

RELATIONSHIPS OF BODY ALIGNMENT
WITH SOMATOTYPE AND CENTER OF
GRAVITY IN COLLEGE WOMEN:
A PILOT STUDY

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AN ABSTRACT OF
A THESIS

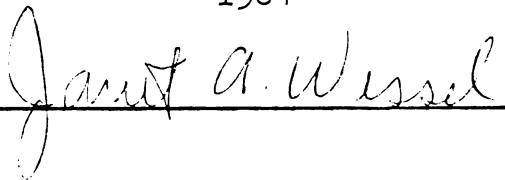
Submitted to
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ABSTRACT

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by Lenore May Kalenda

Statement of the Problem

It was the purpose of this study to investigate body alignment of young adult women during static posture as it relates to body type components and the center of weight.

Procedure

The Massey Technique was employed to assess body alignment in the anteroposterior plane and the Cureton-Wickens test to determine the center of gravity. Body typing was determined by Parnell's method. A pedagraph was used to measure the length of the foot.

Eighty college women ranging in ages eighteen to twenty-one participated in the study. The range, mean, and standard deviation was computed for all measures. For purposes of reliability, the Cureton Wickens Center of Gravity test was done three times, or until agreement in score was reached. Reliability of the Massey Technique was determined by the test-retest method. The Pearson Product Moment Correlation was the statistical technique employed to determine correlations between all variables. A multiple regression equation was used to determine if one particular angle would be a satisfactory predictor of total posture.

Conclusions

Within the limits of this study, the following conclusions are made:

1. Statistically significant correlations were found between posture and body build components although the relationships were low:

(a) The greater the endomorphic component, the greater the possibility of a deviation from the total posture standard used in this study. This was particularly true with Angle I (head-neck-trunk), Angle II (trunk-hip), and Angle III (hip-thigh-knee).

(b) The greater the ectomorphic component, the more likelihood of body alignment approximating the total postural standard, particularly for Angle II (trunk-hip), and Angle IV (thigh-leg-ankle).

(c) No relationship was found between the mesomorphic component and total body alignment as measured in this study.

2. Statistically significant correlations were found between the center of gravity and endomorphic and ectomorphic components. The gravital line when associated with the ectomorphic component passed further forward through the foot anterior to the malleolus, while with the endomorphic component this line fell closer to the malleolus.

3. Body alignment as measured by the Massey Technique was related to the center of gravity. The better the

posture, the more likelihood of the gravital line passing through the foot anterior to the malleoli. This tendency was particularly true of Angle II (trunk-hip) and Angle III (hip-thigh-knee).

4. The correlational pattern between total posture and segmental angulations was statistically significant and the relationship tended to be high.

5. Multiple regression showed Angle II to be highly correlated with total posture. This angle appeared to be the best predictor of total body alignment as measured by the Massey Technique. The combination of Angles II and III also appeared to be a significant indicator of total posture. These findings are similar to the results obtained by Massey (25:19).

Recommendations

1. More subjects representative of the main body build types are needed to determine (a) whether postural patterns characteristic of each type in women do exist, and (b) whether there is a gravital zone which would be representative of each individual's "ideal" posture.

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CHAPTER I

INTRODUCTION

Many writers on posture have stressed the importance of individual differences in evaluating static posture. However, few efforts have been made to investigate the effects of different postural patterns upon the mechanics of body alignment. The expectation has been for all individuals to conform to a so-called ideal posture which was considered normal for all individuals and which all individuals were expected to assume without strain.

Stafford and Kelly (14:101) are of the opinion that:

There has been an unfortunate tendency in the past to describe one good posture, to portray it on a chart, and to imply that all postures, if good, will resemble it. This one good posture would exist in those individuals with average body builds. But relatively few people are completely average in body build. The vast majority differ in one or more important aspects from this average, and would find it difficult if not impossible to achieve in all respects a posture which looks like the standard shown by the chart. They, and often their physical education teachers, have assumed that their differences indicated poor posture. They also have been disappointed with the results of efforts at improvement, when in many cases no improvement was needed. The posture was good for those individuals.

Many inferences were found in the literature indicating the need to carefully consider body type and the center of gravity in static posture. However, there is a scarcity of research studies reported in the literature providing

scientific evidence substantiating these relationships or how these factors should be considered in evaluating static posture. Goldthwaite (2:22), Goff (22:345) and others are of the opinion that the muscular in body type conforms to the ideal posture and all other body type components have difficulty in assuming this standard of excellence without strain. Wells (27:31) feels that there is a gravital "zone" within which good posture could be considered and which would allow for both postural sway and body build. Karpovich (6:300) is of the opinion that body type components and segmental alignment of the body may be related.

The curiosity of the writer concerning body alignment and body type was aroused in one of the few research studies found in the literature by Brown (17), who found no statistical relationship between body types, body alignment, or with center of balance in young adult women. These results were based on the vertical alignment (mechanics of trunk balance) as measured by the alignometer developed by Howland (4). This instrument was proposed by Howland for use in the classroom as an effective teaching aid. Recommendation for its use for postural appraisal has been made by one author (8:251). Molot (30) found no significant correlation between the Howland Alignometer and a subjective rating, nor between the Howland Alignometer and the Massey Technique. Possibly a more critical posture test that would measure the segmental angulation, or position, of different

segments according to the mechanics of balance might reveal relationships with body type components, especially if the sample included extremes in body build.

Statement of the Problem

The purpose of this study was to investigate the relationship of body alignment with body type components and with the center of weight of young adult women during static posture. A sub-problem was to investigate the possibility of predicting total posture score in the Massey Technique from the individual scores obtained for each of the four angles.

Definition of Terms

Posture. The standard definition of "normal posture" is described by Massey (25:4) in terms of the relationships of the body and its parts to the line of gravity.

As viewed from the side, beginning approximately at the atlanto-occipital articulation or externally behind the ear at the mastoid process the line of gravity passes downward posteriorly to the vertebrae of the neck, intersecting the spine near the seventh cervical vertebra, passes anteriorly to the dorsal vertebrae, touches the spine again at the lumbo-sacral junction, passes behind the lumbar spine, passes in front of the sacro-iliac junction to the center of the hip joint, then passes in front of the knee joint and drops to the base of support at the feet directly in front of the ankle joint.

Body Type 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. Sheldon's Components (13) are:

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.

Parnell's Technique.(10) This scheme is a combination of physical anthropology and photography which was developed to provide a more precise definition of the components and add objectivity that was lacking when photoscopy is used alone. Parnell's measurements correspond as closely as possible to Sheldon's estimate of somatotype. Somatotype dominance is estimated by what is termed a deviation chart known as an M.4 chart, so-called because it is based on the assumption that a rating of four in muscularity will bear a constant proportional to stature. On this chart there appears standard scales for height, weight, ponderal index, two bone sizes, two limb girths, and three skinfold measurements. The scales are each plotted around the mean value, with column units equivalent to one-half standard deviations giving a thirteen-point scale over-all.

Center of gravity. The theoretical point which represents the center of weight, or balance, in static posture is

located above the base, its vertical projection (gravital line) downward falling within the geometrical area of the base (20:94).

Line of gravity. The gravital line is the theoretical perpendicular line projecting upward through body segments from the center of gravity and downward to the base of support in the antero-posterior plane (20:94).

Limitations of the Study

Sample. The sample was limited to eighty subjects. The participants were subjectively selected on the basis of extreme body types as determined by their physical education instructors. After being somatotyped, however, the majority of subjects were in actuality found to be more representative of the "balanced" type or average as described by Sheldon.

Technique. The static erect posture assumed by each subject in this study may not have been representative of their habitual posture characteristics.

Body sway and its possible influence on body alignment was a factor not considered in this study.

Body landmarks employed in the Massey Technique proved difficult to locate accurately; especially was this true with the trochanter.

CHAPTER II

REVIEW OF LITERATURE

It appears that many inferences have been made relating posture to body build and the line of gravity. Many of these claims, however, are not supported by scientific evidence. This chapter will first deal with many of the statements regarding these relationships. Studies investigating this same problem will then be reviewed. Finally, objective tests for posture measurement will be discussed.

Statements Relating Posture to Body Type

Many authorities have long felt that there is a variety of postural patterns which may be representative of constitutional body types. Metheny (9:193) is of the opinion that there are many variations in general body type, that each individual differs from all others, and that each has their own particular posture problem. Another author (3:53) states: "The form that malposture may take depends often upon the hereditary type of build and the nutritional status of the individual." Other writers (2:20, 7:58, 3:76) agree, feeling that habitual posture is different in the three classes of body build. Although the different types of posture deviation are believed to be related to

variations in body build, Steindler (15:233) feels that this characteristic alone is not a contributing factor.

Some authorities have mentioned specifically the types of deviations they felt were characteristic of the various body builds. Many authors (2:22, 11:182) are of the opinion that the tall, slender, thin-muscled individual is more apt to assume a position in which the various segments of the body are out of alignment. Stafford and Kelly (14:102) state: "Faulty posture is more common among the very slender than among the stocky, especially if they show other signs of marked ectomorphic type." Lowman (7:92) also feels that the slender individual is prone to faulty alignment, and because of his musculature, tends to slump and find it harder to maintain good posture.

It appears that the obese are not without postural problems believed to be common to their general body type. Lowman (7:92) feels that obese individuals are vulnerable to postural faults such as sagging abdomen, drooped shoulders, and round back. Hawley (3:15) has made the comment that increased pelvic inclination frequently accompanies the obese individual. Because of the large fat deposits in the abdominal wall, the lumbar region of the spine tilts forward and downward causing a lordotic condition.

Some feel that the mesomorph, or medium type, because of his inherent structure, is not as susceptible to postural

problems. Goldthwait, Brown, Swain, and Kuhns (2:22) believe that a better adjustment of the various parts of the body is more easily maintained in the intermediate type. Stafford and Kelly (14:102) postulated that stocky individuals will not suffer such severe posture faults because of their bone structure and because they are not as flexible.

It is the opinion of some authors that these particular differences should be considered when measuring the posture of the individual. Cureton states: "Posture needs to be appraised and interpreted with consideration of its relationships to body build of a permanent, constitutional nature." (19:351) Metheny (9:191) also feels that since no two people are built alike, when the posture of the individual is evaluated, these differences must be taken into consideration. Commenting on this, Zeigler (29:294) states: "Almost every test must be normed eventually in terms of constitutional type (i.e. weight, posture, strength, etc.)."

Statements Relating Posture to the Center of Gravity

Many inferences have been made which attach importance to the role center of gravity plays in determining "correct" or "incorrect" posture. Lowman (7:85) has made the statement that:

Any definition of good posture must take into consideration the proper relationship of the various body segments which should be in alignment under or over each other. That is, so related to the gravity lines laterally and antero-posteriorly that a minimum of

energy needs to be expended to maintain the body as near as possible in a state of equilibrium which is unique to each individual's specific characteristics.

Other authors (4:44, 1:25, 9:118) generally agree, commenting that the body is in good alignment when the center of weight of the various segments of the body--head, trunk, and lower extremities--are centered over the segment immediately below and thereby closely approximating the line of gravity. In this way, muscular effort to maintain the body in the erect position is minimized.

Steindler (15:228) feels that a definition of normal posture must be based on the relation of the line of gravity to the spine. Regarding posture measurement, he states:

This should make it more than ever convincing that any reliable method of analysis of posture must take into account the relation of the body not only to its support but also to the line of gravity if one wishes to establish an earmark of the normal body balance in upright standing position.

There is one dissenter as to the advisability of using the line of gravity to predict good posture. Brunnstrom (18:109,114) comments: "In training for good posture, the body should not be forced into a perpendicular posture which violates the automatic stance pattern." He feels this posture standard has been widely used and taught to physical educators and therapists, and is a pattern that is never assumed by an individual who stands in a natural way. He stresses that this "perpendicular posture" should not be advocated when standards for posture are established.

Studies Relating Posture to Body Build and Center of Gravity

Very few studies have been made to substantiate or disprove the previous statements. However, at Springfield College Cureton (19) classified the class of 1944 on ten items of posture according to four body build groupings--ectomorph, mesomorphic-ectomorph, mesomorph, and mesomorphic-ectomorphs. Posture scores were compared on a percentile basis. He found that head posture averaged best for the mesomorphic-ectomorphs and mesomorphs after which there was a sharp decline at each extreme. On kyphosis, the differences were insignificant between all groups. It was found that the ectomorphs had the greatest lordosis, the scores getting better as the body build became stockier. The mesomorphs had less abdominal ptosis than the others, the mesomorphic-ectomorphs the most. The ectomorphs and mesomorphic-ectomorphs had the best head and shoulder posture. It was found that the ectomorphs had the poorest (or lowest) center of gravity ratings. The scores improved with the mesomorphic groups but declined again in endomorphy. The greatest range of differences between the means were for (1) lordosis, (2) forward shoulders, (3) center of gravity, (4) head posture, and (5) abdominal posture. Cureton was of the opinion that these items were affected most by build.

Cureton and Wickens (20) devised a center of gravity test which was felt to be definitely related to posture. How a person stands (leaning forward or backward of the

ankle joints) was determined by this test as evidenced by the correlation of $.862 \pm .02$ with body lean. The correlation between body lean and kyphosis was $-.363 \pm .07$. The test's relation to body build, however, was not significant, the correlation being zero with Davenport's body-build index, height, weight, abdominal girth, and chest girth. All data was confined to young men.

Goff (22) selected and classified 3400 young male adults under four general body builds--fat, muscular, balanced, and thin or linear. He used Sheldon's method as modified by Hooten for somatotyping purposes. Through a series of tracings made from body build photographs, a "mean" tracing, or composite, for each general body type was established. From these tracings, or "orthograms," it was found that the center of gravity line showed a characteristic pattern for each type. It was also discovered that the main body build types possessed a characteristic postural pattern. The muscular type showed the greatest lumbar curve. However, they closely approximated what is considered the accepted concept of "good" posture. The linear type showed the greatest deviation from this "ideal." Joseph (5:10) comments on this: "Perhaps their posture was the best adaptation for their different body structures since certain mechanical considerations make one posture more efficient than another depending on the body type."

Very few efforts have been made in this area concerning women. Brown (17), however, made a study of the relationship

between body type and static posture of fifty-eight young adult college women. Sheldon's method for somatotyping and a modified technique of Howland's alignometer for posture were used. The center of gravity was determined by the Lovett and Reynolds technique. The foot measurement was also taken by making an outline of each foot and measuring after it was felt there might be some relationship between the length of the foot and the line of gravity. No significant relationship was found to exist between body alignment, body type, and center of balance. The length of the foot and the point where the center of balance fell in foot length was not related to body alignment. However, a significant relationship between ectomorphy and height, ectomorphy and the length of the sternum, and ectomorphy and the sternopubic line was found.

Summary

The consensus of opinion seems to be that posture and the line of gravity are interrelated. It is also felt that there is no single, "correct" posture for everyone although this is in disagreement with the many posture tests now in existence. The majority of authorities cited agree that there are postural patterns and deviations characteristic of each body type and that certain types are more susceptible to these deviations than others. It is generally felt that the medium type, or average, is least susceptible to postural problems due to the characteristics of his build.

The slender (ectomorphic) and obese (endomorphie) individuals are believed to have a greater tendency toward poor postural alignment, the slender person being the more susceptible of the two. These statements are based on empirical evidence. Although sufficient scientific evidence is still lacking, the studies by Cureton and Goff appear to substantiate these statements.

The majority of studies reviewed have dealt with adult males. In two, a relationship was found to exist between posture, body build, and the center of gravity. Brown's study on young women showed no such relationship. The sample size may have been a factor, being relatively small by contrast. The present study, using a larger sample, is an attempt to provide additional information regarding these relationships as it relates to young women.

Studies of Objective Posture Tests

Several different approaches to objective measurement have been made. MacEwan and Howe (24) constructed the Wellesley Posture Test for women to measure the degree of curvature in the dorsal and lumbar spine, body tilt, and segmental angulation, and the position of the head and neck. This was done from photographs of 850 subjects. Eleven aluminum pointers nine centimeters long were attached to the subject at the end of the sternum, on the prominence of the first part of the sacrum, and on the spinous processes of every other vertebra starting at the seventh cervical.

The measurement of the difference between the actual rod length and the rod length shown on the picture described the deviations of the spinal column. Certain landmarks are located on the silhouette. The actual measurement is done by slipping the picture under a transparent triple scale and reading off units as shown on the scale. A numerical scale for grading posture 1 to 25 was set up. This may be translated to a letter grade of A+ to E-.

The Wellesley Test has long been discontinued because of some inconsistencies. Also, much time was used in preparing the subject and in scaling and rating the photographs (16:201). According to Ruth Harris at the University of Michigan, the test had been used there in the past, but was discontinued for the same reasons. Hellebrandt (23:225) states that, ". . . the MacEwan and Howe test, which is one of the most exacting, does no more than replace individual judgment by a group evaluation. That this is inherent in the numerical scoring system proposed has escaped notice."

Using aluminum pointers similar to those used at Wellesley, Wickens and Kiphuth (28) attempted more objective appraisals. The pointers were placed on the spinous process of the seventh cervical vertebra, at the point of the greatest convexity in the upper back, at the point of inflection between the dorsal and lumbar curves, at the point of greatest concavity in the lower back, and on the prominence

of the sacrum. Also, flesh pencil marks were placed at the tragus, acromion, the greater trochanter, the head of the fibula, and the cuboid bone of the foot. From posture photographs, definite angles in the upper and lower back could be noted as well as the position of the head and neck in relation to the body as a whole, and the overall tilt of the body in the antero-posterior position. In 1952, a photometric system (12) was used to provide four images of the subject in one exposure (front, rear, side, and overhead views). It is possible to obtain accurate measurements of any part of the body, a slide of each exposure being projected half life size on the screen. The photometric system used at Yale, because of the cost of equipment and time involved, renders this test impractical for general teacher use.

Cureton (19) devised a conformateur to measure spinal curvature. The conformateur rods, which project horizontally from a vertical stand, touch the spinous processes of the spine from the sacrum to the top of the head. An accurate measurement of spinal deviation is then shown. The angles of various body segments are also measured. Cureton found that objectivity was two to four times as good as a subjective judgment.

A technique for teaching body alignment in standing was developed by Howland (4). It consists of the perpendicular alignment of two landmarks on the body trunk: the

center of the sternum and the superior border of the symphysis pubis. The alignometer consists of sliding calibrated pointers affixed to a perpendicular steel rod. If the pointers used to indicate the center of the sternum and the upper border of the symphysis pubis are the same distance from the vertical rod, the subject is said to be properly aligned.

Massey (25) devised an anteroposterior test to measure four angles of the body: head-neck-trunk alignment (Angle I); trunk-hip alignment (Angle II); hip-thigh-knee alignment (Angle III); and thigh-leg-ankle alignment (Angle IV). Points are marked on the subject at the tragus, center of the greater trochanter, and the external malleolus. The top of the sternum, a point on the back opposite the suprasternal notch, and the fourth lumbar are designated by aluminum pointers. A photograph is then taken. The angles are measured and recorded in terms of deviations from a straight line. The posture grade is the sum of all four angles. This sum is then converted into a letter grade.

After reviewing the objective posture tests, it was felt by the investigator that the Massey Technique was the simplest and quickest to use. This method measures the relationship of body segments as well as total body alignment. In a previous study employing the Massey Technique, Molot (30) obtained a posture grade distribution for young adult women closely approximating the norms Massey devised for

young adult men. For the above reasons, it was decided that this method best suited the purposes of this study.

CHAPTER III

METHODOLOGY

The following methods were used to investigate posture as it relates to body type and line of gravity.

Subjects

Eighty college women enrolled in the physical education instructional program at Michigan State University and ranging in ages eighteen to twenty-one comprised the sample. Each physical education instructor was given a sheet containing silhoettographs of the three extreme body types (as classified by Sheldon), with a general description of each. She was asked to make a subjective judgment in her selection of girls possessing a predominance of endomorphy, mesomorphy, ectomorphy, and those of average build. This list was given to the investigator who contacted each girl and asked her to participate in this study.

General Procedures

All subjects were measured spring term, 1963, from 1:00 to 5:00 in the afternoon. Upon reporting for the study, the name, height, weight, and age of each subject was recorded. The foot measurement was determined by marking the length of each foot on a pedagraph. Objective procedures using anthropometric measurements were taken according to Parnell's

directions for determining body build. The Cureton-Wickens Center of Gravity test was then administered. Following this, the subjects were marked and their posture pictures taken.

Negative slides were made of all subjects, the pictures projected approximately one-half life size on paper, and angles determined and measured.

The formula to determine the center of gravity was then calculated.

Retests for posture were taken within a one-week period. The testing period for obtaining posture pictures, the center of gravity, and body-type measurements covered two weeks. The measurement of angles for the Massey Technique and calculation of the center of gravity extended through approximately one and one-half weeks. All measurements were taken by the investigator.

Specific Procedures

Static anteroposterior posture (Massey Technique). A Zeiss 35 mm camera was used with a setting of F/4 on 1/30. The camera was placed eleven feet from the center of a turntable upon which each subject stood. Kodak Plus X, black and white film was used. Fluorescent lights were set at a 45-degree angle to the subject and at a distance of 6 feet, 8 inches. A meter stick was included in each photograph along side the subject for scaling purposes. A

celluloid protractor, millimeter ruler, and vernier scale were used to accurately measure the angles from the slides for the Massey Technique.

The Massey Technique (25) measures four angles: angle I, head-neck-trunk alignment; angle II, trunk-hip; angle III, hip-thigh-knee alignment; and angle IV, thigh-leg-ankle alignment. These four angles are measured and recorded in terms of deviations from a straight line. If an angle is 170 degrees, it would lack 10 degrees of being a straight line. Therefore, the 10 degrees is recorded. The posture grade is the sum of all four angles. This number is then converted into a letter grade:

<u>Sum of Angles I, II, III and IV</u>	<u>Grade</u>
8° - 22°	A
23° - 36°	B
37° - 51°	C
52° - 65°	D
66° - 78°	E
79° - 93°	F

The procedure was as follows: The following points were marked on the left side of the subject with pointed pieces of tape: (1) the tragus, (2) the greater trochanter, (3) the styloid process of the fibula (center of the knee joint), and (4) the external malleolus. With aluminum pointers 9.20 centimeters in length the following points were marked: (1) the suprasternal notch, (2) a point on the longitudinal midline of the back and at the level of

the suprasternal notch, and (3) the spinous process of the fourth lumbar vertebrae.

A side-view photograph was then taken and negative slides made of each subject.* With a slide projector, the picture of each subject was projected on paper approximately one-half life size (.461). (Actual distance between two points on the meter stick was 10 centimeters. The projector was adjusted until this distance measured 4.46 centimeters on the screen.) Marks were made on the paper at the: (1) tragus; (2) top of the sternum (screen size of the pointers was 4.102 centimeters; measuring in from the end of the pointers 4.102 centimeters with a vernier scale, a mark was placed at this point); (3) a point on the longitudinal midline of the back (procedure no. 2 repeated); (4) the point of the greatest abdominal protruberance; (5) the fourth lumbar (procedure no. 2 repeated); (6) the trochanter; (7) the center of the knee; and (8) the external malleolus.

A line was drawn connecting the suprasternal notch with the point on the back. Another line was drawn connecting the fourth lumbar with the greatest abdominal protruberance. The above two lines were then bisected and perforations made at these midpoints.

Lines were drawn from: (1) the tragus to the midpoint of the suprasternal notch and the spine, (2) the midpoint of

*Technique involving slides suggested by Dr. Wayne D. VanHuss, Director, Human Energy Laboratory, Michigan State University, East Lansing, Michigan.

the suprasternal to the midpoint of the fourth lumbar, (3) the midpoint of the fourth lumbar to the trochanter, (4) the trochanter to the center of the knee, and (5) the center of the knee to the malleolus.

Each line was extended at least twelve inches and a protractor laid down at various points to measure the angles (See Figure 1).

Eleven participants were selected for re-test procedures to determine the reliability of the Massey posture test.

Somatotype (Parnell's Technique). Parnell (10) combines physical anthropology and photography in an effort to provide body typing with an objective and precise definition of body components. He corresponds closely to Sheldon's estimate of somatotype, but used the terms fat, muscularity, and linearity in place of Sheldon's terms of endomorphy, mesomorphy, and ectomorphy. Both height and weight are taken. Bone measurements include the bi-acromial, bi-thoracic, and the humeral and femoral epicondyles. Girth measurements are taken of the biceps and calf. Skinfold measurements include the upper arm (triceps), subscapular, and suprailiac. Body type is then calculated from an M.4 chart on which the measurements have been recorded.

Center of gravity. The Cureton-Wickens test (20) was the instrument employed to determine the center of gravity.

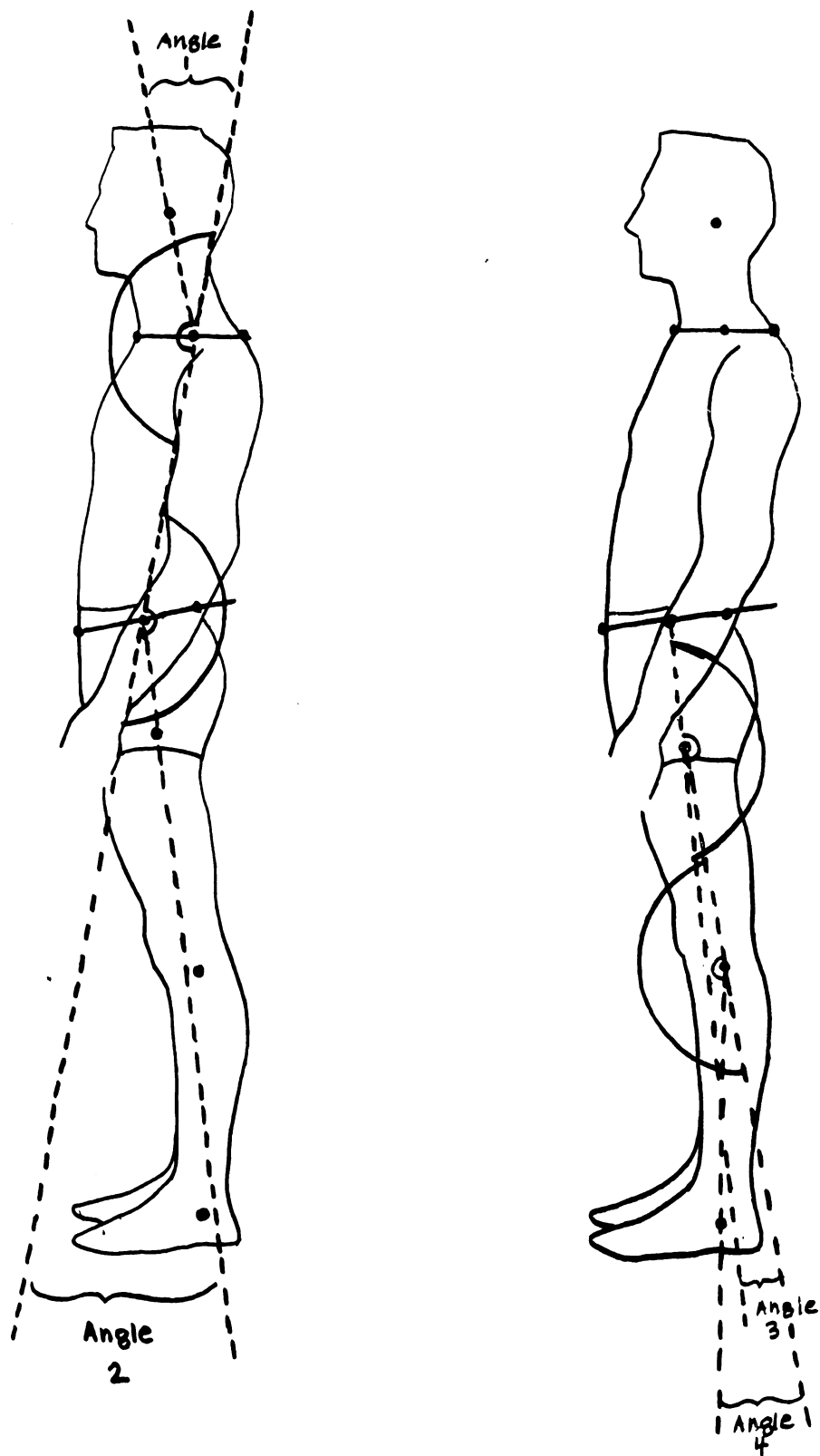


Figure 1. Method of Measuring Angles for Massey Technique

This test, adapting the original apparatus of Reynolds and Lovett (26), indicated the relation of a subject's center of gravity line to the internal malleoli. A board 143 centimeters in length, 23.5 centimeters in width, and 4.4 centimeters in depth was used. The knife edges located under each end were placed upon the centers of two calibrated bathroom scales. With the board on the scales, each scale was set at zero so that one-half of the weight of the board would not have to be subtracted from the reading of each scale. The subject stood in the middle of the board so that the centers of the internal malleoli could be lined up with a vertical pin located in the exact center of the board (71.5 centimeters from each end). Each scale was read and this reading recorded. The procedure was repeated three times per subject or until agreement in score was reached. Using these two readings, the following formula was then calculated:

$$(\text{1st reading}) X = (\text{2nd reading}) (143 - X)$$

It was then possible to determine how far the line of gravity had fallen in front or behind the internal malleoli.

CHAPTER IV

ANALYSIS OF DATA

Description of Subjects

A description of the eighty subjects participating in this study is presented in Table I.

TABLE I
DESCRIPTION OF SUBJECTS

Characteristics	Range	Mean	Standard Deviation
Age (years)	17.0- 21.0	18.600	.860
Height (inches)	58.5- 70.5	64.981	2.664
Weight (pounds)	98.0-244.0	136.690	2.830
Ponderal Index	10.4- 14.5	12.769	.903
Endomorphy Component	2.5- 7.0	4.54	.96327
Mesomorphy Component	1.0- 6.0	3.24	1.26041
Ectomorphy Component	1.0- 7.0	3.15	1.66741

The means, standard deviations, and ranges of segmental angles and total body alignment obtained by the Massey Technique and of the center of gravity determined by the Cureton-Wickens technique are given in Table II. The mean posture score for total body alignment was equivalent to a "C" rating. This score is similar to the results obtained by a previous investigator who employed this technique with young adult women (30). The greatest deviations

in segmental angulations for subjects participating in this study were found to be in Angle II and Angle III. The gravital line at the base of support in the anteroposterior plane fell anterior to the internal malleoli ($M = 2.5$ centimeters). This result is not directly comparable to results obtained by other investigators because of the technique of measuring the line of gravity with respect to the internal malleoli rather than the external malleoli as reported in other studies. Furthermore, there appears to be a great deal of variation regarding the portion of the malleolus selected as the point of reference. There is general agreement among investigators that the gravity line falls anteriorly to the ankle joint.

TABLE II

MEANS, STANDARD DEVIATIONS, AND RANGES OF
SEGMENTAL ALIGNMENT AND CENTER OF GRAVITY

Measurement (degrees)	Range	Mean	Standard Deviation
Total Body Alignment	27.0-88.5	48.919	14.421
Angle I (head-neck-trunk)	12.0-33.0	20.437	3.915
Angle II (trunk-hip)	0.0-39.5	16.175	8.879
Angle III (hip-thigh-knee)	0.0-26.0	8.687	5.798
Angle IV (thigh-leg-ankle)	0.0-12.0	3.762	2.811
Center of Gravity (cm.)	.5- 5.9	2.490	1.144

A comparison of the ranges indicates the results obtained in this study to be dissimilar to the findings reported by other investigators. Hellebrandt (18:114) and Fox and Young (21:282) appear to have obtained more variability (.388 to 13.536 and 1.35 to 9.7 centimeters, respectively). The greater range found in these two studies may possibly be due to the age range and a less homogeneous grouping than that obtained in the present study. The ranges found by Hesser (18:114) (1.0 to 4.8 centimeters) and Basler (18:114) (3.6 to 6.7 centimeters) were less than the results in this study. Since the nature of their samples is not known, no conclusions can be drawn.

Reliabilities

The reliabilities of each measurement used in the Massey Technique as determined by the correlations between test-retest scores for eleven subjects are given in Table III. In general they are relatively high, with the exception of Angle III. This low reliability is probably caused by the variable error of locating the trochanter, the body landmark often obscured by subcutaneous fat in women. This would have a greater influence with this measurement than other landmarks. Perhaps this low reliability may also be due to the subjects' inability to assume the same position each time tested. Any shift in stance, however slight, may occur in the pelvic region more than any other segment of the body. The contribution of this region to total

alignment, as measured in this study, and its influence on total posture and alignment of body segments is believed by investigators to be important.

TABLE III
RELIABILITY COEFFICIENTS BETWEEN FIRST AND
SECOND POSTURE MEASUREMENTS

	Total Posture	Angle I	Angle II	Angle III	Angle IV
Correlation Coefficient	.6608	.9233	.7172	.2591	.8080

The accuracy of scaling and measuring the angles on the slides was determined by repeating this procedure ten times on one slide chosen at random. The average per cent of error was found to be 1.3. The results appear in Table IV, on the following page.

Intercorrelations and Correlations

The intercorrelations between measures of segmental alignment and the correlations of these measures with body type components, center of weight, and length of foot are contained in Table V. Assuming the population r to be zero, a statistically significant correlation at the .01 limit required a correlation of .296; and the .05 limit required a correlation of .228. The 5 per cent level of significance was selected and all interpretations were based upon this significance level.

TABLE IV
ACCURACY OF MEASURING ANGLES FOR MASSEY TECHNIQUE

Number of Measurement	1	2	3	4	5	6	7	8	9	10	Mean	Average % of Error
Total Posture Score	35.5	34.5	35.0	34.0	35.5	34.5	35.5	34.5	35.0	35.5	34.9	1.28
Deviation from Mean	.5	.5	0.0	1.0	.5	.5	.5	.5	0.0	.5		

Total posture alignment scores. Three correlations were statistically significant at the .01 limit with total body alignment and measures of segmental angulation; these were Angle II (.845), Angle III (.722), and Angle I (.462). The correlation of total posture with Angle IV was statistically significant at the .05 level, although the relationship was low (.281). A high correlation was found between Angle II and total posture by Massey (25:15,16).

Segmental alignment scores. Angle I correlated significantly with Angle IV (.257). One correlation was significant at the .01 limit; this was .466 between Angle II and Angle III.

These findings seemed to indicate that a particular angle, or combination of two angles, may be used in the prediction of total body alignment score.

Correlations with body type components. Endomorphy-- Statistically significant correlations at the .01 limit with this body type component were total posture (.479), Angle II (.367), and Angle I (.364). The relationship between endomorphy and Angle III was low, but statistically significant at the .05 level. In the interpretation of these results, positive correlations infer negative connotations; therefore, these data seem to indicate that the greater the endomorphic component the more likelihood of a deviation from the perpendicular posture standard; especially was this

TABLE V

INTERCORRELATION COEFFICIENTS AMONG VARIABLES

N = 80	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Height	1.00	.058	.478	.636	.226	-.051	.066	-.064	.011	-.104	-.164	.559	.467
2. Weight		1.00	-.805	.167	-.243	.476	.411	.364	.202	.274	.769	.341	-.683
3. Pond. Index			1.00	.159	.299	-.382	-.276	-.295	-.132	-.299	-.742	-.637	.926
4. Foot Length				1.00	.186	.022	-.059	.027	.032	.036	-.122	-.210	.130
5. C. of Gravity					1.00	-.305	.003	-.279	-.257	-.090	-.250	-.196	.328
6. Total Posture						1.00	.462	.845	.722	.281	.479	.053	-.326
7. Angle I							1.00	.199	.035	.257	.364	-.096	-.128
8. Angle II								1.00	.466	-.055	.367	.048	-.254
9. Angle III									1.00	.101	.275	-.021	-.163
10. Angle IV										1.00	.154	.254	-.255
11. Endomorphy											1.00	.247	-.675
12. Mesomorphy												1.00	-.706
13. Ectomorphy													1.00

.228 and .296 significant at .05 and .01 levels of significance, respectively

true of the head-neck-trunk position and trunk-hip position.

Mesomorphy--There was a significant correlation with this body type component and Angle IV (.254). No significant correlations were revealed by the data for total posture or the other segmental angulations with the mesomorphy component.

Ectomorphy--Statistically significant correlations with this body type component were Angle IV (-.255) and Angle II (-.254), with total posture being significant at the .01 level (-.326). It would appear from these results that the greater the ectomorphy component, the more the alignment seems to approximate the perpendicular postural pattern. Goff (22:345) found the greater deviation from the "ideal" posture in the linear individual. However, it is not known whether his concept of ideal posture is identical to that proposed by Massey. Also, Goff employed descriptive classifications to body build characteristics and did not delimit body build by components.

Center of gravity scores. Of the five correlations between the center of gravity and measures of body alignment, the significant correlations were -.305 with total posture (.01 limit); -.279 with Angle II; and -.257 with Angle III. It should be noted that for the center of gravity scores, the lower score is the most desirable for perpendicular body alignment as measured by the Massey Technique; e.g., the lower the score, the closer the line

of gravity is to the center of the malleolus. The results seem to indicate that the closer the total stance approaches perpendicular body alignment, the more likely the gravital line falls ahead of the internal malleoli. This finding seems to be related particularly to the position of Angle II (trunk-hip) and Angle III (hip-thigh-knee). It should be noted that these angles were highly associated with total posture score.

Two correlations were significant between the center of gravity score and body type components; these were .328 (.01 level) and -.250 with ectomorphy and endomorphy, respectively. It would seem from these data that the higher the ectomorphic component, the further forward the gravital line falls through the foot; while with the endomorphic component, this line tends to lie closer to the internal malleoli.

Cureton (19:353) found ectomorphs to have the lowest center of gravity ratings; that is, this line fell closer to the internal malleoli.

Because of the difference in the types of posture made reference to by Cureton and Wickens (20:102), the results in the present study are not strictly comparable to those found with men at Springfield College. In the rigid, military stance, they found the gravital line to usually fall farthest forward; with normal, relaxed posture, average or intermediate; and with the excessively poor or slouched position, the center of gravity was closer to the heels.

The center of gravity was also significantly related to ponderal index (.299 at the .01 limit). This result would seem to substantiate the relationship found between the center of gravity and the ectomorphy component.

No significant correlation was found between the center of gravity and the length of the foot.

Other investigators found different relationships between body alignment, center of gravity scores, and body build than those obtained in this study. Using descriptive groups, Cureton (19:353) found ectomorphs to have the greatest lordosis; however, both ectomorphs and mesomorphic-ectomorphs had the best head and shoulder posture. The lowest (poorest) center of gravity scores were found in the ectomorphic group. These scores were larger with mesomorphy, and declined again with endomorphs. Goff (22:345) found that the linear type had the greatest deviation from the accepted concept of "good" posture. Brown (17) found no significant correlation between body alignment, body type, or the center of balance with women. Since the sample in the present study contained no extremes, an effort was made to classify the participants into Sheldon's descriptive groupings. It was found, however, that an insufficient representation was available for such a classification. This may account for the differences in results between this study and those using body types or descriptive groups.

Results of multiple regression equation. As a result of the high correlation of Angles II and III to total posture, a multiple regression equation was run between all angles and total posture to find if a particular angle could predict an individual's total body alignment. These results as measured by the Massey Technique are presented in Table VI, on the following page. The figures show Angle II to be the best indicator of total posture. The best combination of two angles appears to be II and III.

TABLE VI

MULTIPLE REGRESSION EQUATIONS FOR PREDICTING POSTURE FROM SEGMENTAL ANGLES

Number of Equation	Number of Variables	Equation	Correlation Coefficient
I	1	$Y = 14.134 + 1.7021A_1$	.4621
II	1	$Y = 26.7204 + 1.3724A_2$	.8450
III	1	$Y = 33.3178 + 1.7958A_3$	.7219
IV	1	$Y = 43.4999 + 1.4402A_4$	.2807
V	2	$Y = 5.3067 + 1.1261A_1 + 1.2734A_2$	.8966
VI	2	$Y = .7367 + 1.6105A_1 + 1.7575A_3$	.8439
VII	2	$Y = 14.1369 + 1.5380A_1 + .8901A_4$	.4916
VIII	2	$Y = 22.7960 + 1.0551A_2 + 1.0426A_3$	.9228
IX	2	$Y = 19.9129 + 1.4717A_2 + 1.6835A_4$	.9063
X	2	$Y = 29.7252 + 1.7430A_3 + 1.0767A_4$	.7516
XI	4	$Y = -.4585 + 1.0077A_1 + .9941A_2 + 1.0110A_3 + 1.0414A_4$	.9971

Key: Angles expressed in degrees

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

It was the purpose of this study to investigate static anteroposterior posture as it relates to somatotype and to the center of gravity. The Massey Technique was employed to assess body alignment in the anteroposterior plane and the Cureton-Wickens test to determine the center of gravity. Body typing was determined by Parnell's method. A pedagraph was used to measure the length of the foot.

Eighty college women ranging in ages from eighteen to twenty-one participated in the study. The range, mean, and standard deviation was computed for all measures. For purposes of reliability, the Cureton-Wickens Center of Gravity test was done three times, or until agreement in score was reached. Reliability of the Massey Technique was determined by the test-retest method. The Pearson Product Moment Correlation was the statistical technique employed to determine correlations between all variables. A multiple regression equation was used to determine if one particular angle would be a satisfactory predictor of total posture.

Conclusions

Within the limits of this study, the following conclusions are made:

1. Statistically significant correlations were found between posture and body build components although the relationships were low:

(a) The greater the endomorphic component, the greater the possibility of a deviation from the total posture standard used in this study. This was particularly true with Angle I (head-neck-trunk), Angle II (trunk-hip), and Angle III (hip-thigh-knee).

(b) The greater the ectomorphic component, the more likelihood of body alignment approximating the total postural standard, particularly for Angle II (trunk-hip), and Angle IV (thigh-leg-ankle).

(c) No relationship was found between the mesomorphic component and total body alignment as measured in this study.

2. Statistically significant correlations were found between the center of gravity and endomorphic and ectomorphic components. The gravital line when associated with the ectomorphic component, passed further forward through the foot, anterior to the malleolus, while with the endomorphic component this line fell closer to the malleolus.

3. Body alignment as measured by the Massey Technique was related to the center of gravity. The better the posture,

the more likelihood of the gravital line passing through the foot anterior to the malleoli. This tendency was particularly true of Angle II (trunk-hip) and Angle III (hip-thigh-knee).

4. The correlational pattern between total posture and segmental angulations was statistically significant and the relationship tended to be high.

5. Multiple regression showed Angle II to be highly correlated with total posture. This angle appeared to be the best predictor of total body alignment as measured by the Massey Technique. The combination of Angles II and III also appeared to be a significant indicator of total posture. These findings are similar to the results obtained by Massey (25:19).

Recommendations

1. More subjects representative of the main body build types are needed to determine (a) whether postural patterns characteristic of each type in women do exist, and (b) whether there is a gravital zone which would be representative of each individual's "ideal" posture.

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APPENDIX

RAW DATA ON MEASUREMENTS

Subject	Age	Height	Weight	Ponder. Index	Foot Measure		Sheldon Body Type	Line of Gravity	Total Posture	Angle I	Angle II	Angle III	Angle IV	Parnell's Body Type-- Individ. Body Components		
					Measure									End. Mes.	Ect.	
					Left	Right										
1	18	62.0	210	10.4	06.00	06.25	741	3.4	57.0	30.0	10.5	14.0	02.5	6.5	4.0	1.0
2	18	66.0	168	12.0	08.75	09.00	531	0.9	73.0	24.0	33.0	15.0	01.0	5.0	3.0	1.0
3	18	65.0	132	12.8	07.75	07.50	543	3.8	27.0	16.0	10.0	00.0	01.0	5.5	3.5	3.0
4	18	63.0	108	13.3	07.50	07.50	354	1.3	32.0	17.0	07.0	02.0	06.0	3.0	5.0	4.0
5	19	68.0	119	13.8	10.00	09.50	416	2.4	50.5	15.0	19.5	14.5	01.5	4.0	1.0	5.5
6	18	68.0	134	13.3	07.25	07.25	444	3.2	40.0	18.5	11.0	05.0	05.5	3.5	3.5	4.0
7	19	65.0	124	13.1	07.50	08.25	433	4.8	49.0	22.5	16.0	05.0	05.5	4.0	3.0	3.5
8	18	67.0	146	12.8	09.50	09.50	533	2.0	67.5	25.0	28.5	12.0	02.0	4.5	3.0	3.0
9	18	61.0	140	11.8	06.00	06.00	551	1.3	32.5	18.5	09.5	03.0	01.5	5.0	5.0	1.0
10	18	67.5	156	12.6	07.25	07.25	632	3.9	36.5	20.0	06.5	08.5	01.5	5.5	2.5	2.5
11	18	66.5	119	13.5	08.75	09.25	445	5.3	48.5	22.0	17.5	03.5	05.5	3.5	4.0	4.5
12	18	65.0	106	13.7	07.00	06.50	425	3.3	40.5	19.5	12.5	05.5	03.0	3.5	1.5	5.0
13	18	67.5	136	13.2	09.25	09.00	514	3.1	74.0	26.0	27.0	18.5	02.5	5.0	1.0	4.0
14	18	64.5	098	14.0	07.00	06.75	326	2.2	41.0	21.0	14.0	04.5	01.5	2.5	2.0	6.0
15	17	63.0	142	12.1	07.50	06.75	541	1.0	76.0	15.5	33.0	26.0	01.5	5.0	4.0	1.0
16	19	61.0	124	12.3	05.75	06.00	641	2.3	66.5	25.0	25.0	11.0	05.5	5.5	4.0	1.5
17	18	66.5	156	12.4	10.00	10.25	452	2.3	68.0	21.5	21.0	13.5	12.0	4.5	5.0	2.0
18	19	68.5	142	13.2	09.00	09.25	434	3.0	40.0	17.0	07.5	10.5	05.0	3.5	3.0	4.0
19	19	65.0	104	13.8	07.00	07.00	426	4.0	39.0	24.0	07.5	05.5	02.0	3.5	2.0	5.5
20	18	63.0	170	13.3	07.25	07.75	644	0.9	76.5	20.5	33.0	20.5	02.5	5.5	4.0	4.0
21	18	67.5	144	12.9	08.50	09.00	523	2.9	61.5	27.5	17.0	08.5	08.5	5.5	2.0	3.0
22	19	65.0	123	13.1	07.75	07.50	534	1.7	44.5	22.0	17.0	04.0	01.5	4.5	2.5	3.5
23	18	62.0	113	12.8	07.50	08.00	333	3.1	39.5	22.0	12.5	01.5	03.5	3.0	3.0	3.0
24	18	65.0	132	12.8	08.00	08.00	543	2.1	38.0	17.0	03.0	16.0	02.0	5.0	4.0	3.0
25	19	63.0	127	12.6	07.00	07.75	442	2.2	36.5	20.0	04.5	12.0	00.0	4.5	4.0	2.5
26	18	66.0	136	12.9	08.00	08.75	543	4.1	51.0	22.0	20.5	08.0	01.5	4.5	4.0	3.0
27	19	66.5	178	11.8	09.50	09.00	641	1.2	51.5	28.0	13.0	02.0	08.5	5.5	4.0	1.0
28	21	62.0	112	12.9	08.00	07.75	433	2.5	49.0	21.0	03.0	15.0	10.0	4.0	3.0	3.0
29	18	69.5	136	13.5	10.75	10.75	515	5.7	37.0	23.0	00.0	11.0	03.0	5.0	1.0	4.5
30	18	61.5	114	12.7	06.00	06.50	443	1.2	32.0	12.0	13.0	04.0	03.0	3.5	4.0	2.5
31	19	64.0	101	13.8	06.50	06.75	325	2.8	41.0	22.5	11.5	05.0	02.0	3.0	2.0	5.5
32	18	64.0	125	12.8	07.75	08.25	533	2.3	34.5	18.5	14.5	01.0	00.5	5.0	2.5	3.0
33	18	65.0	145	12.4	09.50	09.25	642	2.4	30.0	19.0	08.0	02.0	01.0	5.5	4.0	2.0
34	19	61.5	118	12.6	06.00	06.25	542	2.4	45.5	21.5	05.0	12.0	07.0	4.5	4.0	2.5

35	19	58.5	128	11.6	07.00	07.75	561	3.3	49.5	15.0	23.0	06.5	05.0	5.0	5.0	1.0
36	18	64.0	137	12.8	07.25	07.50	553	2.0	39.5	22.5	13.5	02.0	01.5	4.5	5.5	3.0
37	19	65.0	125	13.0	07.00	07.75	443	3.4	52.0	19.0	21.5	08.0	03.5	4.0	3.5	3.5
38	19	60.0	107	12.7	05.25	05.75	452	2.6	44.0	17.0	12.0	05.5	09.5	4.0	5.0	2.5
39	19	65.5	148	12.4	10.50	10.00	552	3.4	32.5	13.0	15.0	01.0	03.5	5.0	4.5	2.0
40	19	67.5	196	11.6	10.50	11.00	641	1.4	56.5	22.0	23.5	07.5	03.5	6.0	4.5	1.0
41	18	67.0	129	13.3	08.00	07.50	434	0.5	30.5	19.5	06.0	04.0	01.0	4.0	2.5	4.0
42	19	66.5	109	14.0	08.50	08.00	426	2.6	46.0	23.5	06.5	09.0	07.0	3.5	2.0	6.0
43	18	63.5	102	13.6	08.50	08.00	425	2.1	35.5	17.0	14.5	02.0	02.0	3.5	2.0	5.0
44	18	65.0	115	13.4	06.50	06.50	424	1.5	27.0	15.0	10.0	02.0	00.0	4.0	2.0	4.0
45	18	66.0	103	14.1	08.75	08.75	426	2.7	39.5	18.0	03.0	11.5	07.0	4.0	2.0	6.5
46	18	63.0	148	11.9	09.00	09.25	551	1.9	66.0	18.0	28.5	18.5	01.0	4.5	4.5	1.0
47	19	62.0	164	11.3	07.00	06.50	641	1.7	43.5	20.0	19.0	00.5	04.0	5.5	4.5	1.0
48	19	59.5	115	12.3	05.50	05.25	541	1.8	54.5	13.5	23.0	15.0	03.5	5.0	3.5	1.0
49	18	66.5	098	14.5	08.75	09.00	417	2.5	46.5	17.0	20.5	09.0	00.0	3.5	1.0	7.0
50	20	70.5	123	14.2	11.00	10.75	327	4.5	35.5	19.5	12.0	03.0	01.0	3.5	2.0	6.5
51	18	61.5	144	11.7	05.50	04.75	661	2.2	68.0	25.5	27.5	13.0	02.0	5.5	5.5	1.0
52	19	65.5	172	11.8	09.50	09.75	541	2.0	48.0	22.5	08.5	10.0	07.0	3.5	3.5	1.0
53	18	66.5	210	11.2	07.75	07.75	651	1.5	78.0	21.0	33.5	16.0	07.5	6.5	4.5	1.0
54	20	69.0	133	13.5	11.00	11.25	335	3.2	41.0	22.0	11.0	03.0	05.0	3.0	3.5	4.5
55	18	62.5	105	13.3	07.75	07.75	444	2.7	37.0	23.0	13.0	00.5	00.5	4.0	3.5	4.0
56	18	62.5	115	12.9	05.00	04.75	553	3.4	38.5	18.5	04.5	10.5	05.0	5.0	4.5	3.0
57	20	65.0	121	13.2	06.75	06.75	524	2.9	62.0	17.5	28.0	15.0	08.0	5.5	2.0	4.0
58	21	59.0	138	11.4	11.50	11.50	461	3.5	38.5	13.0	12.0	08.0	05.5	3.5	5.5	1.0
59	19	65.0	177	11.6	09.25	09.00	641	1.6	42.5	20.5	05.0	12.5	04.5	6.0	4.0	1.0
60	20	66.0	141	12.7	07.75	08.25	443	1.5	41.5	18.0	01.0	14.0	08.5	4.0	4.0	2.5
61	19	67.0	149	12.6	08.50	09.00	542	2.8	42.0	19.5	09.5	06.0	07.0	5.0	3.5	2.5
62	19	65.0	105	13.8	08.00	07.50	426	2.0	76.5	21.0	29.5	22.0	04.0	4.5	2.0	5.5
63	21	67.0	144	12.8	10.00	10.25	423	5.9	41.5	19.0	13.5	05.0	04.0	4.5	2.0	3.0
64	18	59.5	182	10.5	05.50	05.75	741	1.0	65.0	25.5	25.5	09.0	05.0	6.5	4.0	1.0
65	19	66.5	106	14.0	08.00	08.50	426	4.0	44.0	18.0	19.0	06.0	01.0	5.5	2.0	6.0
66	18	68.5	136	13.4	09.75	10.25	424	2.6	50.0	18.5	20.0	11.0	00.5	4.5	2.0	4.5
67	18	64.0	120	13.0	06.75	07.25	433	1.5	39.5	19.5	09.0	05.0	06.0	4.5	3.0	3.5
68	18	68.0	140	13.1	10.75	10.25	434	0.5	59.0	21.5	18.5	12.0	07.0	3.0	3.0	3.0
69	18	64.5	128	12.8	07.25	07.75	533	1.7	44.0	25.0	14.0	03.5	01.5	5.0	3.0	4.0
70	18	67.5	134	13.2	10.00	09.75	434	1.6	67.0	21.0	22.5	16.0	07.5	4.0	4.0	3.0
71	19	63.5	122	12.8	07.75	07.50	443	2.9	55.5	29.0	17.5	05.0	04.0	4.0	3.0	4.5
72	18	67.5	127	13.5	09.75	09.50	434	1.1	34.5	17.0	10.5	05.0	02.0	3.0	3.0	3.0
73	18	67.0	114	13.8	10.00	10.00	415	2.5	55.5	22.5	21.0	11.0	01.0	1.0	1.0	5.5
74	19	69.5	119	14.2	07.75	08.00	326	4.1	33.0	19.0	17.0	06.0	01.0	3.0	2.0	6.5
75	18	65.0	244	10.4	07.75	07.50	731	2.6	76.0	33.0	29.0	04.0	10.0	7.0	3.0	1.0
76	19	68.5	147	13.0	09.75	09.75	613	1.4	51.0	19.5	20.0	07.0	04.5	5.5	1.0	3.0
77	21	66.0	147	12.5	09.50	09.75	462	3.6	35.5	17.0	13.5	04.5	00.5	4.0	6.0	2.0
78	20	69.0	176	12.3	09.75	09.75	542	1.8	57.0	16.5	24.0	15.0	01.5	4.5	4.0	1.5
79	17	61.5	201	10.5	07.00	07.75	651	0.7	78.5	25.0	33.5	11.5	08.5	6.0	4.5	1.5
80	20	65.5	153	12.3	08.25	09.75	531	1.5	88.5	22.5	39.5	23.0	03.5	5.5	3.0	1.5

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