724822

State of California

Department of Public Health

Memorandum

To : Siri
Sargent
Bruyn
Gaffey and Clark

Date : June 15, 1964

Subject :

From : Bureau of Public Health Nutrition

This is a rough draft of the first paper on the obesity study. I should appreciate any comments you may have. We will try to have this published in the Journal of Chronic Diseases if this meets with your approval.

Other papers we propose to publish are: 1) results of anthropometric and laboratory measurements with the regression equations, 2) diet and physical activity results with relation to measured and estimated body fat, 3) cesium 137 results with relation to diet and 4) somatotype results with relation to measured and estimated body fat.

I should appreciate your early comments.

Sincerely,

Ruth C. Steinkamp, M.D.
Medical Consultant

RCS:eh
Attachment

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Measures of Body Fat and Related Factors in Normal Adults
I. Introduction and Methodology

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California State Department of Public Health, Bureau of Public Health Nutrition with the cooperation of Donner Laboratory, University of California, Berkeley. Supported in part by National Institutes of Health Grant CD 00009 (formerly A-5907).

*Deceased April 26, 1963.

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Measures of Body Fat and Related Factors in Normal Adults
1. Introduction and Methodology

Introduction

The development of laboratory methods to determine body fat in the human has given impetus to distinguishing obesity (excess body fat) from overweight (body weight greater than a standard weight for height and sex), and to developing simpler methods for predicting amount of body fat. This is particularly true since certain chronic diseases with high incidences and mortality rates have been associated with overweight. These diseases are of public health concern. The availability of a simple yet accurate anthropometric tool to estimate amount of body fat would aid in the epidemiologic study of some common degenerative diseases and provide guidance for preventive measures.

Summary of Pertinent Literature

It is impossible here to review the voluminous literature on body composition. Two symposia conducted in the past five years (1,2) and a monograph (3) provide documentation of the extensive and varied recent research in this field.

In 1921, Matiegka (4) first attempted to estimate body composition by anthropometric means in order to establish bases for physical fitness. While he emphasized need for validation with cadaver analyses his approach has proved useful. From it was developed the concept of standard weight for height. Other attempts to define optimum body measurements have been made (5,6,7). Since Behnke developed the measurement of body specific gravity (8) and the concept of lean body mass (9) considerable impetus has been afforded the correlation of physical measurements to reference determinations of body

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composition (10,11,12,13).

Bases of reference for body composition have had several approaches. Cadaver analysis (14,15,16,17), body density (8,18,19,20,21), total body water (22,23,24) combined density and body water determinations (25,26), absorption of non-toxic fat-soluble gases (27), whole-body counting of K^{40} (28,29,30), and measurement of multiple parameters by dilution techniques (3).

Siri has critically evaluated the methods of determining body composition from fluid spaces and density (31). His conclusions that "combined measurements of corporal density and of total body water yield the only method for estimating body composition that does not require a reference body nor an explicit description of the composition of adipose tissue" has been upheld by the work of Allen et al (26). They state "Siri's original simplifying deductions can be shown to hold throughout a wide range in variation of bone mineral: fat: water: solids of healthy persons." The extensive body composition determinations by Moore et al (3) using multiple-isotope-dilution techniques provide an additional approach. Their skeletal weight nomogram has as its basis the work of Allen et al (26) plus a measure of body potassium equivalents.

Additional approaches to body composition methodology have been measurements of subcutaneous fat by roentgenography (32) and by caliper measurements (13,33,34). These have been used to estimate body fat or body density. Sheldon's approach has been that of defining the body build by somatotype (35).

While multiple techniques for measuring body composition have been developed, few

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studies have correlated these parameters to develop a valid practical clinical tool. The work of Brozek and Keys (19), Behnke (12), Young (11) and Moore (3) are exceptions. However, for the most part, these have been limited to one sex and to Caucasians. In addition there has been no study to compare in the same subjects lean body mass and body fat as determined by the total body water-body density technique with these as determined by whole body potassium 40.

There is considerable evidence that body composition is dependent upon multiple factors including sex, genetic constitution, physical activity and nutritional status (36). We are unaware however of previous attempts to correlate in man measured body fat and lean body mass with diet, physical activity and with somatotype.

Objectives of Study

The primary objectives of this study were:

1. to develop for healthy adults a valid regression equation using clinically applicable anthropometric measurements which estimates total body fat and

2. to compare in the same subjects determinations of lean body mass and total body fat as obtained by the total body water - body density technique and by the measurement of whole body K^{40}. Additional objectives were:

3. to relate estimated and measured total body fat to diet, physical activity and somatotype, and

4. to relate whole-body cesium-137 to diet.

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Purpose of this Report

This report presents the selection of study subjects and the methods used. The methods are considered under the following headings: anthropometry, laboratory determinations (body density, total body water and whole body counting of potassium-40 and cesium - 137), diet and physical activity assessment and somatotyping technique. The anthropometric measurements are presented in sufficient detail so that the clinician may perform them in these exact fashions.

Subsequent reports will present results of the various measurements, the regression equations and interrelationships of the various parameters.

Selection of Subjects

2304 healthy* individuals between the ages of twenty-five through forty-four years were obtained as volunteer subjects from many work or other groups in the San Francisco Bay Area. Small as well as large business concerns, companies, agencies and other groups (list appended) were contacted through personnel offices or their associated medical facilities for permission to request employee or group participation on a volunteer basis. Each individual, qualifying by age, received a letter which described the purpose of the study and the parameters to be measured and requested voluntary participation. Anthropometric measurements and diet and physical activity interviews were performed at facilities of the company. Persnns, randomly selected for the laboratory measurements,

* Healthy was defined as free of known disease, acute or chronic, upon statement of the subject, and having had no treatment by a physician for any illness during the three months prior to entry in the study. Any person with obvious physical deformity or loss of limb was excluded. In addition pregnancy or suspected pregnancy eliminated any woman from the study.

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were taken to the Donner Laboratory, U.C. Berkeley, at a subsequent time. Only graduate students of U.C. Berkeley were somatotyped at the Cowell Memorial Hospital Constitutional Research Laboratory.

Owing to limitations in the time schedule for laboratory work and the small numbers of volunteers from several races, age-sex-race groups (vide infra) were arbitrarily chosen for other than anthropometric measurements. From these groups, subjects were randomly selected for diet and physical activity interviews and for laboratory measurements. If for any reason a subject so selected was unable to continue, another subject of the same age-sex-race group was selected. The arbitrary categories were: 25 - 34 year old white males and females, 35 - 44 year old white males and females, and Negro males aged 25 - 44 years. Table 1 presents the number by group, including oriental and other race groups, who participated in each of the phases of the study.

ANTHROPOMETRY

One individual (R.C.S.) measured all the women and a few of the men. G.B. measured the majority of the men. The two examiners thoroughly checked techniques to establish uniformity and to assure reproducibility of results. Measurements were recorded by another individual (N.C.) on the data collection sheet which served as the code sheet for keypunching. Editing of certain of the measurements was checked by two individuals.

1. Weight: A Homs portable scale (capacity 300 pounds) accurate to one ounce was used and checked at frequent intervals by the California State Department of Weights and Measures

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Weights were made to nearest ounce with women subjects wearing only a disposable examining gown (weight 3 ounces) and either barefoot or with stockings and with men wearing only shorts and either barefoot or with socks. Representative shorts and socks were weighed and averaged 5 ounces. The weights of the subjects were corrected to nude weights. Ounces were transposed to hundredths of a pound for coding.

2. Height: Heights were measured to the nearest 0.1 cm by means of a free-standing portable Swiss-made steel measuring bar, calibrated to 0.1 cm and having a sliding straight edge. The subjects, either barefoot or with stockings, were positioned with heels, buttocks and back pressed firmly to a wall with the examiner applying firm upward pressure to the subject's mastoid processes without allowing heels to be raised from the floor. The straight edge was then adjusted to the cranial vertex. The height was measured to the nearest 0.1 cm.

The following measurements (3-11) were taken on the right side of the body and recorded to the nearest 0.1 cm with a steel tape closely fitted to the nude body surface but not so tight as to indent the skin. These body measurements were later edited to the nearest whole centimeter. If the number ended in a half-centimeter, odd whole numbers were raised to the next highest centimeter; even whole numbers were unchanged. A single tape was used for approximately 200 subjects and then discarded.

3. Upper Arm Length: With the subject standing, right arm relaxed but flexed 90°

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at the elbow, the tape was applied from the lateral margin of the acromial process of the scapula to the tip of the olecranon process. The distance between these landmarks was recorded. A skin mark was made at half this length for use in the arm circumference and skinfold measurements.

4. Arm Circumference: The tape was applied to encircle the mid-point of the upper arm length and the measurement recorded.

5. Wrist Circumference: The tape was applied to encircle the right wrist over the styloid processes of the ulna and the radius.

6. Chest Circumference: With the subject standing, arms at sides, and breathing quietly, the tape was applied to the chest so as to encompass the areolae for men and the axillae above the area of breast fullness for women.

7. Waist Circumference: The tape was applied, with the subject standing and breathing quietly, to the circumference encompassing the lower borders of the tenth ribs at the mid-axillary lines.

8. Iliac Crest Circumference: With the subject standing, the tape was applied to encircle the body at the iliac crests and was maintained parallel to the floor.

9. Thigh Length: Measurement was made from the skin surface over the right greater trochanter to that over the right inferior border of the lateral epicondyle of the femur. These landmarks were located by having subject stand with right knee slightly flexed, leg abducted and with right foot remaining on the floor. A skin mark was made at half this distance for the thigh circumference and diameter measurements.

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10. Thigh Circumference: The tape was applied to encircle the right thigh at the mid-point of the thigh length.

11. Ankle Circumference: The ankle was encircled with the tape at a point just superior to the lateral malleolus.

The following measurements (12-16) were taken with a curved-arm metal caliper (Martin) calibrated to 0.5 cm. The readings were recorded to the closest 0.5 cm and later rounded for coding purposes to whole centimeters as previously detailed. Firm pressure on the caliper arms was used to displace insofar as possible any fat deposits over the bony prominences.

12. Biacromial Diameter: With subject standing erect but relaxed and breathing quietly, the distance between the most lateral margins of the acromial processes of the scapulae were measured.

13. Antero-Posterior Chest Diameter: With subject in position as for biacromial diameter, the distance between the sternal angle and the fourth thoracic vertebral spinous process was measured.

14. Bi-iliac Diameter: With subject erect, the calipers were applied firmly to the most lateral margins of the iliac crests and the distance measured across the widest flare.

15. Antero-Posterior Diameter at Iliac Crest Level: With subject standing, and breathing quietly, the calipers were applied to the spinous process of the vertebra at the level of the iliac crests and to a parallel position over the mid-abdominal

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wall. In this instance only the caliper arm over the bony prominence was pressed firmly; the anterior arm touched but did not indent the skin.

16. Thigh Diameter: At the thigh, the calipers were placed in an antero-posterior positi parallel to the floor with the subject standing and relaxed. The caliper arms rested easil on the skin surface with no skin indentation made.

The following measurements (17-20) were made with Lange skin-fold calipers (Cambridge Scientific Instruments, Cambridge, Maryland) in accordance with the techniques described by the Interdepartmental Committee on Nutrition for National Defense (37). Spring tension of these calipers exert a pressure of 10 grams per square millimeter over a 40 square millimeter surface area. The right side was used except for those subjects having a right lower quadrant abdominal scar. In these subjects, the abdominal skinfold was measured on the left side.

17. Arm: With subject standing, right arm relaxed and flexed 90° at elbow, the calipers were applied adjacent to a grasped mid-posterior fold of skin and subcutaneous tissue at mid-arm level.

18. Scapula: With subject standing, a fold of skin and subcutaneous tissue over the inferior angle of the right scapula was grasped so as to parallel a line about 45 degrees from the horizontal level going medially upward. The calipers were applied to t skinfold adjacent to the grasping fingers.

19. Thorax: With subject supine, breathing quietly and knees raised to relax the abdominal muscles the skin and subcutaneous tissue over the right tenth rib was

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grasped parallel to the rib in the anterior axillary line and the calipers applied adjacent to the grasping fingers.

20. Abdomen: With subject in position as for thorax skinfold measurement, a fold of skin and subcutaneous tissue of the abdomen one inch to the right of the midline halfway between the umbilicus and the symphysis pubis was grasped so as to parallel the mid-abdominal line. The calipers were applied and the measurement read.

LABORATORY DETERMINATIONS

Laboratory determinations were usually done within two weeks after the anthropometric measurements. Women were studied when non-menstruating. The body weight and height were recorded at the time of the measurements for total body water and body density. If the weight differed by ± 2 percent of that obtained originally, the anthropometric measurements were retaken.

1. Body density determinations by the method of Siri (21), measured whole body volume in a closed-circuit system which utilizes a gas-dilution principle. With the subject in one chamber and helium in the other, the gases in the two systems are mixed. The helium concentration, measured by thermal conductivity, is related to the volume displacement by the subject. The standard deviation in volume determination is estimated at ± 0.12 liter. Since the error is little affected by absolute volume, the corresponding error in density ranges from ± 0.0024 g cm^{-3} for a 50 kg. subject to ± 0.0012 g cm^{-3} for a person weighing 100 kg.

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2. Total body water was measured after oral tracer dose of tritiated water given on the same day the body density was determined. The methods employed involved equipment and procedures in general use. Four to five timed urine specimens, collected within the first 24-hour period after the dose ingestion, were assayed for tritium with a Tri-Carb liquid scintillation coincidence counter (Packard Instrument Co., LaGrange, Ill.). The liquid scintillator formulated by Werbin et al (38) was used. Fifteen ml of scintillat with 2.0 ml water, the usual sample volume, counted with an efficiency of 17%. Samples were always recounted with an internal standard of tritiated water and appropriate corrections made for quenching. Vacuum distillation of urine specimens reduced the volume an appropriate amount. In general, errors in counting, pipetting, and weighing, ~~or other errors were~~ maintained well below 1% by suitable precautions.

3. Total body fat was calculated for each subject from the combined measurements of body density and total body water. The order of magnitude of the error of this calculation, based on the above values for the experimental errors in density and water determinations and for the variability in the combined densities for protein and mineral, has been found to be ± 1.7 percent of the total body weight (25). For a 70 kg individual the standard deviation in the determination of body fat is therefore ± 1.2 kg.

This error is smaller than that expected when body fat is estimated by either density or water measurements since fewer variables are unaccounted for. In addition this method is completely independent of the state of hydration of the subject.

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4. Whole Body Potassium^{40} (K^{40}) and Cesium ^{137} (Cs^{137})

Under the supervision of ~~T. Sargent, Ph.D.~~ T.S., K^{40} and Cs^{137} were counted using an Argonne type whole-body counter (39). Immediately before the subjects entered the counting chamber they showered (men also shampooed their hair while women shampooed their hair the night before, avoiding the use of hair sprays, rinses, etc.) and put on cotton garments and disposable slippers supplied by the laboratory. These precautions were taken to remove all traces of external activity such as potassium salts on the skin or scalp or from fallout, occasionally found in dust on hair, skin and clothing. Whole body counts were performed usually on the same day, and always within one week, of the body density and total body water measurements.

Cs^{137} activity was determined from the area under the 0.66 mev gamma photopeak of this isotope, potassium from the 1.46 photopeak of K^{40}. Cs^{137} counting efficiency was determined in a group of volunteers by injection of calibrated doses of Cs^{132} (half-life = 6.2 days).

Calibration of the counter for K^{40} was attempted by injection of known doses of K^{42} (half-life = 12.5 hours) into a small group of volunteer subjects. Development of a complete calibration curve was not possible owing to insufficient numbers. However an average counting efficiency of 1.09 cpm/gm $\pm$ 0.10 with a standard deviation of 9.7 percent was determined. The total body potassium for each subject was obtained by dividing K^{40} cpm by the efficiency factor. This standardization compares with

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the theoretical-empirical calibration obtained by Meneeley et al (40). The latter considers the subject's height and weight and yields values with a mean deviation of about 3.3 percent.

Diet and Physical Activity Assessment

Nutritionists (~~Elizabeth Hutson~~ E.H. and ~~Mary Rourke~~ M.R. during the first part of the study and ~~Elizabeth Hutson~~ E.H. and ~~Nancy Kunkel~~ N.K. during the last part of the study) interviewed individually each subject selected for dietary intake and physical activity estimate. Time for the interview was approximately thirty minutes and was conducted immediately after the anthropometric measurements were completed. Since selection of subjects was made at the time of the anthropometric measurements, these individuals were previously unaware they would be subjects for this phase.

The nutritionist asked the individual to describe his physical activity chronologically and by amount of elapsed time for the immediately preceding twenty-four hour period with the reference point as time of awakening. Concurrently, description of food eaten was recorded for each time of feeding.

Food eaten was described by kind, preparation and amount. Reference was made to food models, measuring cups, spoons, rulers and glasses of known volume. Whenever possible, composite ingredients for mixed dishes such as casseroles and sandwiches were noted. Weights or prices (to estimate weight) of individually packaged foods,

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candy bars, soft drinks, nuts, popcorn, beer, etc., were obtained when available. Brand names of special diet items were noted.

In addition to the detailed record of food eaten and time of feeding for the previous twenty-four hours, each individual was questioned concerning adherence to any special diet, use of vitamin supplements, of other food supplements, of 900 calorie preparations and of salt. Body weight change within the previous year was also recorded.

Calculations of intake of nutrients including calories, protein, fat and carbohydrate as well as alcohol were made using the method of the U.S.D.A. (41). This method is performed with IBM cards punched for the individual food code and the quantity unit consumed. Master cards for 512 different foods provide values for nine nutrients (42). Since the 517 diet records obtained in this study listed over 500 items or composites of individual foods not available in the master deck, additional master cards necessarily were calculated. Whenever feasible, substitutions were made for specific food items using nutrient comparable foods; i.e. chicken for turkey, cornstarch pudding for tapioca pudding or papaya for mango, etc.

Calculation by computer methods of nutrients consumed by two-hour intervals during the day as well as the total consumption in twenty-four hours was accomplished by use of appropriate coding techniques.

The twenty-four hours recalled were accounted for by times spent performing each of four arbitrary classifications of expended energy and sleeping. Table 2

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represents classification of physical activities as adapted from Passmore and Durnin (43). Since energy expenditure for comparable physical activity is greater with higher degrees of body weight, an attempt was made to define the body weights above which the arbitrary categories of caloric expenditure would be greater. Application of the regression equation for energy expenditure in slow walking (43), $C = 0.047W + 1.02$ in which C is energy expenditure in calories per minute and W is body weight in kilograms, was made for various weights. At body weights of 260 pounds and greater, activities grouped as light (2.5 - 4.9 cal./min.) were reclassified as moderate (5.0 - 7.4 cal./min.); and for body weights 310 pounds and greater, moderate activities were reclassified as strenuous

Somatotyping Technique

Somatotyping was carried out, according to the technique originated (33) and modified by Sheldon (44), at the Cowell Memorial Hospital Constitutional Research Laboratory, University of California, Berkeley, under the direction of Henry B. Bruyn, M.D.

This procedure determines the position of the physical constitution of an individual within a three dimensional taxonomy which includes the normal variations of human physique. A somatotype is a point in space where three determining parameters cross, or simply, where three metric distributions cross. These are height, trunk index and ponderal index; the latter two are defined (vide infra). Tables* based upon these parameters, determined for over 5,000 subjects, present the distribution of the

* These unpublished tables are six in number for each sex; one set for each of the following age groups by sex: 1) 18 years and less, 2) 18-23 years, 3) 24-28 years, 4) 29-33 years, 5) 34-38 years and 6) 39-43 years.

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specific somatotype. The latter can be mechanically determined from these tables in the same manner by which various number functions are obtained from mathematical tables.

Height, weight and standardized medical black and white photographs were taken. The maximum weight experienced by the subject at any age was recorded. From these data the somatotype ponderal index and trunk index were determined. The somatotype ponderal index is the determined height divided by the cube root of the maximum experienced weight. Trunk index is the ratio of the thoracic area to the abdominal area, as measured with a planimeter on the dorsal photograph. When the trunk index equals 1.45, mesomorphy and endomorphy are equal. A high trunk index indicates predominance of mesomorphy over endomorphy while a low ratio indicates emphasis on endomorphy.

By the use of the tables, the somatotype, described in terms of three components, was determined from the subject's height, trunk index and the somatotype ponderal index. The somatotype components, endomorphy, mesomorphy and ectomorphy are measured on a 13 point scale, 1 to 7, with intervals of ½ unit, i.e. 3½, 4,3. Data accumulated on several thousand subjects (44) have established standards for each component as follows:

Component	Males Range	Females Mean
Endomorphy	3½ to 4	5
Mesomorphy	4 to 4½	3
Ectomorphy	3 to 3½	3

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Additional descriptive classifications for both men and women were accumulated from the somatotype photographs on the basis of more subjective interpretations.

These are:

1. a rating for structural masculinity termed "a" or andric. Mean values for both men and women equal 22.

2. a rating for structural feminity termed "g" or gynic. Mean values for both men and women equal 22.

3. the ratio of a/g. Mean values for both men and women equal 1.0.

4. a measure of the degree of skin pigmentation termed B.I. or color index. From the photographs, comparison of skin color of the least exposed area of the body was made with a black and white value scale photographed with the individual. Higher numbers indicate a greater degree of pigmentation. In this study only the men were so measured.

5. a measure of similarity of the somatotype in different regions of the body and the balance of bone to muscle termed "SI_2"* or structural integration 2. The mean for both men and women is 22 and is an inverse ratio of the degree of dysphasia between body regions.

6. a measure of detail or refinement of structure of all the somatotype segments of the body termed "SI_3" or structural integration 3. For both sexes the mean is 22.

* SI_1 is defined as a measure of symmetry and was omitted in this study.

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Summary

A valid clinically applicable anthropometric method to estimate body fat in adults would aid in the epidemiologic study of diseases associated with overweight. Such a method has been developed from anthropometric measurements of 2053 healthy white men and women and Negro men aged 25 through 44 years and laboratory determinations of body density, total body water, whole body potassium-40 for about 8 percent of all subjects.

Methods used have been presented; those for anthropometry have been detailed for reproducibility by interested clinicians.

Methods for studying additional parameters associated with body composition: diet, physical activity and somatotype are given. Cesium 137 methodology has been described.

Subsequent papers will present regression equations for estimating body fat and interrelationships of studied factors.

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TABLE 1

NUMBER OF PARTICIPANTS

Race	Sex	Age in Years	Anthropometric Measurement	Interview	Laboratory Measurement: TBW and Specific Gravity	Laboratory Measurement: K40, Cs137	Somato-type	Somatotype and Labobatory Measurements
White	Males	25-34	478	107	35	23	119	9
		35-44	416	106	34	25	21	4
	Females	25-34	379	101	33	12	17	1
		35-44	438	101	31	16	9	1
Negro	Males	25-44	342	102	34	4	-	-
		Subtotal	2053	517	167	80	166	15
Negro	Females	25-44	154					
Oriental	Males	25-44	32					
	Females	25-44	44					
Other	Males	25-44	15					
	Females	25-44	6					
		Total	2304	517	167	80	166	15

Note: TBW = Total Body Water
K40 = Potassium-40
Cs137= Cesium-137

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TABLE 2
CLASSIFICATION OF WORK AND EXERCISE

Very Light (<2.5 cal./min.)	Light (2.5-4.9 cal./min.)	Moderate (5.0-7.4 cal./min.)	Strenuous (>7.5 cal./min.)
Standing, at base	Personal care	Walking, mod. to fast	Running
Lying	Walking, slowly	Walking, mod. up hill	Walking fast up hill
Sitting	Standing using arm movement	Housework, stooping and bending	Climbing a ladder Skiing
Sitting, using arm movements	Housework except stooping and bending	Swimming	Walking in snow
Reading	Light gardening	Heavy gardening	Digging
Writing Knitting	Driving car, motorcycle	Tennis	Sawing wood
Sewing	Golfing	Dancing	Planing wood
Typing	Carpentry work	Bicycling	Shoveling
Light machine work	Gymnastic exercises, except hopping	Bowling	Carrying load upstairs
Light assembly line	Mixing cement	Gymnastic exercises, hopping and swinging arms	Playing football
	Playing with child	Stacking firewood Using pickaxe Pushing wheelbarrow	Chopping with an axe

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Kind appreciation is expressed to the following participating groups for making their employees or members available for this study. To those who volunteered as subjects ~~for the study~~ sincerest appreciation is extended. Without their support and interest this work would not have been possible.

Alameda County Employees

Alta Bates Hospital

Berkeley City Employees

Berkeley League of Women Voters

Berkeley Tennis Club

California Packing Corporation

California State Department of Health

California State Department of Public Works (Toll Plaza)

City of Oakland Employees

Durkee Famous Foods, Inc.

Emporium

Fireman's Fund Insurance Company

Gerber Products Company

International Business Machines

International Toastmistresses Club

League of Women Voters, Berkeley

Mary Ellen Jams and Jellies, Inc.

Men of Tomorrow

Metropolitan Life Insurance Company

Moore Business Forms

Mount Everest Expedition Team

Saint Cyprian's Episcopal Church

San Francisco General Hospital

San Jose City Health Department

San Mateo County Health Department

Santa Clara County Health Department

Shell Oil Company

Standard Oil Company

University of California Staff and Students (Berkeley)

University of California Workshop

U.S. Department of Agriculture

Extension Service and Western Regional Laboratories

U.S. Naval Supply Center

U.S. P.H.S. Hospital

Women's Auxiliary, Berkeley City Firemen

Women's Auxiliary, Berkeley City Policemen

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Ranges, Means and Standard Deviations for Somatotype, Determined and Estimated Body Composition and Anthropometric Measurements for 12 Men

	Mean	S.D.	Range	Median
Age, years	30.2	--	24 - 41	29.0
Endomorphy	36.5	11.715	15 - 60	
Mesomorphy	42.9	8.529	30 - 60	
Ectomorphy	33.3	12.134	10 - 55	
% Under Somatotype Wt.	13.2	10.566	3 - 41	
Andric	22.3	1.795	20 - 26	
Gynic	22.0	1.155	20 - 24	
Kg Determined Body Fat	14.1	6.670	6.0- 28.2	
Kg Determined LBM	56.5	5.537	49.4- 68.2	
% Body Wt. Det. as Fat	19.4	7.046	8.3- 33.4	
Kg Est. B.F.	14.0	6.145	6.0- 23.5	
Kg LBM	56.4	5.200	47.8- 66.8	
% Body Wt. Est. as Fat	19.3	6.588	10.3- 27.5	
T. Body Wt., pounds	154.9	20.365	128.6-196.8	
Height, cm	179.2	6.280	165.2-188.6	
Biac. D., cm	39.1	2.019	35 - 42	
AP Chest D., cm.	16.2	2.165	14 - 22	
Bi-iliac D., cm	29.3	3.448	26 - 40	
Chest C., cm	93.3	7.846	80 -112	
Waist C., cm	78.4	6.837	69 - 90	
Iliac C.C., cm	86.2	9.619	76 -105	
Arm C., cm	31.1	1.891	28 - 33	
Wrist C., cm	17.2	0.898	16 - 18	
Thigh C., cm	50.4	2.900	45 - 55	
Ankle C., cm	21.5	1.190	20 - 24	
Arm Length, cm	38.4	1.847	36 - 42	
Thigh Length, cm	40.9	4.172	36 - 52	
R. Arm SF, mm	7.8	4.580	3 - 18	
R. Scap SF, mm	11.1	5.823	6 - 24	
Thor S.F., mm	11.3	7.542	4 - 30	
Abd SF, mm	13.3	11.025	4 - 42	
Ave. SF., mm	10.9	6.518	5.0- 25.2	
Gubner	39.6	3.303	34 - 45	
Ponderal	13.2	0.507	12.4- 14.2	
% Std. Wt.	96.2	10.771	77 -112	
AP Iliac, cm	20.4	0.800	20 - 22	
Thigh D., cm	15.5	0.500	15 - 16	

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Ranges, Means and Standard Deviations for Somatotype, Estimated Body Composition and Anthropometric Measurements for 26 Women

	Mean	S.D.	Range	Median
Age, years	33.2	--	25 - 43	33.0
Endomorphy	50.1	8.752	20 - 65	
Mesomorphy	34.4	8.806	10 - 50	
Ectomorphy	31.4	11.429	10 - 50	
% Under Somatotype Wt.	16.8	7.024	7 - 35	
Andric	23.0	3.246	16 - 34	
Gynic	21.6	2.150	14 - 24	
Kg Est. Body Fat	19.3	4.898	9.2- 30.4	
Kg Est. LBM	39.7	4.326	32 - 48.8	
Est. % Body Wt. as Fat	32.4	5.741	19.7- 43.7	
T. Body Wt., pounds	129.2	16.165	102.6-165.1	
Height, cm.	165.2	6.244	153.3-178.4	
Biacr. D., cm	35.3	2.385	30 - 40	
AP Chest D., cm.	15.5	1.247	14 - 18	
Biiliac D., cm	27.5	1.599	25 - 30	
Chest C., cm	84.3	3.658	78 - 92	
Waist C., cm	68.9	3.856	60 - 76	
Iliac Cr. C., cm	85.7	6.421	73 - 99	
Arm C., cm	27.2	2.161	22 - 31	
Wrist C., cm	14.8	0.818	14 - 16	
Thigh C., cm	51.1	4.521	43 - 63	
Ankle C., cm	20.8	1.520	18 - 25	
Arm Length, cm	34.5	2.080	30 - 38	
Thigh Length, cm	39.3	4.520	22 - 46	
R Arm SF, mm	19.4	6.306	6 - 34	
R Scap. SF, mm	13.8	5.715	8 - 28	
R Thor SF, mm	13.2	5.487	5 - 26	
Abd SF, mm	25.8	10.753	9 - 54	
Ave SF, mm	18.0	5.998	8.5- 31.0	
Gubner Index	37.7	2.565	33 - 42	
Ponderal Index	12.9	0.483	11.9- 13.7	
% Standard Weight	103.0	11.024	87 -127	

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Ranges, Means and Standard Deviations for Somatotype, Weight & Body Circumference and Anthropometric Measurements for [illegible]

	Mean	S.D.	Range	Median
Age, years	29.7	--	24 - 43	28.2
Endomorphy	41.7	8,557	10 - 63	
Mesomorphy	44.2	8.475	25- - 65	
Ectomorphy	29.1	10.797	10 - 60	
% under S.W.	11.3	6.972	0 - 34	
Andric	22.5	2.061	18 - 32	
Gynic	22.7	1.538	18 - 26	
Kg est. Body Fat	19.3	6.394	3.3- 37.9	
Kg est LBM	55.9	5.165	45.1- 73.4	
% Body Wt. est. Fat	25.2	6.224	6.3- 41.6	
T. Body Wt. pounds	165.5	20.409	114.6-244.7	
Height, cm	179.1	5.883	167.0-194.4	
Biac. D., cm	40.1	1.801	36 - 44	
AP Chest D., cm	16.7	1.351	14 - 21	
Bi-iliac D., cm	29.5	2.019	26 - 39	
Chest C., cm	95.7	5.527	82 -117	
Waist C., cm	83.2	6.745	68 -112	
Iliac Cr. C., cm	89.7	7.614	73 -116	
Arm C., cm	31.4	2.502	24 - 41	
Wrist C., cm	17.4	0.903	16 - 20	
Thigh C., cm	52.7	3.571	43 - 65	
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	
Thigh Length, cm	40.1	3,019	22 - 49	
RASF, mm	11.7	4.549	3 - 23	
R Scap SF, mm	11.6	3.662	6 - 24	
R Thor SF, mm	13.2	5.748	4 - 36	
Abd SF, mm	16.5	9.429	4 - 50	
Ave SF, mm	13.3	5.286	4.2- 32.8	
Gubner Index	37.8	3.208	25 - 45	
Ponderal Index	12.9	0.487	11.0- 14.1	
% S.A. W.	102.7	11.212	76 -158	
AP Iliac Crest, cm	22.8	5.027	18 - 44	
Thigh D., cm	16.2	1.214	13 - 20	

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LOW-BEER, B. V. A.

"Radioactive Phosphorus as an External Therapeutic Agent in Basal Cell Carcinoma, Warts and Hemangioma."

The American Journal of Roentgenology and Radium Therapy, 58:4-9, 1947.

G. 0 T. 4 I. 5

Superficial skin diseases were successfully treated with direct application of radioactive phosphorus (P^{32}) to the area of the lesion. Office type blotting paper, 0.4 mm thick and weighing 21 mg. per square centimeter, is cut to the size of the lesion with a 0.3 - 1.0 cm margin and backed with adhesive tape and dried. It is then soaked in active Na HPO solution, dried, and secured to the area of the lesion with adhesive tape. The threshold erythema dose was found to be 34 uc per sq. cm; mild erythema was produced by 620 uc per sq. cm. and severe epidermitis by 4400 uc per sq. cm. Treatment doses for basal cell carcinoma, hyperkerotosis, verruca, plantor wart, subungal wart, and hemagioma varied from 300 to 5000 uc - hr. per sq. cm. depending upon the size and type of lesion. Of the lesions treated, 88.6 to 100 percent disappeared without recurrance.

William Siri

Berkeley, California

1172884