low degree of relationship between flexibility and speed.

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[30] Rees, loc. cit.

[31] Hatlestad, loc. cit.

[32] Bullen and Hardy, loc. cit.

[33] Lloyd Burley, Helen Dobeff and Betty Farrel, "Relations of Power, Speed, Flexibility and Certain Anthropometric Measures of Junior High School Girls," Research Quarterly, 32:443, December, 1961.

Perfix,[34] working with college women, found a definite relationship between mesomorphy and strength and power. A direct opposite relationship was found with endomorphy in strength and power. Carruth[35] found a high relationship of motor ability with body coordination, a moderate relationship with strength and speed, and a slightly positive relationship with flexibility, balance, endurance and agility. The results found by Morris[36] were very similar to those found by Carruth. Wessel, Nelson and Dillon[37] set up anthropometric and physical performance standards for college women.

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[34]Joyce A. Perfix, "Relationship between Somatotype and Motor Fitness in Women," Research Quarterly, 25:84, March, 1954.

[35]Carl E. Willgoose, Evaluation in Health Education and Physical Education (New York: McGraw-Hill Book Company, Inc., 1961), p. 326 citing Wincie Ann Carruth, "Analysis of Motor Ability and Its Relationship to Constitutional Body Pattern of College Women," (unpublished doctoral dissertation, New York University, New York, 1952).

[36]Ibid., citing Patricia Collins Morris, "A Comparative Study of Physical Measures of Women Athletes and Unselected College Women," (unpublished doctoral dissertation, Temple University, Philadelphia, 1960).

[37]Janet A. Wessel, Richard Nelson, Eva Lou Dillon, "Frequency Distributions and Standards of Anthropometric Measures for College Women," Research Quarterly, 21:523, October, 1960.

CHAPTER III

METHODOLOGY

Sample

The subjects for this study were 80 healthy women students enrolled in physical education instructional classes at Michigan State University. Instructors in the Department of Health, Physical Education, and Recreation were given information sheets. These sheets described endomorphy, mesomorphy, and ectomorphy. The instructors were requested to make a list of those students with extreme body components and five others who were average in the components. After returning the lists, the investigator informed each subject of the purpose of the study, the subject's role in the study, and who was doing the study. The subjects who agreed to participate were very cooperative.

Procedures

All measurements were taken during Spring Term, 1963, from 12:00 noon until 5:00 p.m. The actual time involved for each student was fifteen minutes: ten minutes for taking anthropometric measurements and five minutes for taking body

build pictures.

Anthropometric Measurements.[1] The subjects were prepared for the study by removing all clothes except for brassiere and panties. Skinfold, girth, and skeleton width measurements for Parnell's M.4 chart were taken on the right side of the body. All measurements were taken three times and averaged except for height and weight measurements which were taken once. The measures were taken as follows:

A. Height. Height was recorded to the nearest half inch. The subject stood barefooted with back to the height scale, took a deep breath and stretched up to maximum height while heels remained in contact with the floor.

B. Weight. Weight was recorded to the nearest pound.[2]

C. Biepicondylar dimensions. The bone measurements were recorded in centimeters with Narrogansett calipers. These measurements were taken with firm pressure.

1. Humeral epicondyles. Distance was measured between the medial and lateral epicondyles (bony part of elbow, felt when upper arm was held horizontally and forearm was bent upwards at a right angle).

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[1] Parnell, op. cit., pp. 14-17.

[2] One pound was deducted for underclothes.

2. Femoral epicondyles. Distance measured was the maximum bony width which was felt by the horizontal groove on either side of the knee. The subject sat on a chair with her foot on the floor and the lower leg vertical.

D. Skinfold. The skinfold measurements were recorded in millimeters. The skinfolds were grasped between the thumb and the index finger of the left hand. The size of the fold included two thicknesses of skin and subcutaneous fat but no muscle. The application of the Lange Calipers[3] was about one centimeter from the finger at a depth equal to the thickness of the skinfold. Readings were taken within the first five seconds when needle first stopped momentarily.

1. The upper arm. The skinfold was taken halfway between the acromion process and the olecranon process on the back of the upper arm over the triceps muscle.

2. Subscapular. The skinfold was taken over the bottom tip of the right scapula diagonally

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[3]Lange Skinfold Calipers available from the Wenner-Gren Aeronautical Research Laboratory, University of Kentucky, Lexington, Kentucky.

downwards and outward toward the ribs.

3. Suprailiac. The skinfold was taken one to two inches above the anterior iliac spine and diagonally toward the mid-line of the body.

E. Body circumference or girth measurements. Measurements were taken over the maximum girth with a steel tape held in light contact with the skin.

1. Biceps. The measurement was taken with the elbow fully flexed.

2. Calf. The measurement was taken with the subject standing with legs slightly apart and weight equally distributed.

Completion of Parnell's M.4 Chart.[4,5]

A. Fat or Sheldon's endomorphy estimate.

1. The skinfolds were totaled.

2. The number most closely representing the total skinfold was circled in the row opposite the correct age group.

3. The endomorphy estimate was circled.

B. Muscularity or Sheldon's mesomorphy estimate.

1. The number most closely representing the

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[4]Parnell, op.cit., p. 20. [5]M.4 Chart (see Appendix A).

height, bone width, and muscle girth in each row was circled.

2. The mean position of the bone and muscle measurements was found by units (two columns equal one unit) in relation to the height column. Those measurements falling to the right of the height column were plus and those falling to the left were minus. The four plus and minus figures were totaled and divided by four to find the relation of the mean to the height column.
3. The first estimate of mesomorphy was computed by placing the mean found above in relation to the mesomorphic mean of 4.
4. The final estimate of mesomorphy was computed by correcting for fat. The number most closely representing total fat was circled. The correction was made by adding or subtracting the amount found from the correct age group to the first estimate.
5. The mesomorphy (corrected) estimate was circled.

C. Linearity or Sheldon's ectomorphy estimate.

1. The number most closely representing the ponderal index was circled opposite the correct age.
2. The ectomorphy estimate was circled.

Somatotype Pictures and Photographic Method.

A. Attire of subjects. The subjects removed all clothes and jewelry except brassiere and panties. A hairnet was placed over their hair leaving the left ear and neck exposed.

B. Camera and set-up.

1. The Zeiss Contaflex camera was set at f/4 on 1/30 with at a distance of eleven feet (from camera lens to center of turntable).

2. The tripod was 44-1/2 inches high at attachment with the camera.

3. The lighting was by 4 fluorescent bulbs of 90 watts each. The lights were set at a 45 degree angle to the subject. The light distance was 82-1/2 inches away on the right side and 79 inches on the left.

C. Pose of the subjects[6] (three views - front, side, back).

1. Standard front view pose.

a. Feet. The heels were placed against the heelplate with the inside edge of both feet

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[6] C. W. Dupertuis and J. M. Tanner, "The Pose of the Subject for Photogrammetric Anthropometry, With Especial Reference to Somatotyping," American Journal of Physical Anthropology, 8:28-33, March, 1950.

angles out at 10 degrees.

b. Legs. The legs were relaxed. If knees touched the heels were moved apart equal distances until they did not.

c. Instruction to the subjects. The subject was told to stand up to her full height with arms held stiff by her sides. The investigator then demonstrated this position.

d. Shoulders. The subject was checked for relaxed shoulders. The investigator pulled down gently on the subject's arms.

e. Arms and hands. The arms were semi-pronated with the minimum wrist diameter toward the camera. The elbow was locked about 2 inches from the waist. Hands were 4 inches from hips with fingers together and extended with thumb along the index finger and the hand bent inwards at the wrist so fingers pointed vertically towards the floor.

f. A final check was made before the picture was taken.

2. Side view.

a. The subject retained the same position while

being turned so left side of body faced the camera.

b. The overall pose for good relaxed posture and profile position was checked.

c. When legs were not in perfect profile the knee showing from behind was brought forward until a profile was seen.

d. The subject was checked for head position and relaxed shoulders.

e. Arms were checked and placed so as not to obstruct the profile.

f. A final check was made before the picture was taken.

3. Back view.

a. The subject retained the same position while being turned so the back of the body faced the camera.

b. The overall pose was rechecked for correct alignment of the head, relaxed shoulders, arm position with wrists rotated so minimum wrist diameter showed, and fingers pointed vertically downward.

c. A final check was made before the picture was taken.

Anthroposcopy. The photographs were examined and by inspectional study an estimate was made of the relative strength of each component of the body as a whole (endomorphy, mesomorphy and ectomorphy). The judgment was made from positive slides. Two investigators (women physical education instructors) worked independently to check each other. After rating independently where two investigators varied in their results they discussed it further until consensus was reached. The components were recorded as equal unless dominance was distinct and certain. The components were rated on a scale from one (minimum) to seven (maximum). The anthroposcopic estimate was based on detailed inspectional criteria set forth by Sheldon.

CHAPTER IV

ANALYSIS OF DATA

It was the intent of this study to devote systematic effort to improve the visual and photographic appraisal of body build of college women by:

1. Appraising body build on the basis of Parnell's and Sheldon's somatotypes and to determine the degree of agreement between such estimates.

2. Assisting in the development of an album of photographs of college women which will serve as a visual guide and reference.

Degree of Agreement between Parnell's and Sheldon's Somatotype Estimate

The agreement between the two somatotype estimates was represented by the product-moment correlation coefficients: + .77 in endomorphy, +.34 in mesomorphy, and +.90 in ectomorphy. In this series of 80 specific estimates of somatotype the following agreement was found in each of the three components: 32 cases of endomorphy, 27 cases in mesomorphy, and 48 cases in ectomorphy. The degree of difference in rating components is shown in Table 1 below.

In a good number of subjective estimates the ratings in endomorphy and ectomorphy were too low and in mesomorphy the estimates were too high. This substantiates Parnell's findings in which he found his distribution tended to be more endomorphic and less mesomorphic when using his system than when using Sheldon's subjective method.[1]

Table 1. Degree of agreement between Parnell's and Sheldon's somatotype estimate.

Degrees of Difference	Endomorphy		Mesomorphy		Ectomorphy	
	Over	Under	Over	Under	Over	Under
1	11	29	25	11	10	21
2		5	8	3		1
3		3	2	2		
4				2		

Parnell[2] reported that estimates between photoscopic estimates and expert somatotypists agreed to within one-half unit in 87.3% of the cases on 282 Oxford University undergraduate men. Tanner[3] found that trained observers using

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[1] Parnell, op. cit., p. 25.

[2] Ibid., p. 214.

[3] J. M. Tanner, "The Reliability of Anthroposcopic Typing," American Journal of Physical Anthropology, 12:261, June, 1954.

anthrosposcopic techniques agreed in their rating to within a half rating on the seven point scale of 90% of instances. The reliability coefficients for this were +.83 for the first two components (endomorphy and mesomorphy) and +.92 for the third (ectomorphy). Tanner also found that mesomorphy was usually the hardest and ectomorphy the easiest to rate. The data presented above agreed with the results of this study.

Beckerle[4] in a similar comparative study done with men reported product moment coefficients of +.60 in endomorphy, +.75 in mesomorphy, and +.78 in ectomorphy.

Somatotype Comparison by Rank with Ponderal Index of Parnell's and Expert's Ratings with Somatotypes by Ponderal Index of Bullen and Sheldon's Findings

In a more detailed analysis the somatotypes found by using Parnell's M.4 chart method and expert rating method were compared according to ponderal index findings by rank (rank being based on deviations of ponderal index) by Sheldon and Bullen. Better agreement of findings was found with Sheldon's ponderal index technique than Bullen's (see Table 2).

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[4]Gerald Beckerle, "The Relationship of Somatotype to Dream Recall" (unpublished Master's thesis, Michigan State University, East Lansing, 1963).

Table 2. Comparison by rank of objective and subjective rating with Bullen and Sheldon.

Rank	Parnell's M.4 Chart		Expert Rating	
	Bullen	Sheldon	Bullen	Sheldon
	Frequency		Frequency	
0	3	9	7	11
1	10	23	8	27
2	6	10	7	10
3	3	5	8	11
More than three	11	9	23	15
Different	47	24	27	6

Bullen's subjective method[5] of somatotyping was a simplification of Sheldon's method in which she set up a check list to be used with a table for determining somatotypes from photographs of 175 college women. In the five body regions (listed by Sheldon) seven observable characteristics were chosen for each component. On the score sheets the characteristics present were checked off by body regions, then totaled and averaged by component for overall determination of somatotype. The ponderal index distribution represents the mean of height over cube root of weight of the

[5]Bullen, loc. cit.

somatotypes falling in that group. Poor agreement with Bullen was probably due to an incomplete list of somatotypes by Bullen for comparison.

Sheldon's somatotype results from an objective method were set up "by ponderal index in a table which represents the distribution of means of 76 somatotypes against 18 anthropometric criteria including height over cube root of weight"[6] on men. In using the rank method Sheldon found that all somatotypes fell within rank three, 92% within rank two, and 67% within rank one when using the ponderal index on men ages 17-19.[7]

Silhouette Illustration

Silhouettes were prepared for twelve somatotypes. These silhouettes were prepared as part of the problem under investigation. However, there were an insufficient number available for use at this time. These silhouettes which have been prepared are presented in Appendix B.

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[6]Sheldon, op. cit., p. 265.

[7]Ibid., p. 98.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

It was the intent of this study to devote systematic effort to improve the visual and photographic appraisal of body build of college women by:

1. Appraising body build on the basis of Parnell's and Sheldon's somatotypes and to determine the degree of agreement associated with such estimates.

2. Assisting in the development of an album of photographs of college women which will serve as a visual guide and reference.

Data were collected on 80 women enrolled in physical education instructional classes at Michigan State University. The methods used for determining somatotypes were Parnell's objective method (M.4 chart) and Sheldon's subjective rating technique on positive slides (three views of each person) by one expert.

Conclusions

1. Parnell's method is applicable to college women.

2. The Parnell and Sheldon techniques were in poorer agreement when the more extreme body types were compared.

3. A partial album of silhouettes were prepared. At this time there is an unsufficient number for use.

Recommendations

1. A more extensive study should be undertaken using samples of larger size.

2. The photographs should be rated by several experts so that correlations may be compared.

3. Development of silhouettes for a series or an album on different somatotypes found in women should be continued.

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APPENDICES

APPENDIX A

SOMATOTYPE RATINGS AND RAW DATA ON ANTHROPOMETRIC MEASUREMENTS

Table 3. Somatotype ratings and raw data on anthropometric measurements.

Number	Ponderal Index	Body Type 7-Point Scale	Body Type 13-Point Scale	Expert Rating	Fat-Biceps	Subscapular	Supr-iliac	Total Fat	Weight	Height	Bone Humerus	Bone Femur	Muscle-Biceps	Muscle-Calf
1.	10.4	741	6-1/2 41	731	32	33	30	95	209	62	6.5	9.7	39.8	40.5
2.	12.0	531		551	20	15	13	48	167	66	5.7	9.2	27.5	36.0
3.	12.8	543	5-1/2 3-1/2 3	543	23	22	10	55	131	65	5.9	9.4	36.6	35.3
4.	13.3	354		343	7	7	5	19	107	63	6.4	9.3	26.0	33.2
5.	13.8	416	415-1/2	326	8	10	9	27	118	68	6.1	8.5	23.6	31.8
6.	13.3	444	3-1/2 3-1/2 4	353	9	8	8	25	133	68	6.2	9.9	26.5	36.2
7.	13.1	433	433-1/2	433	13	9	9	31	123	65	5.8	9.0	25.7	35.8
8.	12.8	533	4-1/2 33	443	13	15	12	40	145	67	6.1	9.2	27.6	35.8
9.	11.8	551		641	18	18	14	50	139	61	5.7	9.4	29.8	38.0
10.	12.6	632	5-1/2 2-1/2 2-1/2	631	22	23	11	57	155	67.5	6.0	9.9	28.8	37.0
11.	13.5	445	3-1/2 44-1/2	345	10	8	7	25	118	66.5	5.6	8.8	21.7	34.0
12.	13.7	425	3-1/2 1-1/2 5	335	10	9	7	26	105	65	5.7	8.2	23.4	30.9
13.	13.2	514		443	14	16	15	45	135	67.5	5.8	8.9	24.9	34.6

14.	14.0	326	2-1/2 26		236	8	6	4	18	97	64.5	5.9	8.3	24.0	22.3
15.	12.1	541			541	19	17	15	51	141	63	5.9	9.0	29.4	35.7
16.	12.3	641	5-1/2 41-1/2		541	19	22	21	62	123	61	5.7	9.0	26.7	45.0
17.	12.4	452	4-1/2 52		543	10	14	10	34	155	66.5	6.0	9.8	38.8	36.7
18.	13.2	434	3-1/2 34		343	8	9	7	24	141	68.5	6.4	9.8	25.9	37.2
19.	13.8	426	3-1/2 25-1/2		335	11	10	5	26	103	65.0	5.9	8.2	22.1	33.1
20.	11.7	641	5-1/2 41		642	18	25	21	64	157	63	6.3	9.0	31.3	36.8
21.	12.9	523	5-1/2 23		443	21	19	16	56	143	67.5	5.9	9.4	26.6	37.1
22.	13.1	534	4-1/2 2-1/2	3-1/2	352	17	11	10	38	122	65	5.7	9.1	26.0	35.0
23.	12.8	333			433	12	10	9	21	112	62	5.6	8.7	26.5	32.7
24.	12.8	543			543	25	9	8	42	131	65	6.0	9.4	29.8	35.9
25.	12.6	442	4-1/2 42-1/2		542	12	12	8	32	126	63	5.9	9.0	26.9	34.9
26.	12.9	543	4-1/2 43		443	15	11	10	36	135	66	6.4	8.9	28.3	36.1
27.	11.8	641	5-1/2 41		632	30	17	14	61	177	66.5	6.5	9.6	33.2	38.3
28.	12.9	433			433	16	10	6	32	111	62.0	5.8	8.8	26.7	23.7
29.	13.5	515	514-1/2		326	16	16	14	46	135	69.5	6.8	9.4	24.6	32.8
30.	12.7	443	3-1/2 42-1/2		352	11	9	6	26	113	61.5	5.5	8.9	23.4	35.6
31.	13.8	325	325-1/2		336	8	8	5	21	100	64.0	5.4	8.0	22.3	32.2
32.	12.8	533	52-1/2 3		533	18	16	8	42	124	64.0	6.1	8.8	27.7	25.0
33.	12.4	642	5-1/2 42		532	26	22	14	62	144	65.0	6.3	10.1	29.2	38.4
34.	12.6	542	4-1/2 42-1/2		632	16	11	12	39	117	61.5	5.7	9.0	25.3	36.9
35.	11.6	561	55-1/2 1		622	21	17	7	45	127	58.5	5.9	9.6	28.6	35.6

Table 3.--Continued.

Number	Ponderal Index	Body Type 7-Point Scale	Body Type 13-Point Scale	Expert Rating	Fat-Biceps	Subscapular	Supr-iliac	Total Fat	Weight	Height	Bone Humerus	Bone Femur	Muscle-Biceps	Muscle-Calf
36.	12.8	553	4-1/2 4-1/2 3	642	16	13	9	38	124	64.0	6.2	9.5	28.6	37.7
37.	13.0	443	43-1/2 3-1/2	353	14	9	5	28	124	65.0	5.8	9.3	26.6	36.0
38.	12.7	452	452-1/2	362	11	11	7	29	106	60.0	5.8	8.5	26.4	36.0
39.	12.4	552	54-1/2 2	461	20	12	11	43	147	65.5	6.4	9.8	27.4	38.8
40.	11.6	641	63-1/2 1	721	24	24	19	87	195	67.5	6.3	10.0	30.9	43.5
41.	13.3	434	42-1/2 4	344	14	9	6	29	128	67.0	6.1	8.7	26.4	34.1
42.	14.0	426	3-1/2 26	326	10	8	6	24	108	66.5	5.7	9.0	23.1	31.8
43.	13.6	425	3-1/2 25	334	12	8	6	26	101	63.5	5.3	8.5	21.8	31.5
44.	13.4	424		344	14	9	8	31	114	65.0	5.8	8.8	23.8	33.9
45.	14.1	426	426-1/2	126	14	9	5	28	102	66.0	5.6	9.1	22.9	30.5
46.	11.9	551	4-1/2 4-1/2 1	541	13	13	11	37	147	63.0	6.0	9.2	28.2	37.2
47.	11.3	641	5-1/2 4-1/2 1	721	22	22	17	61	163	62.0	5.6	9.6	29.8	40.0
48.	12.3	541	53-1/2 1	541	15	18	11	44	114	59.5	5.2	8.4	25.8	34.8

49.	14.5	417	3-1/2 17	126	11	8	6	25	97	66.5	5.5	8.6	22.2	29.9
50.	14.2	327	2-1/2 26-1/2	226	9	9	5	23	122	70.5	6.2	9.1	24.0	36.1
51.	11.7	661	5-1/2 5-1/2 1	631	24	22	13	59	143	61.5	6.2	10.0	30.8	39.1
52.	11.8	541	53-1/2 1	641	17	12	17	46	171	65.5	5.4	10.2	27.2	40.9
53.	11.2	651	6-1/2 4-1/2 1	711	26	32	26	84	209	66.5	7.0	11.0	33.9	44.0
54.	13.5	335	334-1/2	354	7	8	5	20	132	69.0	6.0	9.2	26.9	34.4
55.	13.3	444	43-1/2 4	344	15	8	6	29	104	62.5	5.5	8.8	25.6	34.6
56.	12.9	553	54-1/2 3	344	17	16	8	41	114	62.5	5.5	8.8	33.8	32.0
57.	13.2	524		533	19	11	10	40	120	65.0	5.5	9.0	25.8	33.6
58.	11.4	461	3-1/2 5-1/2 1	452	10	9	7	26	137	59.0	6.2	9.2	26.5	34.1
59.	11.6	641		641	27	25	19	71	176	65.0	6.1	10.2	30.7	40.7
60.	12.7	443	442-1/2	452	11	13	7	31	140	66.0	6.0	8.9	29.8	34.8
61.	12.6	542	53-1/2 2-1/2	452	13	11	15	49	148	67.0	6.4	9.8	28.2	39.4
62.	13.8	426	4-1/2 25-1/2	326	16	10	8	34	104	65.0	5.5	8.4	25.2	31.5
63.	12.8	423	4-1/2 23	342	14	11	8	33	143	67.0	5.7	8.5	28.8	24.8
64.	10.5	741	6-1/2 41	711	29	38	27	94	181	59.5	6.0	9.5	33.6	40.7
65.	14.0	426	4-1/2 26	136	15	9	10	34	105	66.5	6.4	8.8	23.5	31.6
66.	13.4	424	4-1/2 24-1/2	343	14	11	9	34	135	68.5	6.2	9.2	24.5	35.7
67.	13.0	433	4-1/2 33-1/2	433	15	9	9	33	119	64.0	5.7	8.6	25.4	33.3
68.	13.1	434	4-1/2 33-1/2	343	13	12	8	33	139	68.0	5.8	9.4	26.6	38.2
69.	12.8	533		443	17	12	12	41	127	64.5	5.7	9.0	26.0	35.0

Table 3.--Continued.

Number	Ponderal Index	Body Type 7-Point Scale	Body Type 13-Point Scale	Expert Rating	Fat-Biceps	Subscapular	Supr-iliac	Total Fat	Weight	Height	Bone Humerus	Bone Femur	Muscle-Biceps	Muscle-Calf
70.	13.2	434		533	15	9	8	32	133	67.5	6.0	9.2	25.1	35.7
71.	12.8	443		443	14	10	5	29	121	63.5	5.7	9.0	26.7	35.8
72.	13.5	434	434-1/2	433	12	10	8	30	126	67.5	6.0	9.1	26.0	35.3
73.	13.8	415	415-1/2	236	15	9	8	32	113	67.0	5.6	8.8	24.3	32.1
74.	14.2	326	326-1/2	336	8	7	4	19	118	69.5	6.0	9.1	23.8	35.3
75.	10.4	731		721	40	40	33	113	243	65.0	6.7	9.8	40.0	43.0
76.	13.0	613	5-1/2 13	442	22	20	15	57	146	68.5	5.6	9.0	27.1	36.0
77.	12.5	462		462	16	8	5	29	146	66.0	6.3	9.6	31.6	39.5
78.	12.3	542	4-1/2 41-1/2	542	13	14	9	36	175	69.0	6.5	9.6	29.8	38.2
79.	10.5	651	64-1/2 1	632	33	27	18	78	200	61.5	6.0	9.2	36.0	41.2
80.	12.3	531	5-1/2 31-1/2	541	23	19	14	56	152	65.5	6.2	9.2	30.1	37.2

APPENDIX B

RECORDING CARD AND M.4 CHART

NUMBER____ NAME _____ AGE _____

PONDERAL INDEX _____

HEIGHT _____(in.)
WEIGHT _____(lb.)

FAT (mm.)
TRICEPS _____
SUBSCAPULAR ____
SUPRACILIAC ____
TOTAL _____

BONE (cm.-nearest hundredth)
HUMERUS _____.___
FEMUR _____.___
BIACROMIAL _____.___
CHEST WIDTH _____.___
BI-ILIAC _____.___

MUSCLE (cm.-nearest tenth)
BICEPS _____.___
CALF _____.___

BODY TYPE

PARNELL _____

BULLEN (Ponderal Index) _____

SHELDON (Ponderal Index) _____

SHELDON (ratings by experts) _____

NAME_____ DATE_____

gle. Ch.: M_____ F_____ Ref.No._____

Total 3 Skirfold Measurements

'	20	24	29	36	45	57	73	93	114	
)	24	30	38	48	60	74	94	114	+	
2	27	35	44	55	68	87	109	+	+	
3	29	37	47	61	74	95	118	+	+	
2½	3	3½	4	4½	5	5½	6	6½	7	
.5	67.0	68.5	70.0	71.5	73.0	74.5	76.0	77.5	79.0	80.5
5.37	6.51	6.65	6.80	6.95	7.09	7.24	7.38	7.53	7.67	7.82
).08	9.28	9.49	9.70	9.91	10.12	10.33	10.53	10.74	10.95	11.16
).0	29.7	30.3	31.0	31.6	32.2	33.0	33.6	34.3	35.0	35.6
3.9	34.7	35.5	36.3	37.1	37.8	38.6	39.4	40.2	41.0	41.8

2½	3	3½	4	4½	5	5½	6	6½	7	
2	27	33	40	48	57	68	83	100	120	140
-¼	0	-¼	-½	-1	-1½	-2	-2½	-3	-4	
-¼	0	-¼	-½	-¾	-1¼	-1¾	-2¼	-2¾	-3½	-4
-¼	0	-¼	-¼	-½	-1	-1½	-2	-2½	-3	-3½
2½	3	3½	4	4½	5	5½	6	6½	7	

2.7	12.9	13.1	13.3	13.5	13.7	13.8	14.0	14.2	14.4
2.5	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.2	14.4
2.4	12.6	12.8	13.0	13.3	13.5	13.7	13.9	14.2	14.4
2.3	12.5	12.7	12.9	13.2	13.4	13.6	13.9	14.1	14.4
2.1	12.4	12.6	12.8	13.1	13.3	13.6	13.9	14.1	14.4
2.0	12.3	12.6	12.8	13.1	13.3	13.6	13.9	14.1	14.4
2½	3	3½	4	4½	5	5½	6	6½	7

APPENDIX C

SILHOUETTE ILLUSTRATIONS

PREPARATION OF SILHOUETTES

Twelve somatotypes found in this study were used in preparation of silhouettes. The twelve somatotypes were 641, 551, 542, 452, 442, 533, 523, 443, 433, 424, 335, and 326. The slides of the selected somatotypes were projected onto cardboard and outlines were drawn directly from the projected form. Each silhouetted somatotype and descriptive information was then photographed for use in slide form. These graphic illustrations were made for use in the foundation classes at Michigan State University.

SOMATOTYPE 641

Mesomorphic Endomorph

Body Regions	Characteristics
Head, face, neck	Head large Facial features heavy, strong Jaw often prominent Neck fairly long, massive
Thoracic trunk	Massive chest
Arms, shoulders, hands	Shoulders wide Arms long, well shaped Forearms, wrists with distinct muscular shaping Wrists thick
Abdominal trunk	Waistline high Abdominal mass predominates Hips broad
Legs and feet	Thighs "ham" formation Muscular molding patella, calves, ankles Ankles thick
Others	Unusually tall Muscular strength, skeletal firmness for upright posture, erect carriage

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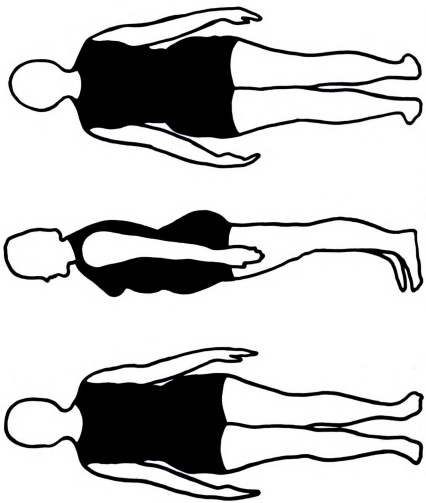
Somatotype 641 Ponderal Index 11.6 Age 19



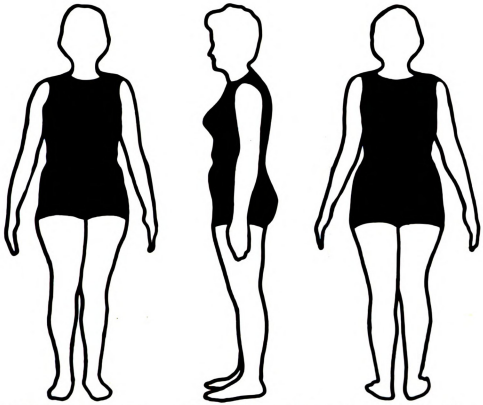
SOMATOTYPE 641 PONDERAL INDEX 11.6 AGE 19

SOMATOTYPE 551

Mesomorph-Endomorph

1. **Massive features which lack fragility**
2. **Somatotype 551 falls between a 461 and 641**
3. **Rare somatotype**

Somatotype 551 **Ponderal Index 11.9** **Age 18**



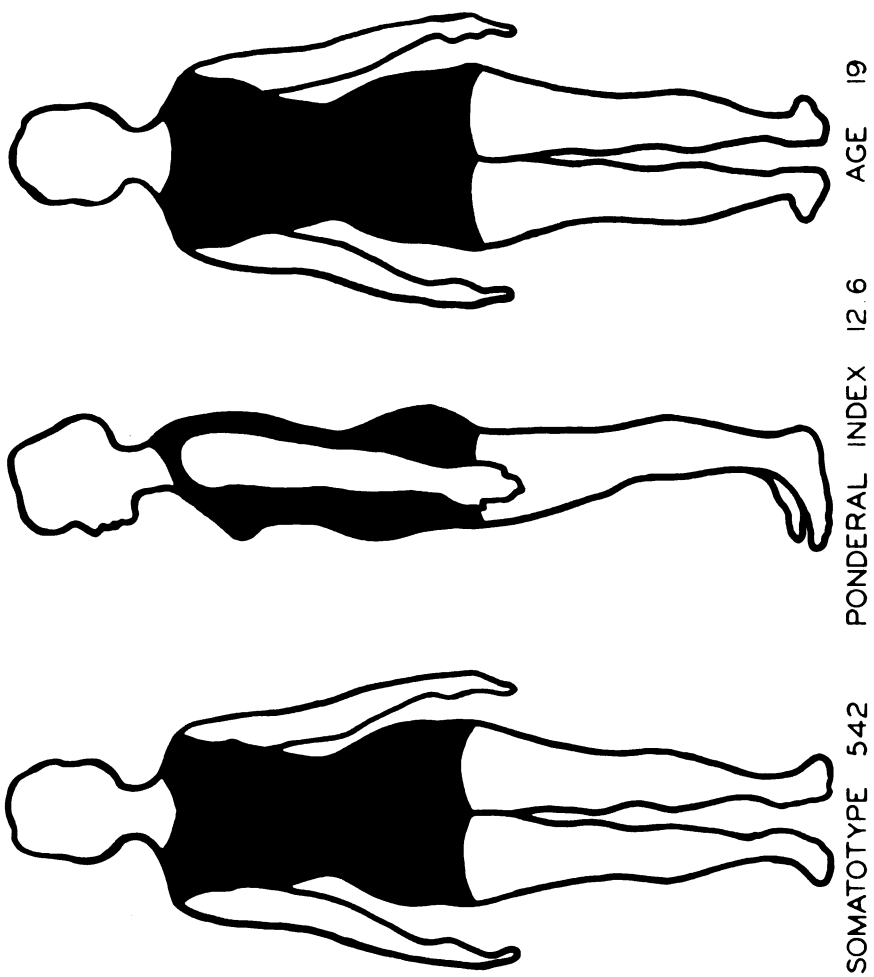
SOMATOTYPE 551 PONDERAL INDEX 11 9 AGE 18

SOMATOTYPE 542

Mesomorphic-Endomorph

Body Regions	Characteristics
Head, face, neck	Head very round Facial features small, not prominent Slight facial triangularity possible Nose often sharp, projecting Neck usually short
Thoracic trunk	Chest round, soft Trunk long
Arms, shoulders, hands	Shoulders high, soft, average width, tendency of squareness Upper arms soft, inflated Forearms small Arms short, weak
Abdominal trunk	Waist relatively high Abdominal preponderance Wide hips Heavy buttocks Trunk long
Legs and feet	Thighs inflated with "hamming" tendency Legs short, weak
Others	Body small boned Short stature

Somatotype 542 Ponderal Index 12.6 Age 19


SOMATOTYPE 542
PONDERAL INDEX 12.6
AGE 19

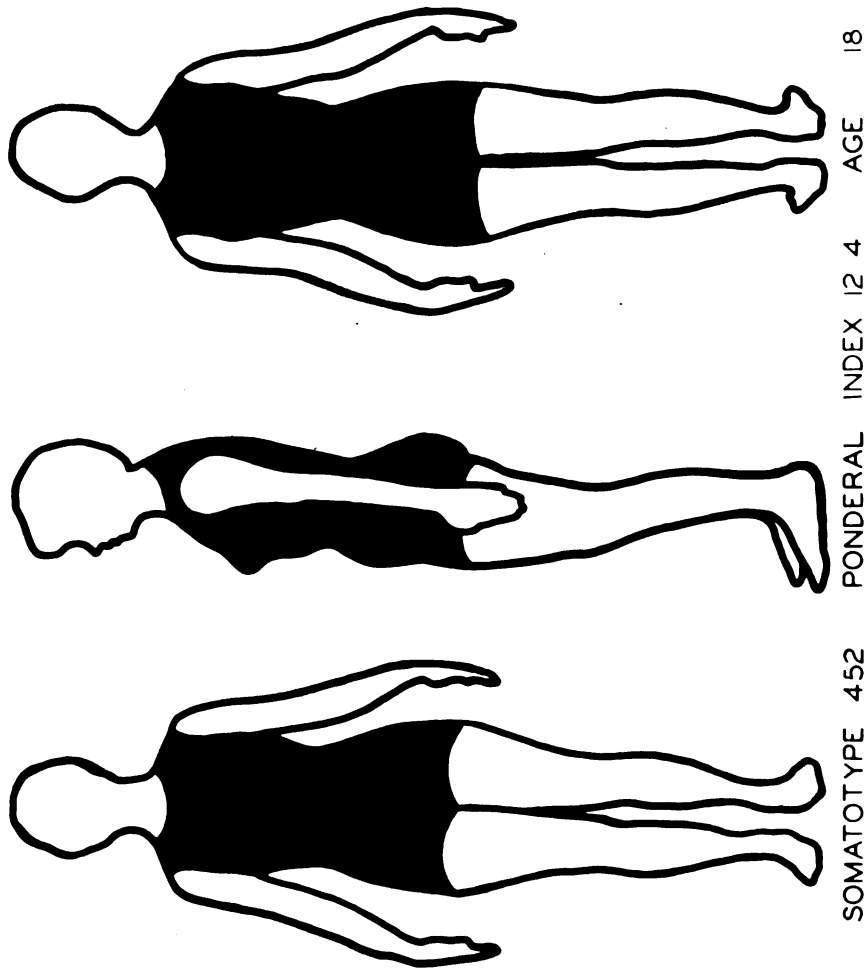
SOMATOTYPE 452

Endomorphic-Mesomorph

Body Regions	Characteristics
Head, face, neck	Head and face square, cube shaped Facial bones and features strong, prominent Jaw square Cheeks softened, lips full Neck strong, long
Thoracic trunk	Chest broad, fairly deep Trunk long
Arms, shoulders, hands	Shoulders broad Upper arms well rounded, softened Arms often long Bone predominate in forearm, wrist
Abdominal trunk	Trunk long Waist low Abdomen broad, fairly deep Hips narrow
Legs and feet	Legs long Upper legs well rounded, soft Ankle bone predominant
Others	Typically energetic, solid, heavy strong Medium height

---

Somatotype 452 Ponderal Index 12.4 Age 18


SOMATOTYPE 452
PONDERAL INDEX 12 4
AGE 18

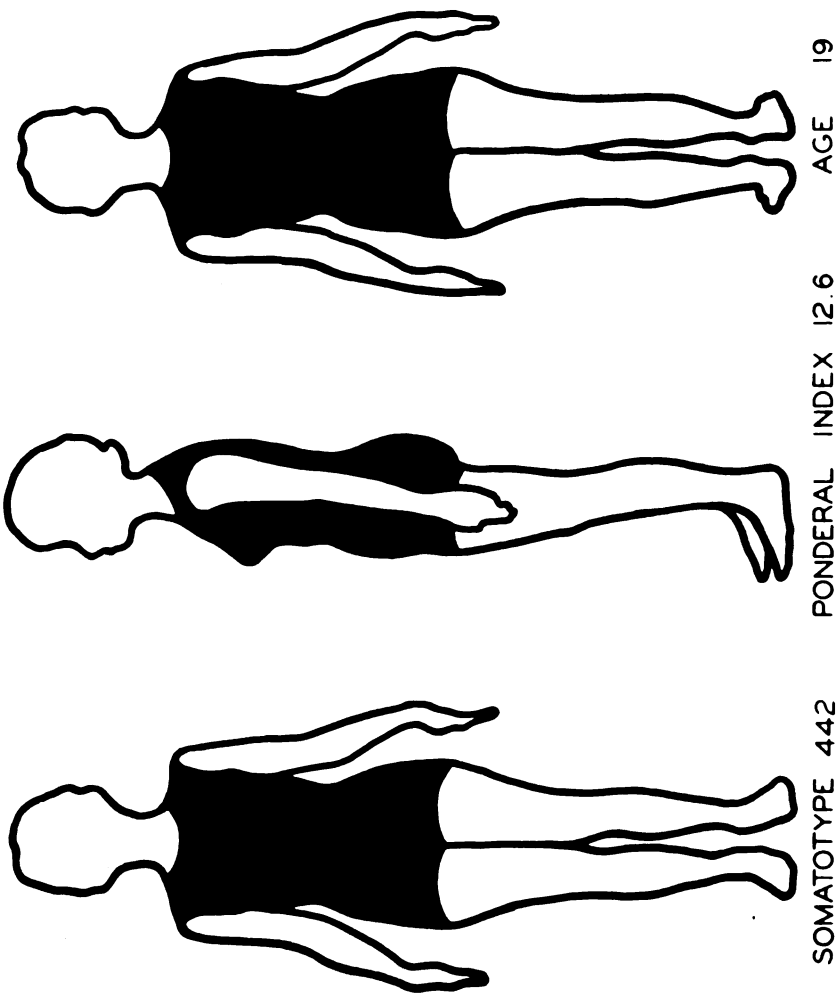
SOMATOTYPE 442

Mesomorph-Endomorph

Body Regions	Characteristics
Head, face, neck	Head intermediate size Facial appearance squarish Face features small, blunt, solid Strong neck
Thoracic trunk	Chest well developed, supported
Arms, shoulders, hands	Arms moderate length, well muscled, soft contour Shoulders rather high, square, strong, not wide
Abdominal trunk	Waist thick, low Little athletic taper Hips moderate breadth Trunk fairly long
Legs and feet	Legs moderate length, well muscled, soft contour
Others	Excellent posture Body generally slender young, fills out later Contours rounded and even Highly active

---

Somatotype 442 Ponderal Index 12.6 Age 19

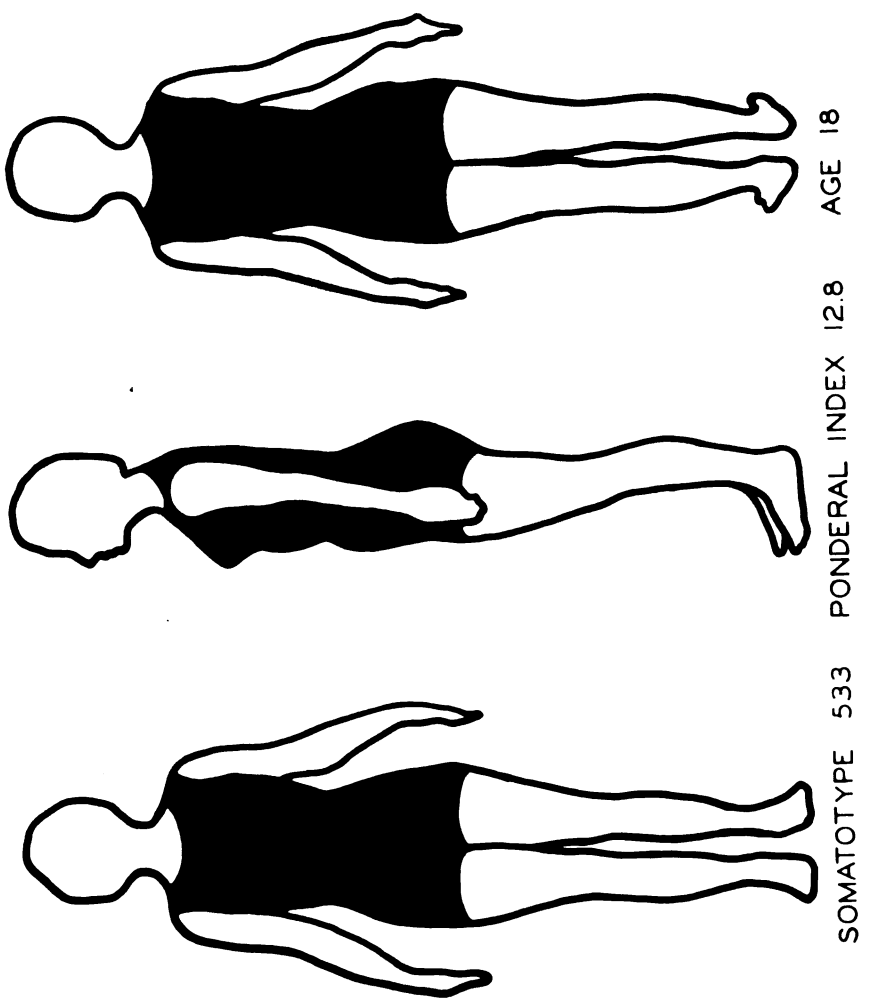

SOMATOTYPE 442
PONDERAL INDEX 12.6
AGE 19

SOMATOTYPE 533

Strong Endomorph

Body Regions	Characteristics
Head, face, neck	Bony skeleton light Head large, spherical Head features not prominent Mouth tends to be shapeless Lips may protrude Neck is rather slender
Thoracic trunk	Chest full
Arms, shoulders, hands	Shoulders rather narrow Distinct silhouette of deltoid muscle Arms moderately long and slender in distal extremities
Abdominal trunk	Hourglass effect of high waist
Legs and feet	Upper thighs approximate (when heels together) Legs moderately long and slender in distal extremities.
Others	A common body type

Somatotype 533 Ponderal Index 12.8 Age 18

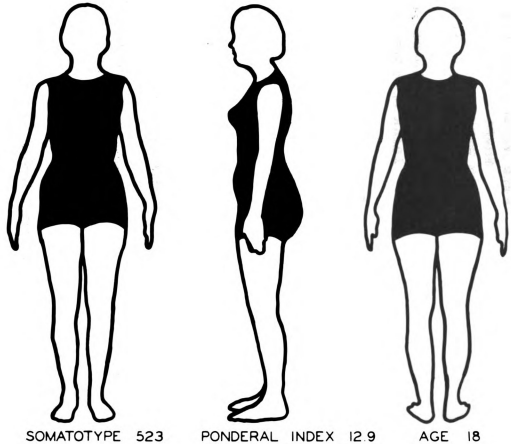

SOMATOTYPE 533
PONDERAL INDEX 12.8
AGE 18

SOMATOTYPE 523

Ectomorphic-Endomorph

Body Regions	Characteristics
Head, face, neck	Head round, rather large Face soft, round triangular shape Chin weak Mouth shapeless, lips often gap open Neck rather slender, medium length, lacks muscular relief
Thoracic trunk	Trunk short Upper chest slightly flattened
Arms, shoulders, hands	Shoulders narrow Ectomorphic stoop of shoulders Upper arms show "hamming" Distal segments weak
Abdominal trunk	Abdomen long, deep, round Waist high with sharp constriction Hourglass effect
Legs and feet	Thighs show "hamming" Distal segments weak

Somatotype 523 Ponderal Index 12.9 Age 18



SOMATOTYPE 523 PONDERAL INDEX 12.9 AGE 18

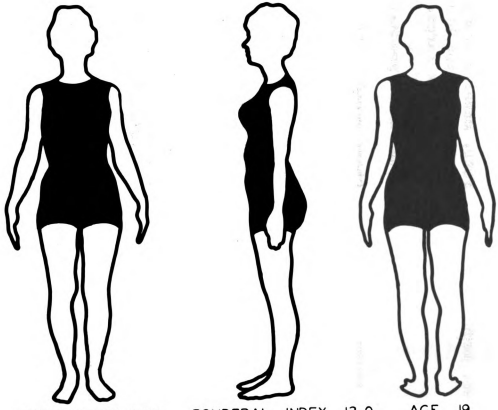
SOMATOTYPE 443

Balanced

Body Regions	Characteristics
Head, face, neck	Face, massive tendency Facial features blunt Mouth rather large, relaxed Neck often full Often small pockmarks mark face
Thoracic trunk	Chest round, full
Arms, shoulders, hands	Shoulders moderately broad
Abdominal trunk	Waist slightly low, little athletic taper Abdomen full, not bulging
Others	Weight problem tendencies without diet Acne infection common Mesomorphy shapes body, fixes skeletal framework

---

Somatotype 443 Ponderal Index 13.0 Age 19



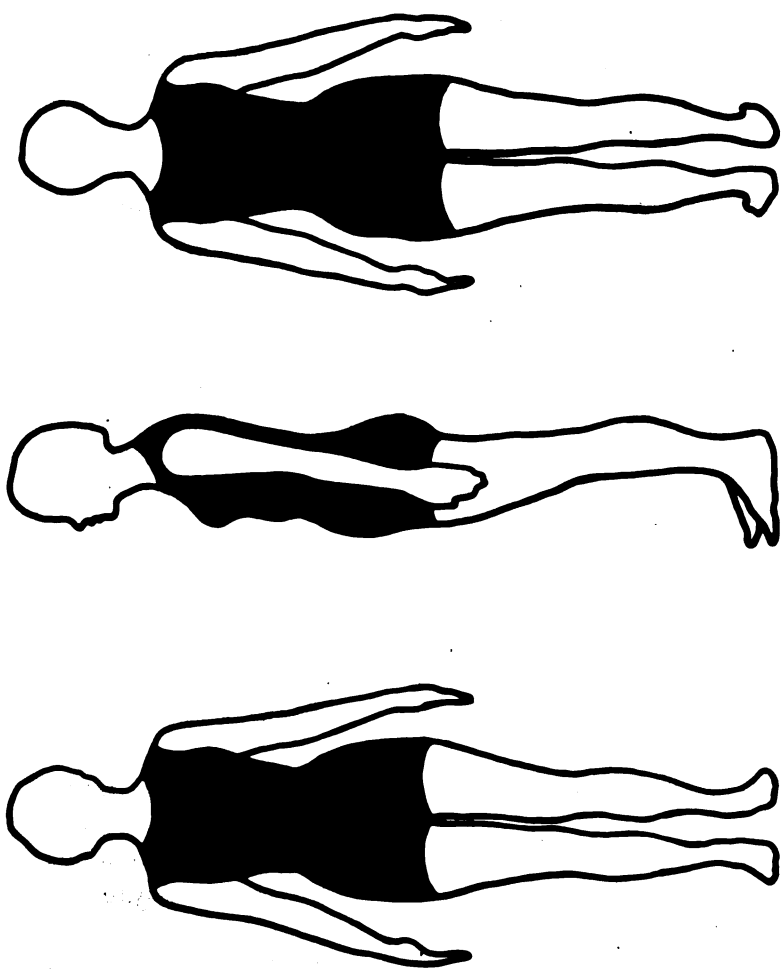
SOMATOTYPE 443 PONDERAL INDEX 13.0 AGE 19

SOMATOTYPE 433

Moderate Endomorph

Body Regions	Characteristics
Head, face, neck	Round face Chubby cheeks with high color Neck soft
Thoracic trunk	Rounded chest tends toward flatness
Arms, shoulders, hands	Shoulders narrow Muscle silhouette of deltoid Promimal segments predominate over distal Distal segments appear weak Hands soft
Abdominal trunk	Waistline moderately high Abdomen predominant over chest Hourglass appearance in dorsal view Wide hips dysplasia (common)
Legs and feet	Well muscled thighs Proximal segments predominate over distal segments Distal segments appear weak
Others	Soft bodily contours General distribution of curves

Somatotype 433 Ponderal Index 13.1 Age 19

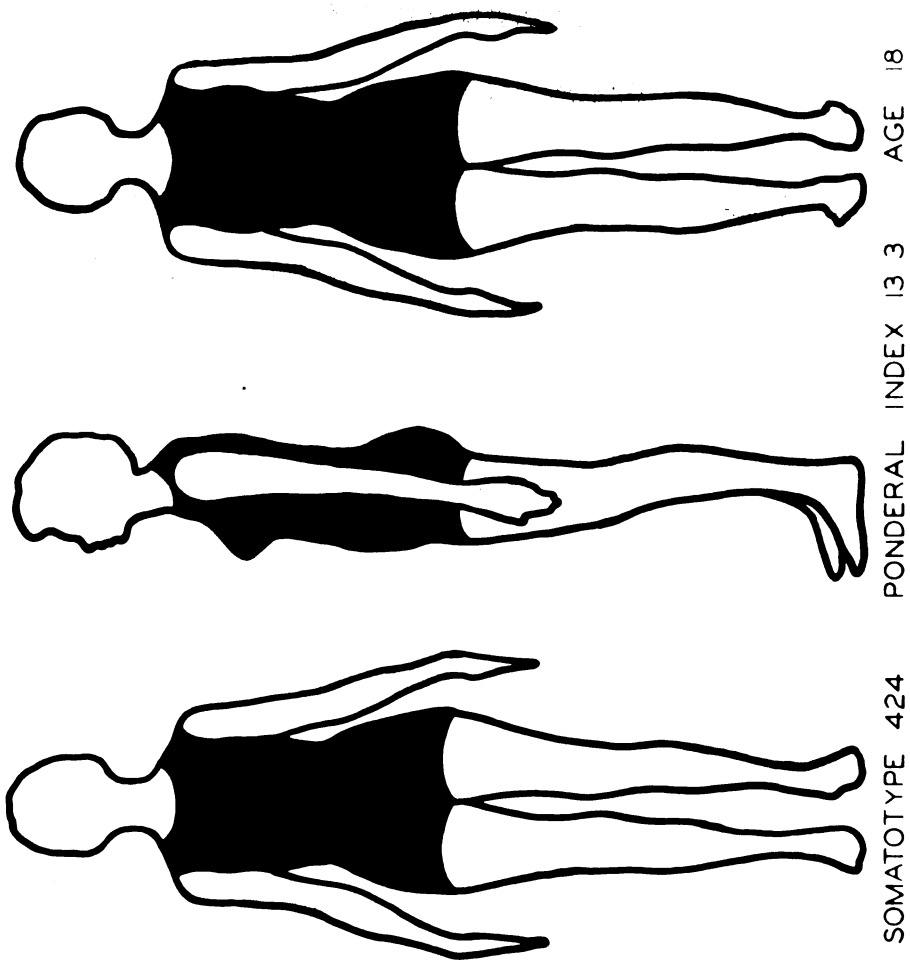

SOMATOTYPE 433
PONDERAL INDEX 13.1
AGE 19

SOMATOTYPE 424

Ectomorph-Endomorph

Body Regions	Characteristics
Head, face, neck	Face round, small features Most blush easily
Thoracic trunk	Chest rather full
Arms, shoulders, hands	Shoulders high, square, soft Arms soft
Abdominal trunk	Waist rather high, not pinched Abdomen predominant over chest Hips wide
Legs and feet	Legs soft

Somatotype 424 Ponderal Index 13.3 Age 18


SOMATOTYPE 424
PONDERAL INDEX 13 3
AGE 18

SOMATOTYPE 335

Strong Ectomorph

Body Regions	Characteristics
Arms, shoulders, hands	Shoulders fairly wide
Abdominal trunk	Hips fairly wide Waist low
Other	Physique highly dysplastic, difficult to distinguish Sharp, lean body features covered lightly with endomorphy

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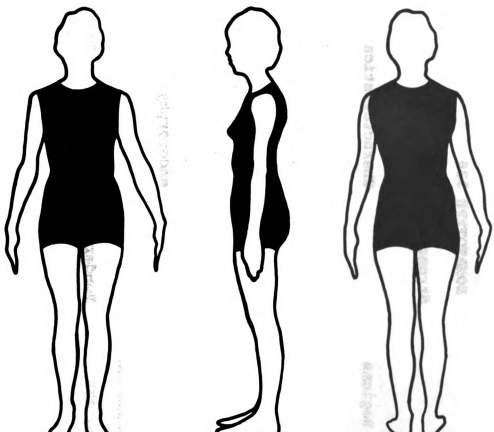
Somatotype 335 Ponderal Index 13.5 Age 20



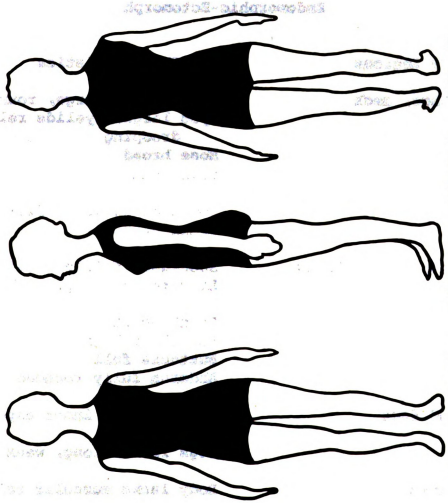
SOMATOTYPE 335 PONDERAL INDEX 13 5 AGE 20

SOMATOTYPE 326

Endomorphic-Ectomorph

Body Regions	Characteristics
Head, face, neck	Face fairly large, round Eyes large, eyelids relaxed, drooping Nose broad Neck weak
Thoracic trunk	Upper chest weak, flattened Trunk short
Arms, shoulders, hands	Shoulders fairly broad Arms rather long, weak
Abdominal trunk	Trunk short Waistline high Buttocks full Abdomen fully rounded
Legs and feet	Thighs full, inner aspects weak Legs rather long, weak
Others	Body lacks muscular relief

Somatotype 326 Ponderal Index 14.0 Age 18


SOMATOTYPE 326
PONDERAL INDEX 14 0
AGE 18