VITAL & HEALTH STATISTICS

Obese and Overweight Adults in the United States

Estimates of obesity of U.S. adults ages 20-74 years were obtained from skinfold thickness, and overweight was estimated from weight–height measurements. Comparisons are made between methods, and estimates are presented based on cross-classification of the two methods.

Data From the National Health Survey Series 11, No. 230

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Symbols

- - - Data not available

. . . Category not applicable

- Quantity zero

0.0 Quantity more than zero but less than 0.05

Z Quantity more than zero but less than 500 where numbers are rounded to thousands

* Figure does not meet standards of reliability or precision (more than 30 percent relative standard error)

Figure suppressed to comply with confidentiality requirements

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Obese and Overweight Adults in the United States

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Introduction

This report presents estimates of the prevalence of obesity and overweight in the U.S. civilian non-institutionalized population 20-74 years of age by sex and age. These estimates are based on body measurements obtained from the first National Health and Nutrition Examination Survey conducted by the National Center for Health Statistics in 1971-74. The National Health and Nutrition Examination Survey was designed to measure the nutritional status of the United States population as well as certain aspects of general health status and medical care needs. A nationwide probability sample of 28,043 persons was selected to be examined in 65 primary sampling units visited between April 1971 and June 1974.

The survey included a general medical examination by a physician for indicators of nutritional deficiencies, a skin examination by a dermatologist, and a dental examination by a dentist. Body measurements were taken by a trained technician. A dietary interview was administered consisting of a 24-hour recall of food consumption and a food-frequency questionnaire. Laboratory tests were performed on whole blood, serum, plasma, and urine. A description of the sampling process and survey content and operation was published previously.[1]

Findings in this report are based on examinations of 13,131 persons from a probability sample of 18,816 persons ages 20-74 years selected to represent 122 million persons of these ages in the population. The examination response rate was 70 percent, and findings are shown as national estimates based on weighted observations. Appropriate weights were used to account for sampling fractions and survey response results with a final adjustment to closely aline population estimates with the independent U.S. Bureau of Census estimates for the U.S. civilian non-institutionalized population as of November 1, 1972, by race, sex, and age.

In this report, distinctions are made between the terms "obesity" and "overweight." *Obesity* is an excess of body fat; *overweight* is an excess in body weight relative to standards for height. Obesity, defined by triceps plus subscapular skinfold measurements, reflects adipose tissue. Obesity determined by weight indexes, independent of a fat measurement, commonly is defined as overweight. Overweight reflects several tissues—bone, muscle, and adipose—and is measured by using two types of weight indexes that differ in the manner in which they include height.

The most commonly used method to measure overweight is to compare the height and weight of persons with tables of standard weights, referred to as "relative body weight." Another method used is the "power function" of height in relation to weight obtained by calculating a power function of height in a weight-height index (W/H^P in kilogram/meter^P). The weight indexes allow individuals to be classified as overweight or underweight. Because obesity and overweight are not synonymous, the relationship is analyzed between the obesity measure and the overweight measure, which traditionally is used to estimate the prevalence of obesity. The analysis aids in determining whether overweight measures are reliable estimates of obesity and may be used interchangeably with independent measures of obesity.

Estimates of obesity also are obtained by cross-classifying triceps plus subscapular skinfold measurements with weight indexes, assuming that the weight indexes are a measure of body size. Because fat content of the individual is not the only body measurement that can account for the difference in body composition of the obese and the nonobese, this approach provides an estimate of body size in assessing obesity.

Because no critical values of overweight and obesity have been identified at which cardiovascular or other morbidity predictably occur, in this report, overweight and obesity in adults were statistically defined at the 85th, 90th, and 95th percentiles for men

and women ages 20-29 years. These criteria follow the principle of "ideal weight"—in adults, increase in body weight with age is undesirable and, after the twenties, an individual should not gain weight (presumably fat) with each year of age. Although not ideal for some persons in the age group 20-29 years (average age of 24 years), the standard minimizes the observed increase in fat in men and women during maturity and is not based on morbidity or mortality experience of the survey population.

Table A presents triceps plus subscapular skinfold measurements, relative desirable weight, and weight-height index values at selected percentiles of defining obesity and overweight in men and women. The mean of these measurements plus one standard deviation of the distributions of the measurements is almost equal to the values derived from the 85th percentiles and is slightly less than the 90th percentiles. The mean of measurements plus two standard deviations showed almost equivalent values derived from the 95th percentiles. Data at the 85th, 90th, and 95th percentiles are presented, but only data at the 85th and 95th percentiles are discussed.

Another estimate was made by cross-classifying the measures of overweight with the measures of obesity. The resulting interrelationship of the two distributions of underweight and overweight and leanness and fatness then was examined. This method determined to what degree excess weight over a given standard for weight and height measurements was accounted for by excess fat or the relative contribution of fat to the overweight status of individuals. It considers that fat is not the only component of body composition that accounts for the difference between obesity and nonobesity of individuals. The determination of relative fatness of individuals is of primary importance because obesity is associated with excess mortality and morbidity.

From the combined distribution, results were classified into several excess weight categories. Prevalence data were obtained on weight categories pertaining only to the presence and absence of obesity, obese not overweight, overweight not obese, and overweight and obese. The cross-classification between overweight and obesity described previously also was prepared between weight-height index and triceps plus subscapular skinfold measurements.

The schematic representation of the cross-classification is presented in figure 1. The 15th and 85th percentile cutting points are used in the illustration. This illustration also applies to the 90th and 95th percentile cutting points, with the exception of cell 5, which was not used as a weight category at the 95th percentile cutting point. Underweight and lean individuals are in cell 1 (<15th percentile of the distribution of triceps plus subscapular skinfold measurements and relative desirable weight or weight-height index); average weight and medium obese individuals are in cell 3 (≥15th-<85th, ≥15th-<90th percentiles of the distribution of triceps plus subscapular skinfold measurements and relative weight or weight-height index); obese not overweight individuals are in cell 2 (the ≥85th, ≥90th, and ≥95th percentiles of the distribution of triceps plus subscapular skinfold measurements and the <85th, <90th, and <95th percentiles of the distribution of relative desirable weight or weight-height index). Overweight not obese individuals are in cell 4 (the ≥85th, ≥90th, and ≥95th percentiles of the distribution of relative desirable weight or weight-height index, and the

Table A. Distribution of obesity[1] and overweight[2,3] values at selected percentiles of criteria measures, by sex: United States, 1971-74

Obesity and over-weight measures	Men						Women					
	Percentile			Mean	Standard deviation	Mean plus two times standard deviation	Percentile			Mean	Standard deviation	Mean plus two times standard deviation
	85th	90th	95th				85th	90th	95th			
Obesity												
Triceps plus subscapular skinfold in millimeters[1]	38.0	43.0	51.0	25.9	13.0	51.9	52.0	58.5	68.0	36.2	16.0	68.2
Overweight												
Relative desirable weight[2]	114	118	130	99	16	131	115	123	139	98	20	138
Weight-height index[3]	28.0	29.0	32.0	24	4	32	34.0	37.0	42.0	29	6	41

[1]Obesity—triceps plus subscapular skinfold thickness.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight adjusted for height times 100 based on average weights estimated from regression equations of weight on height for men and women ages 20-29 years.
[3]Weight to the power of height ratio, where p = 2 for men, and p = 1.5 for women.

NOTE: Criteria of obesity and overweight are at the 85th, 90th, 95th percentiles or more with measurements for persons ages 20-29 years as the standard.
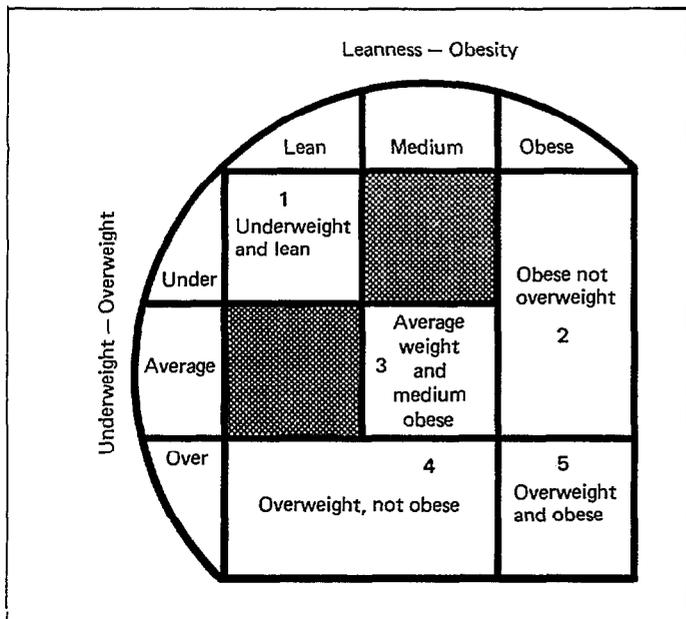
Figure 1. Cross-classification of the distribution of relative desirable weight and triceps plus subscapular skinfold measurements: United States, 1971-74

<85th, <90th, and <95th percentile of the distribution of the triceps plus subscapular skinfold measurements); and overweight and obese individuals are in cell 5 (the ≥85th, ≥90th, and ≥95th percentiles of

the distribution of relative desirable weight or weight-height index and triceps plus subscapular skinfold measurements.

The mean values of weight categories obtained by cross-classifying triceps plus subscapular skinfold measurements with relative desirable weight or weight-height index at selected percentiles are shown in tables 1 and 2. The mean values, as expected, are related to the weight categories.

Two kinds of statements throughout the text concern differences in prevalence rates of weight categories: (1) statements based on results of tests of hypotheses or significance tests, and (2) statements based on observed differences (not tested for statistical significance but may be of interest from a descriptive standpoint). To enable the reader to differentiate between the two types of statements in the text, the terms "statistically significant" and "not statistically significant" are used to indicate all "tested" differences in the prevalence rates of weight categories, and the term "observed" is used to indicate that the differences in the percent values may be of interest but are not "tested" for statistical significance.

Highlights

Obesity, which refers to a surplus of body fat, is defined by the sum of triceps and subscapular skinfold thickness measurements. Overweight, which refers to an excess in body weight, is defined by two indexes: (1) Relative weight—expressed as the deviation of observed weight from the NHANES table of desirable weights. (2) Weight-height index—weight divided by a power function of height. All three of the measures use ages 20-29 as the standard.

Estimates of the number and the percent of adult men and women in the civilian noninstitutionalized population of the United States who were obese or overweight by each of these measures are shown in table B. The estimates are also shown by three percentile levels to demonstrate the effect of changing the criterion on the estimated prevalence.

- There were 11 million men, 19 percent of the adult males in the United States, who were obese using the 85th percentile.
- The proportion of men who were overweight was significantly higher than the proportion of men who were obese regardless of which measurement of overweight was used.
- At the 95th percentile there were no significant differences in the prevalence regardless of which of the three measures were used. The three measures can be used interchangeably to estimate prevalence.
- There were 18 million women, 28 percent of the adult females in the United States, who were obese using the 85th percentile.

Table B. Number and percent of population overweight and obese ages 20-74 years at selected percentiles of criteria measures, by sex: United States, 1971-74

Overweight and obese at selected percentiles	Men		Women	
	Estimated number in millions	Percent of adult population	Estimated number in millions	Percent of adult population
85th percentile or more				
Overweight				
Relative desirable weight	13.3	23.2	18.9	29.5
Weight-height index	13.1	22.8	19.0	29.5
Obesity				
Triceps plus subscapular skinfold	11.1	19.4	17.7	27.7
90th percentile or more				
Overweight				
Relative desirable weight	9.9	17.1	13.4	20.8
Weight-height index	9.5	16.5	12.0	18.8
Obesity				
Triceps plus subscapular skinfold	6.9	12.0	11.4	17.8
95th percentile or more				
Overweight				
Relative desirable weight	3.5	6.0	6.2	9.6
Weight-height index	3.3	5.8	5.4	8.3
Obesity				
Triceps plus subscapular skinfold	2.9	5.1	5.5	8.5

- The proportion of adult women who were overweight was significantly higher than the proportion who were obese regardless of which measurement of overweight was used.

- At the 95th percentile, there are no significant differences in the prevalence regardless of which of the three measures were used. The three measures can be used interchangeably to estimate prevalence.

- Regardless of which measure or cutoff level was used, prevalence rates were higher for women than for men.

Estimates of the number and the percent of adult men and women who were both obese and overweight, who were obese but not overweight, and who were overweight but not obese are shown in table C.

- About 13 percent or 7 million of the adult men in the United States were both obese and overweight using the 85th percentile.

- This was significantly higher than the proportion who were obese but not overweight and overweight but not obese.

- The method of measuring overweight made no difference in the estimate at the 95th percentile.

- About 22 percent or 14 million of the adult women were both obese and overweight using the 85th percentile.

- This was significantly higher than the proportion who were obese but not overweight and overweight but not obese.

Table C. Number and percent of population overweight and/or obese ages 20-74 years below and above selected percentiles of criteria measures, by sex and method of determining weight status: United States, 1971-74

Overweight and obese at selected percentiles	Men				Women			
	Cross-classification of triceps plus subscapular skinfold				Cross-classification of triceps plus subscapular skinfold			
	With relative desirable weight		With weight-height index		With relative desirable weight		With weight-height index	
	Estimated number in millions	Percent of adult population	Estimated number in millions	Percent of adult population	Estimated number in millions	Percent of adult population	Estimated number in millions	Percent of adult population
85th percentile cutting point								
Overweight								
and obese	7.3	12.7	7.3	12.6	13.8	21.5	13.9	21.6
not obese	6.0	10.5	5.9	10.2	5.1	8.0	5.1	7.9
Not overweight								
obese	3.8	6.6	3.9	6.7	3.9	6.1	3.9	6.0
90th percentile cutting point								
Overweight								
and obese	4.5	7.9	4.4	7.7	8.4	13.2	8.0	12.5
not obese	5.3	9.3	5.1	8.8	4.9	7.6	4.0	6.3
Not overweight								
obese	2.4	4.1	2.5	4.3	3.0	4.6	3.4	5.3
95th percentile cutting point								
Overweight								
and obese	1.6	2.8	1.6	2.7	3.4	5.3	3.2	5.0
not obese	1.8	3.2	1.8	3.1	2.7	4.3	2.2	3.4
Not overweight								
obese	1.3	2.3	1.4	2.4	2.1	3.2	2.3	3.6

Methods

Anthropometric measurements

The first National Health and Nutrition Examination Survey (NHANES I) was staffed with two highly trained examination teams. Two mobile examination centers, which could be moved to a central location in each of the primary sampling units, were used. Selected sample persons for whom appointments could be made were brought into the examination centers. Examinees changed from street clothing into disposable paper examination uniforms and foam rubber slippers designed to facilitate and standardize various parts of the examination. Body measurements were made at various times of the day at each examination center and in different seasons of the year; therefore, body measurements were not standardized for diurnal and seasonal variations. Weights vary between winter and summer and may differ depending upon recency of food and water intake.

Using standardized anthropometric equipment, trained technicians made multiple measurements until two results agreed within specified limits. One member of the examining teams observed and corrected any errors in the measurement technique, aided in positioning the examinee, and recorded information.

When possible, all measurements were taken on the right side of the body. Measurements were taken on the left side if the right side could not be used because of casts, amputations, or any other reason. Detailed explanations of the procedures used to determine the body measurements discussed in this report follow.

Height.—For height measurements, adults wore disposable foam rubber slippers and stood with their feet together and their backs and heels against the upright bar of the height scale. Examinees' heads were approximately in the Frankfort horizontal plane (examinees were instructed to "look straight ahead"). They stood erect (they were told to "stand up tall" or "stand up real straight"); assistance and demonstration were provided when necessary. Upward pressure was not exerted by the examiner on subjects' mastoid processes to "stretch everyone in a standard manner," as is recommended by some.[1]

The equipment consisted of a level platform with a vertical bar attached with a steel tape. A horizontal bar was attached perpendicularly to the vertical bar and was lowered snugly on the examinee's head. In the same plane as the horizontal measuring bar, a Polaroid camera was attached to another bar; the camera was used to record the subject's identification number next to the pointer on the scale giving a precise reading. The camera not only gave a permanent record (minimizing observer and recording error) but, by sliding up and down with a horizontal bar and always being in the same plane, the camera also completely eliminated parallax. If the pointer had been in the space in front of the scale, it would have been read too high if the observer had looked up at the scale from below or too low if read from above.

Weight.—A Toledo self-balancing scale was used that mechanically printed the weight to one quarter of a pound directly onto the permanent record. This direct printing minimized observer and recording errors. The scale was calibrated with a set of known weights, and any necessary fine adjustments were made at each new location before examinations began, that is, approximately every month. The recorded weight to the nearest 0.25 pound was later transferred to a punched card. The total weight of all clothing worn ranged from 0.20 to 0.62 pounds; this was not deducted from weights presented in this report. The examination clothing used was the same throughout the year, which eliminated seasonal variation in the weight of clothing.

Skinfold measurements.—Skinfold measurements were taken with a Lange skinfold caliper calibrated to exert a pressure of 10 grams per square millimeter of jaw surface, as suggested by the *Recommendations Concerning Body Measurements for the Characterization of Nutritional Status.*[2] The precision of the caliper was tested daily against metal standards of known widths.

Triceps—The skinfold caliper measure was read to the nearest half of a millimeter. The thickness of a skinfold plus subcutaneous tissue (but no muscle) was taken over the right midtriceps at the level previously marked. The crest of the skinfold was parallel to the long axis of the arm. The technician held the calipers about 1 cm below thumb and forefinger. The fingers were not released when taking the triceps or any other skinfold measurements. A second measurement was taken and, if the two measurements disagreed by more than 1mm, they were repeated until they agreed within 1 mm. If a skinfold was too tight to be measured, "too tight" was written in the recording space for that measurement.

Subscapular—The thickness of a skinfold was taken just below the angle of the right scapula, with the subject's shoulder and arm relaxed. The subscapular measurement was recorded to the nearest mm. The fold was parallel to the natural cleavage lines of the skin—often a line about 45 degrees from the horizontal extending medially upward. As previously, two measures were taken until two were obtained that agreed within 1 mm.

Several methods are currently used to determine the amount of fat in individuals. Some methods require expensive and elaborate laboratory procedures;[3] others need minimum hardware, yet yield suitably accurate results if performed properly, such as measurement of skinfold thickness. Rather than measuring chemically extracted fat, this method involves the measurement of a double fold of subcutaneous tissue plus skin, pulled away from the underlying tissue by the observer at a selected site on the body.

The validity of skinfold measurements rests upon two assumptions: (1) the measurement of the thickness of the subcutaneous layer of fat will reflect suitably the total body fat of an individual, and (2) certain sites are correlated well enough with the entire subcutaneous layer so that relatively few measurements will accurately estimate its thickness. Both of these assumptions are considered sound enough that the exceptions to them do not vitiate the use of skinfold measurements in the study of body composition in large population samples.

Taking skinfold measurements has distinct advantages. The measurement does not require elaborate, expensive, or time-consuming procedures. Rather, trained technicians, using standardized calipers spring loaded to a constant tension to ensure uniform compression of the tissue, are able to measure skinfolds quickly and at an acceptable level of accuracy and replicability, if the measurement is performed with suitable skill and care. This method is the most applicable method for the large-scale studies necessary to determine within and between population studies. It is also the method suited for studies that are conducted away from sophisticated physiological laboratories.[3-5]

Findings

Obesity measurement — skinfold thickness

Cumulative percent distributions of triceps plus subscapular skinfold measurements for men and women ages 20-74 years are presented in tables 3 and 4. Table 5 summarizes the distributions in terms of basic statistics for men and women by age. In addition to listing the number of adults examined and the estimated number in the United States population, the tables include means, standard deviations, and selected percentiles. Table 5 also presents the skinfold thickness values of men and women 20-29 years of age at the 85th, 90th, and 95th percentiles. The values at these percentiles were the cutoff levels to estimate the prevalence of obesity. Table 6 presents the estimates of obesity in the United States for all three percentiles by sex and age. Estimates of the standard error are presented in appendix I, table III.

In the United States, 19.4 percent of the men (an estimated 11.1 million) ages 20-74 years were obese at the 85th percentile criterion ($\geqslant$38.0 mm) in 1971-74. At the 85th percentile or more criterion ($\geqslant$52.0 mm), obesity was significantly more prevalent among women—27.7 percent, or an estimated 17.7 million— than among men of comparable ages. In each age group, 35-74 years, the proportions of women obese were significantly higher than the proportions of men with the highest prevalence of obesity at ages 45-54 years for men and women.

At the 95th percentile criterion ($\geqslant$51.0 mm), 5.1 percent (an estimated 2.9 million) of the men were obese. The corresponding estimate for women ($\geqslant$68.0 mm) was 8.5 percent (an estimated 5.5 million). The percent of women who were obese significantly exceeded that among men at the 95th percentile. In each age group, 35-74 years, the proportion of women obese was significantly higher than the proportion of men obese. There was no significant or consistent age-related trend for men. For women, the percent increased significantly from ages 20-24 to 25-34 years. Thereafter, the increase was slight and

inconsistent with a significant decline occurring in the oldest age group.

Overweight measurements

Overweight implies excessive weight relative to some standard, with no direct measurement of fat. These standards are of two types. One is overweight obtained by comparing the observed weight with those shown in the NHANES I table of desirable weights for given height and sex (table D). Overweight status is the deviation of observed weight from desirable weight multiplied by 100 (referred to as

Table D. Desirable weights[1] for men and women ages 20-74 years by height: United States, 1971-74

Height	Weight in pounds	
	Men	Women
57 inches	---	113
58 inches	---	117
59 inches	---	120
60 inches	---	123
61 inches	---	127
62 inches	136	130
63 inches	140	134
64 inches	145	137
65 inches	150	140
66 inches	155	144
67 inches	159	147
68 inches	163	151
69 inches	168	154
70 inches	173	158
71 inches	178	---
72 inches	182	---
73 inches	187	---
74 inches	192	---

[1]Based on average weights estimated from regression equation of weight on height for men and women ages 20-29 years.

NOTES: Height measured without shoes. Clothing ranged from 0.20 to 0.62 pounds, which was not deducted from weights shown. Derived from data of the National Health and Nutrition Examination Survey, 1971-74.

relative desirable weight). The desirable weight was developed using regression equations of weight on height measurements for men and women ages 20-29 years. The result was used as the standard for desirable weight (appendix I, table IV). These desirable weights were used to predict relative desirable weights for all persons in the NHANES I population 20-74 years of age.

The second standard weight uses the average weight of men and women of specific age groups as the standard to calculate relative weights. Standard weights were developed using regression equations of weight on height for men and women for each age group (appendix I, table IV). This type of standard assumes that average weight increases with age.

Standards derived from sex and age-specific mean weight for height in this report are not presumed to indicate desirable weight but only to present a reference base for an individual's observed weight. They show estimates under and over excess body weights of men and women based on selective body measurements by age and were not used to estimate the prevalence of overweight in the U.S. population from NHANES I data. For this purpose, desirable weights of men and women ages 20-29 years were used as the standards or criteria. Desirable weights are based on the concept that after growth in height in adults has stopped, there is no need to gain weight, presumably fat, in adulthood. However, no estimates of fat other than what can be inferred from the deviation of observed weight from desirable weight are available. Such gross estimates will not yield information of how much of the weight difference is accounted for by excess fat.

Relative desirable weight

The cumulative percent distribution of relative standard and desirable weights of men and women ages 20-74 years are presented in tables 7-10. Tables 7 and 8 show the relative standard weight values when the standard is based on the average weight for height, sex, and age. Tables 9 and 10 show the relative desirable weight values when the standard is based on the average weight for height of men and women ages 20-29 years.

Tables 11 and 12 summarize the distributions of the relative standard and desirable weight in terms of basic statistics for examined persons by age and sex. In addition to listing the number of persons examined and the estimated number in the U.S. population, the tables include means, standard deviations, and selected percentiles. Table 12 presents the relative weight values of men and women ages 20-29 years at the 85th, 90th, and 95th percentile. The values at these percentiles were the criteria selected to estimate the proportion of overweight persons in the U.S. population. Table 13 presents the estimates of over-

weight persons at the selected cutoff levels by sex and age. Estimates of standard error are presented in appendix I, table III.

At the cutting point of the 85th percentile (14 percent or more above desirable weight), 23.2 percent (13.3 million) of the men ages 20-74 years were overweight. The corresponding value for women at this cutoff point (15 percent or more above the desirable weight) was 29.5 percent (18.9 million). In each age group 35-74 years, the percent of women overweight significantly exceeded that of overweight men.

The percent of men overweight increased significantly from ages 20-24 to 25-34 years. No significant differences or age-related trends were found thereafter. The percent of women overweight increased significantly only to 35-44 years; changes in percents were not significant after this decade.

Among men ages 20-74 years, 6.0 percent (3.5 million) were overweight based on relative desirable weight at the 95th percentile (30 percent or more above desirable weight). At the same percentile (39 percent or more above desirable weight, 9.6 percent (6.2 million) of the women were overweight. The difference between proportions of men and women overweight was statistically significant.

In each age, higher proportions of women than men were overweight, but the differences in proportions were significant only at ages 35-44 and 65-74 years. By this criterion, a significant age-related trend for overweight among men ages 25-34 years was found. Thereafter, the percent of overweight men remained level and declined in the oldest age group. Overweight among women increased significantly to 35-44 years, after which the values declined and then remained fairly stable.

Weight-height index

Another approach to relative weight indices to estimate the prevalence of overweight is by the use of weight-height index (W/H^p).[6,7] The index is obtained by dividing weight in kilograms by the power of height in meters squared (kg/m^2). Womersley and Durnin[8] agree with Keys, et al.,[9] that, in the absence of skinfold measurements, the most satisfactory relative weight index is W/H^2. Goldbourt and Medalie[10] used data from Birmingham, Framingham, and Israel and found that the weight-height index of choice for men was also W/H^2. Benn[11] questioned the validity of applying a specified power of H to different populations and suggested that the power value of H should be examined for each population studied. This suggestion was followed for this study, and a value of p was calculated in the range of 1.75 to 2.06 for men by age group; the corresponding values for women by age group were 1.44 to 1.63. The power value of choice was a value of $p = 2$ for men and $p = 1.5$ for women (see appendix I). Thus the weight-height

index used in this report is W/H^2 for men and $W/H^{1.5}$ for women.

Cumulative percent distributions of the weight-height index are presented in table 14 for men and in table 15 for women. Table 16 summarizes the distribution in terms of basic statistics for men and women by age. In addition to the number of examined persons and the estimated number in the U.S. population, the tables include the means, standard deviations, and selective percentiles. Table 16 also shows the weight-height index values of men and women ages 20-29 years at the 85th, 90th, and 95th percentiles. The values at these selected percentiles were the criteria to estimate the proportions of overweight persons for this measure. Table 17 shows estimates of overweight persons in the United States using these cutoff levels by sex and age. Estimates of the standard errors of percents are presented in appendix I, table III.

In 1971-74, 22.8 percent (13.1 million) of the men ages 20-74 years were overweight at the 85th percentile and 5.8 percent (3.3 million) at the 95th percentile, where the weight-height index was greater than or equal to 28.0 and 32.0, respectively. For women, the percent overweight was significantly higher than that for men, 29.5 percent (19.0 million) at the 85th percentile and 8.3 percent (5.4 million) at the 95th percentile, where the weight-height index was greater than or equal to 34.0 and 42.0, respectively.

In each age group 35-74 years at the 85th percentile, the percent of women overweight was higher than that for men overweight. All differences were large enough to be considered significant. For each age group at the 95th percentile, the percent of women overweight was consistently higher than that for men overweight; however, the differences were large enough to be statistically significant only for ages 35-44 and 65-74 years.

Comparability of obesity and overweight measures

Analyses were made of the comparability of triceps plus subscapular skinfold measurements, the measure of obesity with the relative desirable weight, and the weight-height indexes—the measures of overweight. Several approaches were used. The first approach was that all measures were independent of height. There was a low coefficient of correlation between these measures and height (table 18); whether obese or overweight, smaller persons did not have more or less excess weight than taller persons did.

The second approach was to demonstrate that measures of overweight were associated with total body weight. Table 18 shows the high coefficients of correlation between the obesity measure and each of the overweight measures with total body weight.

A third approach to examine the comparability of the obese measure with each of the overweight measures was to compare prevalence estimates. Comparable results would suggest that overweight measures may be used interchangeably with obesity measures for population estimates. The estimates of the proportion of obese and overweight persons at the 85th, 90th, and 95th percentiles or more are summarized in table 19 and graphically shown in figures 2 and 3.

Regardless of approach, the percents of men ages 20-74 years and overweight at the 85th and 90th percentiles were significantly higher than percents of men obese. At the 95th percentile, the differences in percents were no more than expected from sampling variability.

Among women of comparable age, the percents overweight at the 85th percentile, independent of overweight method, were significantly higher than percents of the women obese. At the 90th percentile, the same pattern was observed in comparing the differences in proportions between women obese and women overweight based on the two methods of classifying overweight status. At the 95th percentile, the magnitude of the difference between the percent of women obese and women overweight was not large enough to be statistically significant.

In each age group, the percent of men overweight was generally higher than that of men obese at the 95th percentile. However, differences in proportions were not large enough to be statistically significant, except for men ages 55-64 years.

In each age group, the proportions of men overweight were also generally larger than proportions of men obese at the 85th and 90th percentiles. The differences were too large to reflect sampling variability alone.

Among women ages 20-54 years, the proportions obese and overweight were within sampling variability, regardless of method of measurement or percentile cutoff point. Among women ages 55-64 years, a significantly higher proportion were overweight than were obese at the 85th and 90th percentiles but not at the 95th percentile. At ages 65-74 years, a significantly higher proportion of women were overweight than were obese, regardless of method of measurement or cutoff point.

The final approach of comparing the obesity measure with the overweight measure was to determine the relationship of overweight measures with the laboratory measure of obesity, such as body fat estimated by densitometry, and use this method as the standard. Because densitometry was not available, leanness to fatness was estimated by triceps plus subscapular skinfold measurements, which is in "good" agreement with laboratory indices of obesity.[8,9] Table 20 shows the correlation coefficients of the relationship between triceps plus subscapular skinfold criteria, the obesity measure, and each of the overweight measures (relative desirable weight and weight-height index).

The coefficients of correlation between relative desirable weight adjusted for height and triceps plus subscapular skinfold measurements ranged from 0.729 to 0.828 for men and from 0.769 to 0.857 for women ages 20-74 years. The corresponding values for weight-height indexes were almost identical for men and women in the same age ranges. The differences between coefficients of correlation were small.
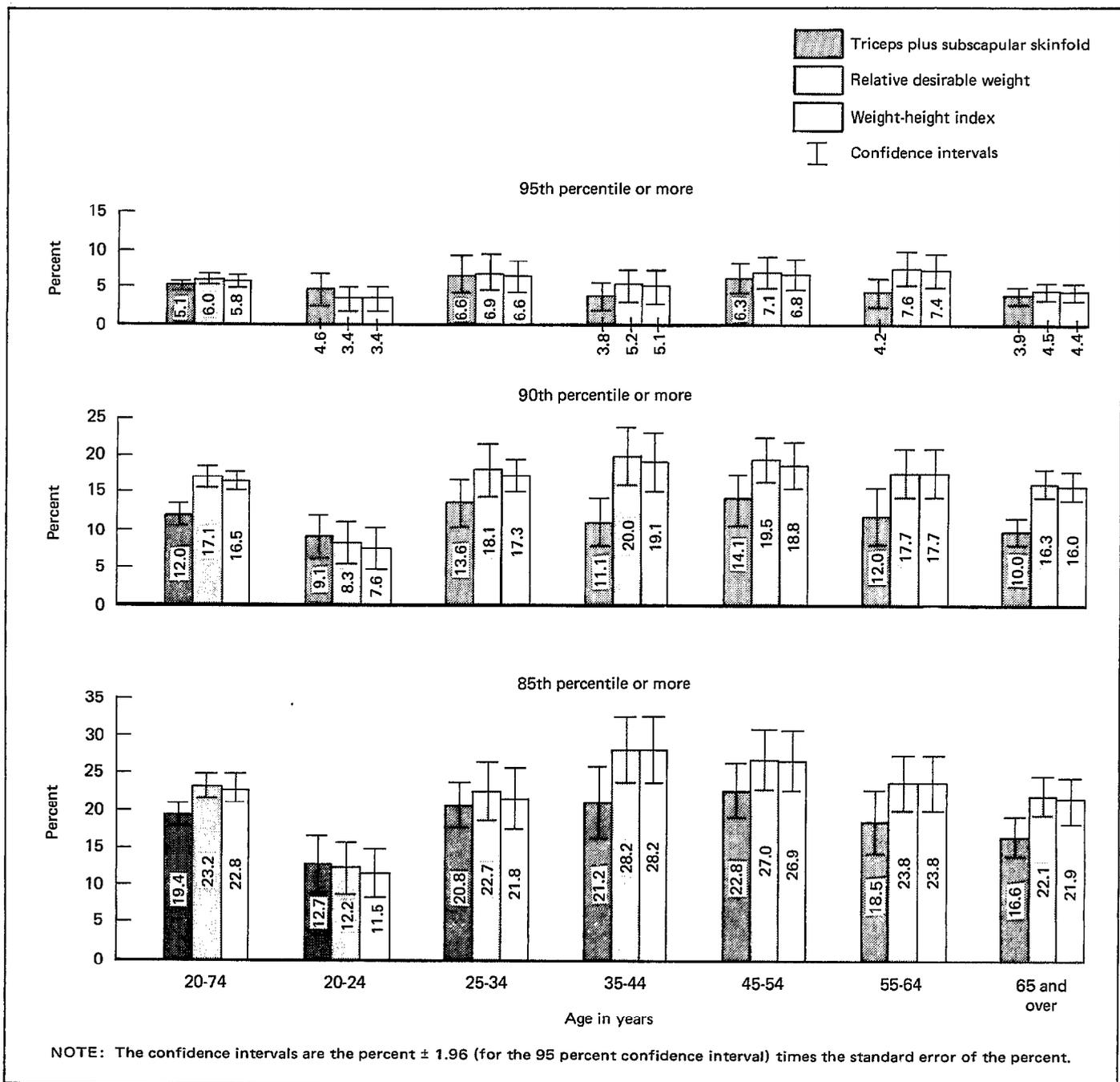
Figure 2. Percent of men obese and overweight at selected percentiles of criteria measures, by age, with confidence intervals: United States, 1971-74

The highest coefficient of correlation was r = 0.857. The coefficient of determination of this relationship, r², indicated that about 73 percent of the total variance of the obesity measure was accounted for by the regression of obesity on the overweight measure.

On the basis of the high values of the coefficients of correlation, it appears that overweight measures may be used interchangeably with obesity measures. However, according to Florey,[12] the coefficient of correlation does not consider the increase in variabil-

ity of skinfold values with increasing weight-height indexes. Therefore, the coefficient of correlation is of little value as a valid statistic to measure the relationship between overweight and obesity measures. The coefficient of correlation considers individuals in the total range of leanness and fatness (that is, extreme leanness to extreme fatness). In this range, a high correlation between obesity and overweight measures was expected and observed.

The agreement between obesity and overweight measures also was examined by arraying the distri-
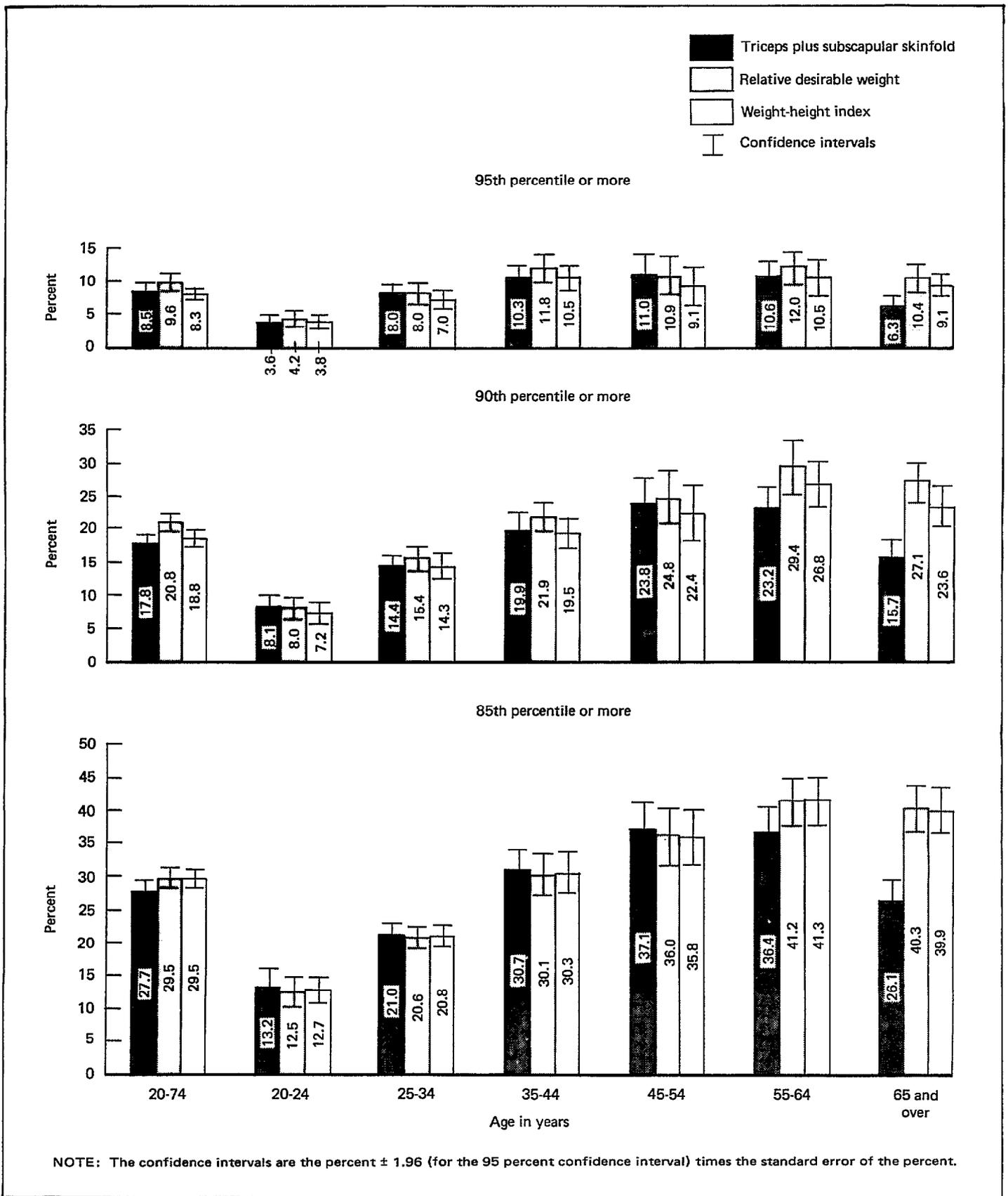
Figure 3. Percent of women obese and overweight at selected percentiles of criteria measures, by age, with confidence intervals: United States, 1971-74

bution of the obesity values according to overweight values. The variability of the triceps plus subscapular skinfold values indicated by the standard deviation increased with the increase in relative desirable weight. At the relative desirable weight of less than 85, the standard deviation of triceps plus subscapular skinfold for men ages 20-74 years was 4.2 (table 21). The corresponding standard deviation for the relative desirable weight of 130 and more was 15.2. Low values of relative desirable weight generally were found among lean persons, and higher relative weights were found among men in a wider range of triceps plus subscapular skinfold values.

The standard deviation of the triceps plus subscapular skinfold also increased for women with increased relative desirable weight (table 22). Among women ages 20-74 years, at relative desirable weight of less than 85, the standard deviation of triceps plus subscapular skinfold was 6.8 compared with the standard deviation of 15.2 at relative desirable weight of 130 and more. As shown in tables 23 and 24, a similar pattern was observed for the relationship between triceps plus subscapular skinfold measurements and weight-height index. (Tables that show the distributions of triceps plus subscapular skinfold values according to relative desirable weight or weight-height index for men and women by specific age groups are too numerous to include in this report but are available upon request from NCHS.)

Further analysis of the agreement between obesity and overweight measures showed men and women with relative desirable weight values less than 100, that is, less than 85, 85-89, 90-94, and 95-99, also have a very low proportion of obese persons (tables 25 and 26). At higher relative weight values, the proportion of obese persons increased with increased relative desirable weight values. However, an appreciable proportion of persons with high relative desirable weight values were not obese. At the highest relative desirable weight value (30 percent or more above the desirable weight of men and 39 percent or more above the desirable weight of women), 46.9 percent of the men and 55.5 percent of the women were obese.

The pattern of relationships previously found between triceps plus subscapular skinfold values and relative desirable weight also was found between triceps plus subscapular skinfold measurements and weight-height index (tables 27 and 28).

When similar data were examined separately for each age group, the same relationship appeared between obese and overweight measures that previously was observed for men and women across the age range 20-74 years. Low values of weight-height indexes were in categories of lean skinfold measurements, and high values occurred more often in a very wide range of triceps plus subscapular skinfold values. (Tables that show the relationship of triceps plus subscapular skinfold measurements and relative desirable weight or weight-height indexes at selected percentiles by specific sex-age groups are available upon request from NCHS.)

Interrelationship of overweight and obesity

The estimated number and percent of men and women ages 20-74 years in each of the overweight and/or obesity categories at selected percentile cutting points are presented in tables 29-31 and are graphically shown in figures 4-9 by method of assessing overweight and obesity and summarized in tables 32 and 33. Estimates of standard error are presented in appendix I, tables V and VI. At the 95th percentile cutting point for men, a pooled value was needed because data for specific age groups did not meet standards of precision. Therefore, data were analyzed for ages 20-44, 45-64, and 65-74 years in place of the six age groups analyzed for the 85th and 90th percentile cutting points. A profile of selected body measurements was done for those persons in weight categories obtained from the cross-classification of overweight and obesity measures (see appendix III).

For men at the 85th percentile cutting point, 12.7 percent (7.3 million) were overweight and obese, 10.5 percent (6.0 million) were overweight but not obese, and 6.6 percent (3.8 million) were obese but not overweight (table 29). The percent of men overweight and obese (12.7 percent) was significantly higher than the percent of men overweight not obese (10.5 percent) and of men obese not overweight (6.6 percent). The percent of men overweight not obese (10.5 percent) was also significantly higher than that of men obese not overweight (6.6 percent). However, at the 95th percentile, no differences were statistically significant (table 31).

Among women 20-74 years of age, at the 85th percentile cutting point the proportions were largest for women overweight and obese—21.5 percent or 13.8 million—followed by the proportions for women overweight not obese—8.0 percent or 5.1 million—with the lowest proportion recorded for women obese not overweight—6.1 percent or 3.9 million (table 29). Like the proportions for men, the percent of women overweight and obese was significantly higher than the percent of women obese not overweight and women overweight not obese. The percent of women overweight not obese was significantly higher than that of women obese not overweight.

At the 85th percentile cutting point, the percent of men overweight and obese increased significantly from 8.7 percent for ages 20-24 years to 15.0 percent for men ages 25-34 years, peaked in this age group, and declined thereafter with no significant age-specific trend. The percent of women overweight and obese increased significantly to ages 35-44 years, but the increase in percent after age 45 was not large enough to be statistically significant. The percents declined significantly from ages 55-64 to 65-74 years, a decrease of 8.1 percent.

The percent of women overweight and obese was higher than that of men across the age range 20-74 years as well as in each age group; however, only the higher age-specific differences in ages 20-24 and 25-34 years were not large enough to be statistically significant. At the 95th percentile cutting point, only the percent of women overweight and obese was significantly higher than that of women obese not overweight.

Sex and age

At the 85th percentile cutting point, the percent of men overweight not obese increased significantly with age only from ages 20-24 to 35-44 years. A different pattern was found for women overweight not obese. Significant or consistent age-related trends were shown from ages 25-34 to 35-44 years. Similar significant trends were noted from ages 55-64 to 65-74 years.

The percent of men overweight not obese was higher than that of women overweight not obese across the age range 20-74 years and in each age group except in ages 65-74 years, but were significantly different only for ages 35-44 years. A significantly higher percent of women were overweight not obese for ages 65-74 years than men.

At the 85th percentile cutting point, the percents of men and women obese not overweight showed no significant age-related pattern. A slight exception was
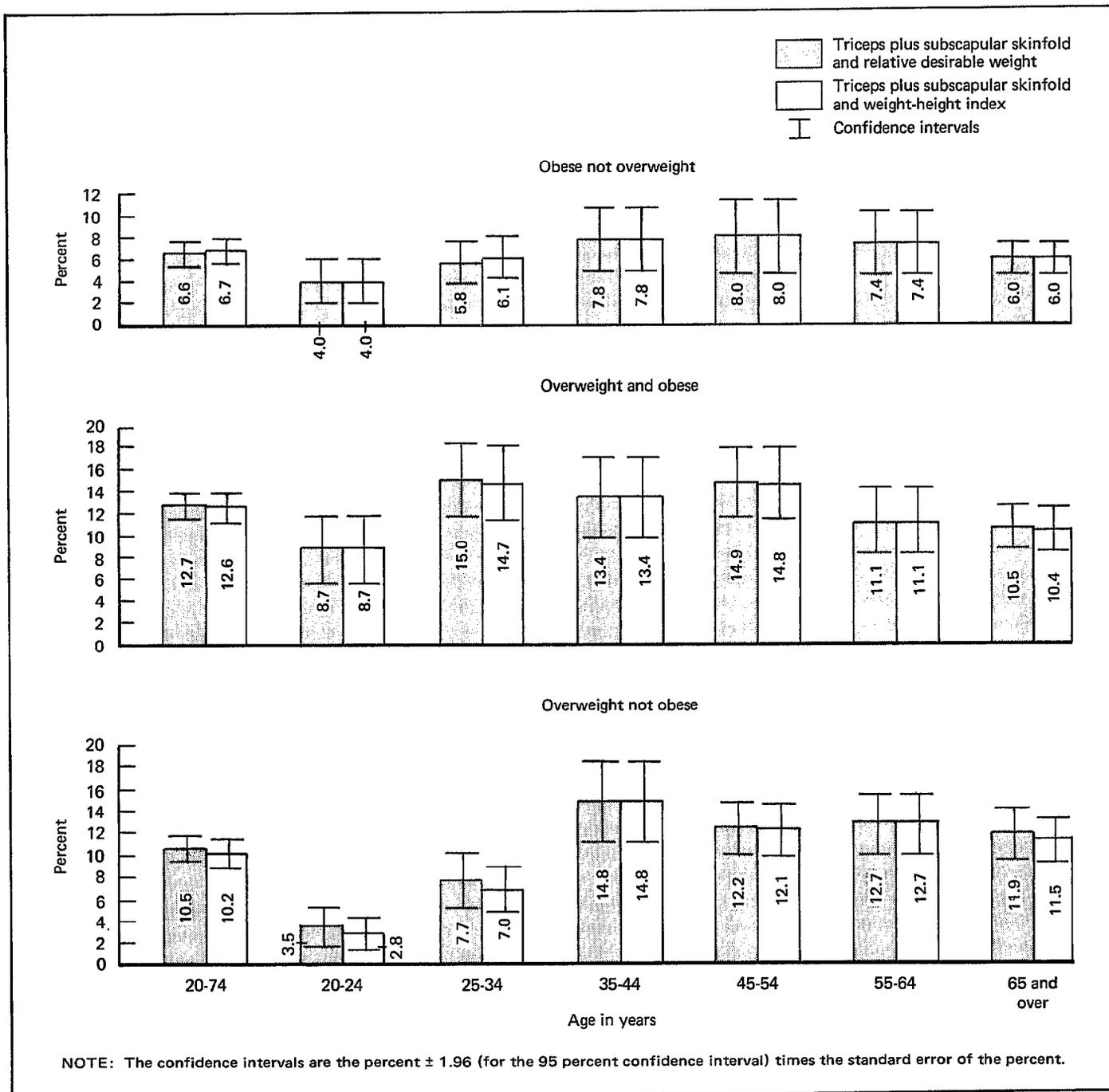
Figure 4. Percent of men overweight and/or obese at the 85th percentile estimated from cross-classification of triceps plus subscapular skinfold with relative desirable weight and weight-height index, by age, with confidence intervals: United States, 1971-74

noted for women—there was a significant increase in percents between ages 25-34 and 35-44 years. After the percents peaked at ages 45-54 years, the percents declined slightly with no significant trends. Overall and in each age group, the differences in percents between men and women obese not overweight differed no more than expected from sampling variability.

Across the age range 20-74 years and in ages 20-44 and 45-64 years at the 95th percentile cutoff point, the differences in percents of men and women overweight not obese were small enough to be due to

sampling variability. This pattern was not evident for ages 65-74 years for which the difference in percents between sexes was statistically significant. The difference in the percent of men and women obese not overweight at the 95th percentile cutting point was not statistically significant across the age range 20-74 years and in ages 20-44 and 65-74 years. However, at ages 45-64 years, the difference in percents for men and women was statistically significant. The percent of women overweight and obese was significantly higher than that of men overweight and obese
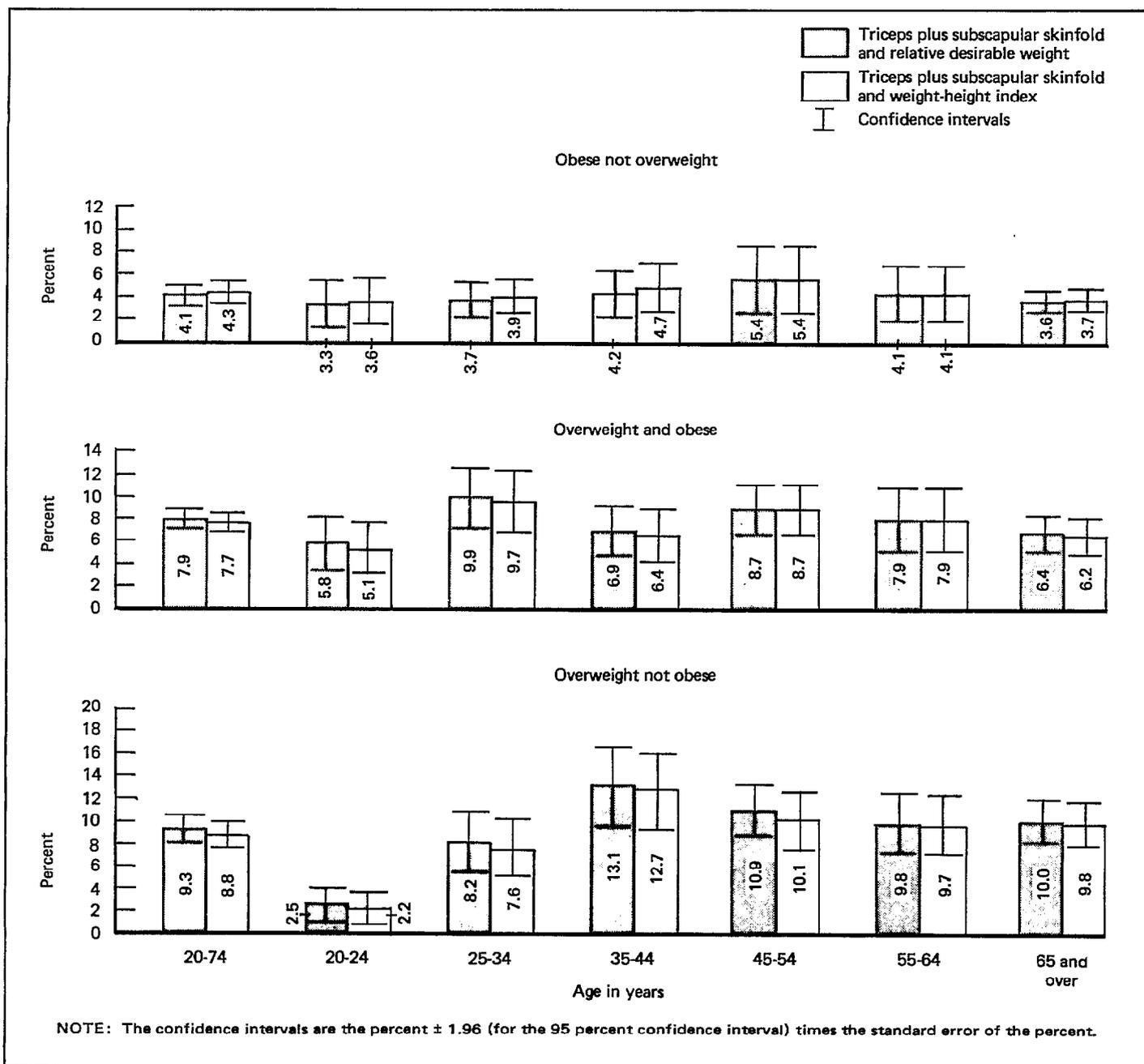
Figure 5. Percent of men overweight and/or obese at the 90th percentile estimated from cross-classification of triceps plus subscapular skinfold with relative desirable weight and weight-height index, by age, with confidence intervals: United States, 1971-74

at the 95th percentile cutting point across the age range 20-74 years and at ages 20-44 and 45-64 years. At ages 65-74 years, the difference in percents between men and women was not statistically significant.

Tables 29-31, summarized in tables 32 and 33, show the percents of men and women overweight and/or obese based on cross-classification of triceps plus subscapular skinfold values and weight-height indexes. At all selected percentile cutting points, the direction and the magnitude of the difference between three subsets of overweight and/or obese categories for men and women were found to be the same

as when overweight and/or obesity categories for men and women were based on the cross-classification of relative desirable weight and triceps plus subscapular skinfold values. The significance of the differences in percents between each of the three pairs of categories from the overweight and/or obesity classifications also generally held true. The exceptions were the differences in proportions of women overweight and obese and women obese not overweight at the 95th percentile cutting point and proportions of women overweight not obese and women obese not overweight at the 90th percentile cutting point.
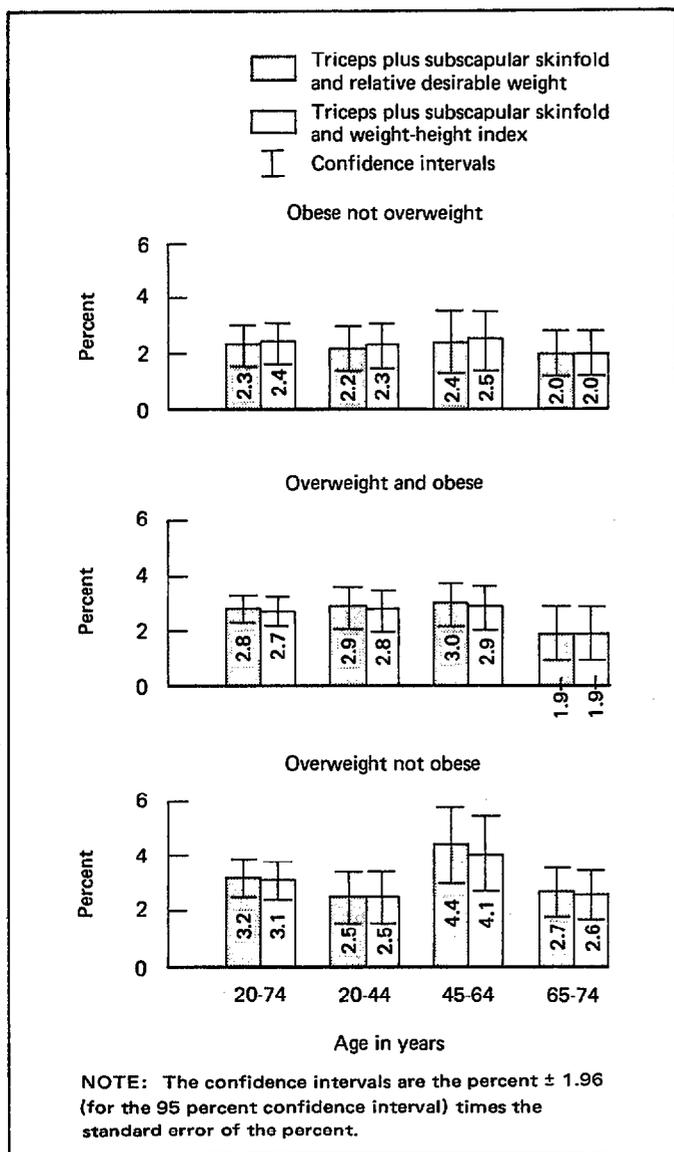
Figure 6. Percent of men overweight and/or obese at the 95th percentile estimated from cross-classification of triceps plus subscapular skinfold with relative desirable weight and weight-height index, by age, with confidence intervals: United States, 1971-74
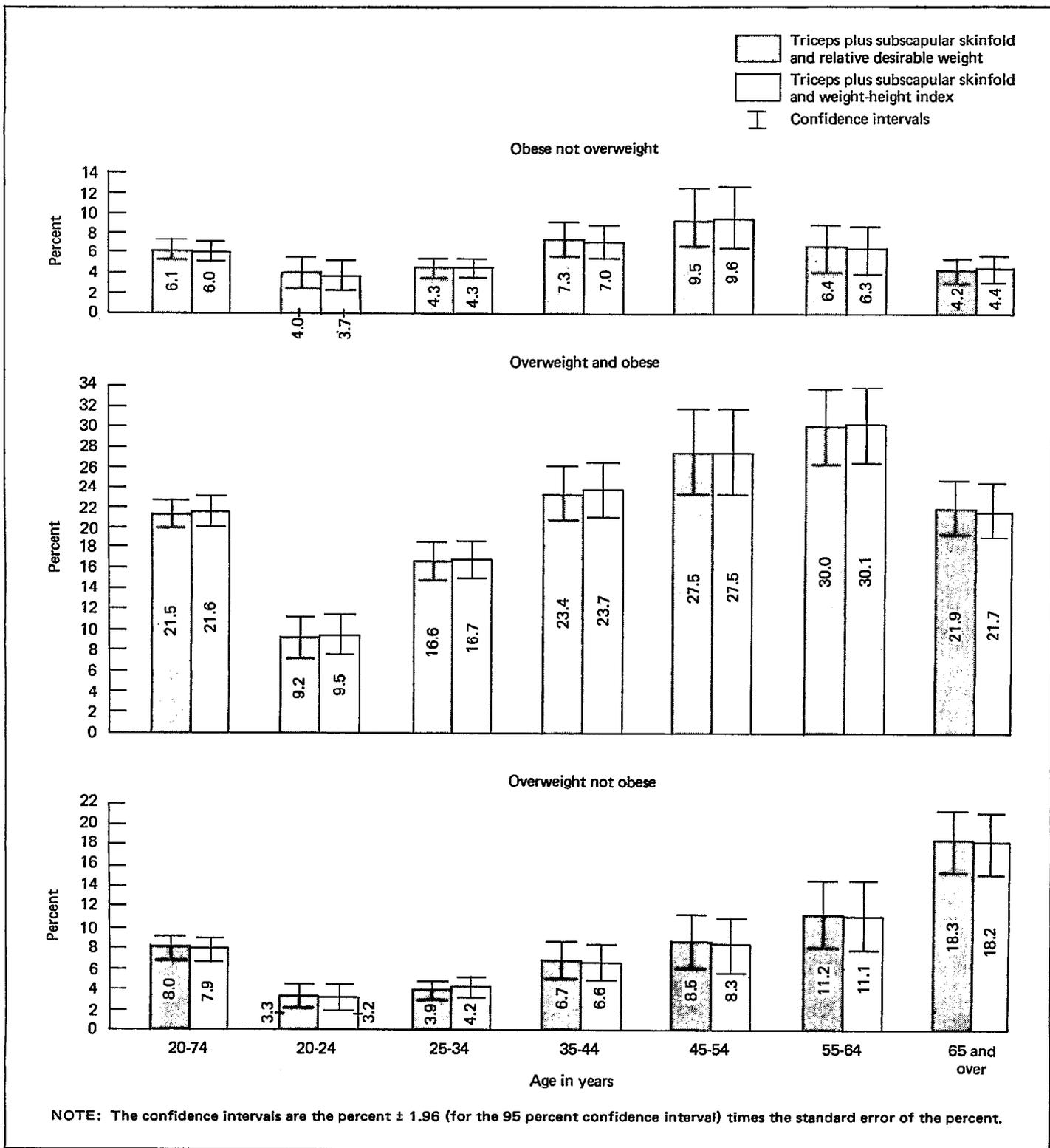
Figure 7. Percent of women overweight and/or obese at the 85th percentile estimated from cross-classification of triceps plus subscapular skinfold with relative desirable weight and weight-height index, by age, with confidence intervals: United States, 1971-74
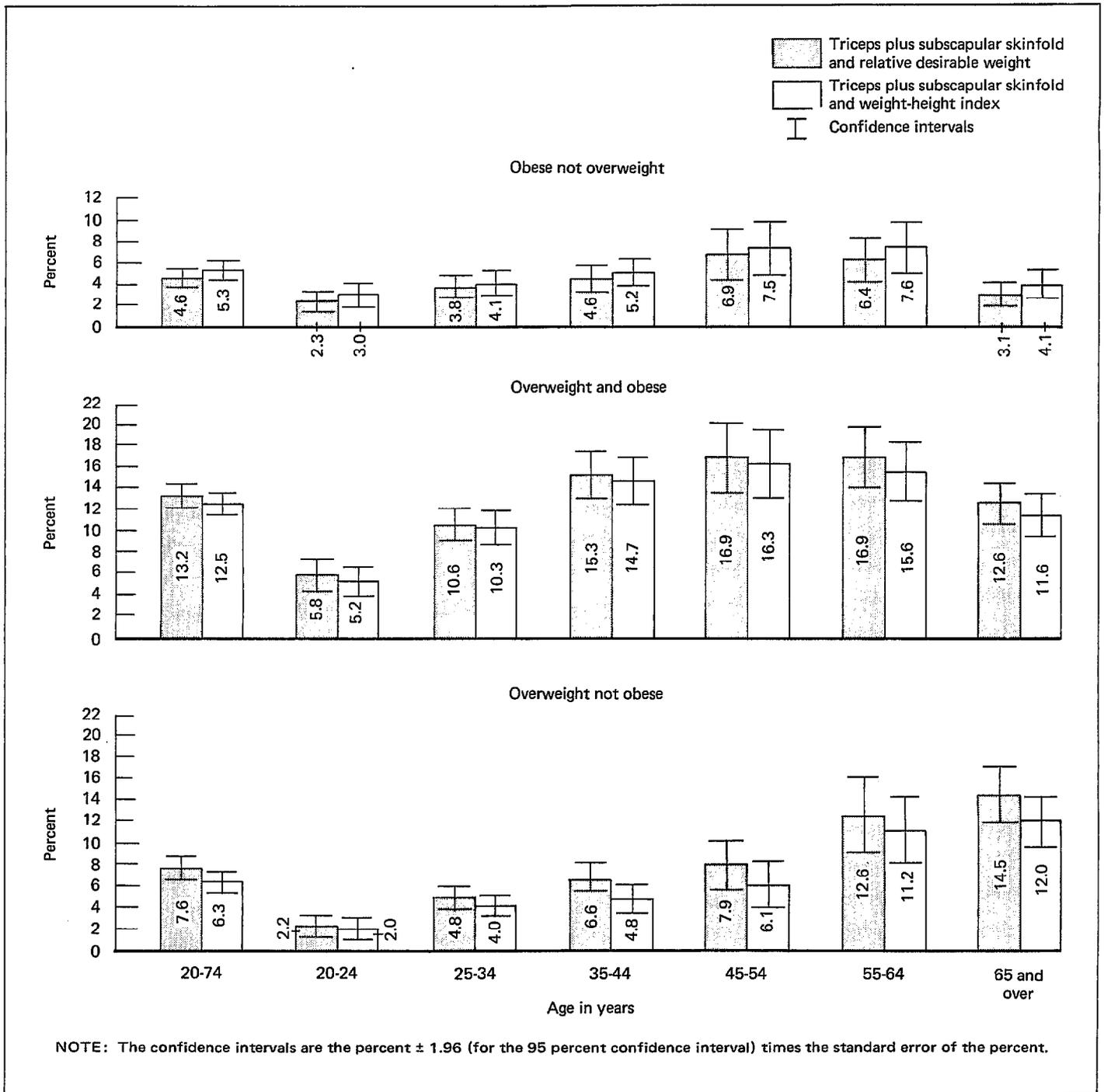
Figure 8.   Percent of women overweight and/or obese at the 90th percentile estimated from cross-classification of triceps plus subscapular skinfold with relative desirable weight and weight-height index, by age, with confidence intervals: United States, 1971-74
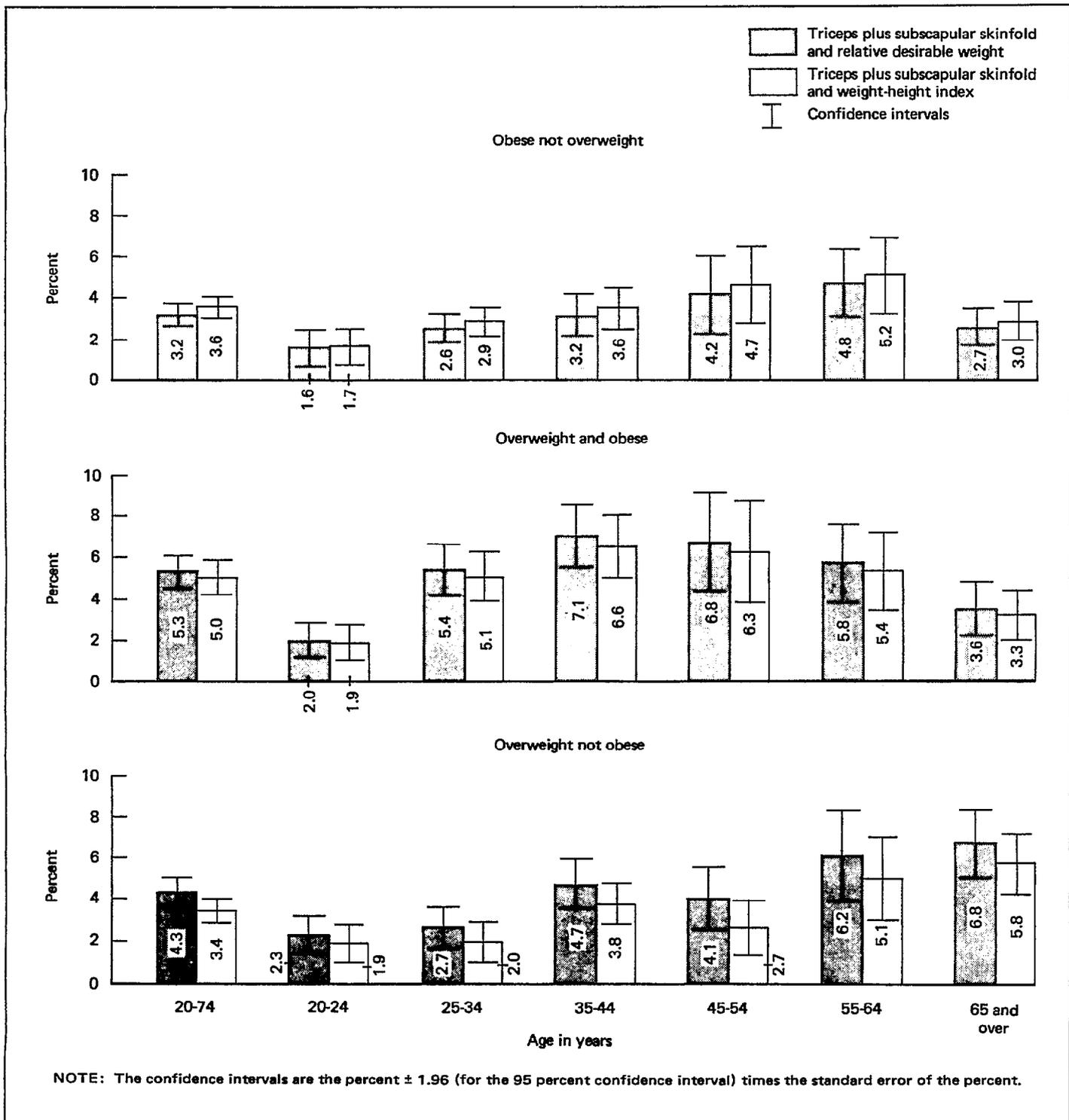
Figure 9. Percent of women overweight and/or obese at the 95th percentile estimated from cross-classification of triceps plus subscapular skinfold with relative desirable weight and weight-height index, by age, with confidence intervals: United States, 1971-74

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Discussion

This report presents national estimates of the prevalence of obesity and overweight among adults in the U.S. civilian noninstitutionalized population ages 20-74 years. Estimates were developed from body measurements obtained as part of the first National Health and Nutrition Examination Survey conducted during 1971-74. A distinction was made between estimates of obesity based on triceps plus subscapular skinfold measurements to indicate the amount of subcutaneous adipose tissue and estimates of overweight based on weight indexes, independent of relative fat content.

This report also shows, at one point in time, that estimates of obesity and overweight differ depending on which measure is used and also shows the interrelationship between these measures. The results provide a basis for comparison of estimates over time among the U.S. population. Comparisons will be made in a future report using data from three cycles of this survey: NHANES I 1971-74, National Health Examination Survey (NHES) 1960-62, and NHANES II 1976-80.

The first National Health and Nutrition Examination Survey supplied data to make a comparative analysis of national estimates of obesity and overweight. These data provided cross-sectional estimates for different birth cohorts representative of the U.S. population. The age differences represented data for successive cohorts of persons of different ages when examined and reflect the effect of different environmental and hereditary influences. The limitations of cross-sectional data in contrast to longitudinal data are recognized in considering differences among age categories. The quality of selected body measurements was maintained throughout the survey by trained technicians who followed standardized measurements procedures.

Estimates of prevalence of obesity varied in the literature depending on the method of classifying obesity. Estimates were obtained from two major sources—life insurance data and epidemiologic surveys taken from selected segments of the population and special study groups—and cannot be easily generalized to the U.S. population.[13-18] These sources indicated that obesity is a common disorder, but comparisons of estimates are difficult and do not represent a true cross-section of the country's population. Other factors that substantially affect comparability among studies are the different type and quality of techniques and measurements used and the criteria selected to classify obesity.

The earliest and most commonly used method for measuring obesity is to compare heights and weights with established tabulated standards. Life insurance studies determined excess body weight status defined as the deviation of observed weight from standard weight for a given sex, age, and height multiplied by 100. These data initially were obtained from the *Medico-Actuarial Investigations* (1912)[13] and later from the *Build and Blood Pressure Study, 1959*[14] and the *Build Study, 1979*.[15] Others, such as the *Framingham Heart Study*, defined obesity as a relative weight of 20 percent or more above the median weight for a given height and sex.[16]

Because it is recognized that height and weight alone are incomplete indicators of obesity, "desirable" weight tables that consider measurements of body build were developed by the Metropolitan Life Insurance Company for adults 25 years of age and over.[17-19] The tables were devised in response to criticism that weight-height tables ignored the disadvantages of gains in body weight with advancing years as well as variations in body build that influence weight.

Largely by necessity, life insurance studies of association of obesity and mortality have been limited to use of height and weight as measures of body fat. However, these measures are not satisfactory for studying the influence of obesity on mortality. Obesity, an excess accumulation of fat,

has been used interchangeably with overweight or excess body weight above average or desirable weight. Total body weight is a measure of bone, muscle, and fat, and departure from average weight may be due to one or a combination of these components. Overweight prevention and control is directed against overweight due to fat, which is primarily the result of food intake in excess of the energy requirements of the individual.

Although direct anatomical and chemical methods for estimation of body fat are not suitable for large-scale epidemiologic surveys, the indirect method, such as measurement of skinfold thickness, meets the need for a simple test of relative fatness as basis for estimation of prevalence of obesity. If skinfold measurements are not available, the most satisfactory index is the body mass index, W/H^P.[8,9] This index is easy to compute and applies to all populations without the need for a reference population. A reference population is necessary for obtaining relative desirable weight, the ratio of a subject's weight to desirable weight for height and sex.

Among men and women, at the 95th percentile cutoff point, there were no significant differences in the percents of individuals assessed obese and overweight using the skinfold thickness values and weight-height index methods of assessing obesity. These findings also were found generally by age except at ages 55-64 years for men and at ages 65-74 years for women, where the differences in prevalence of obesity as estimated by the overweight methods (relative desirable weight and weight-height index) and the obese method (skinfold thickness) were significant.

Findings at the 95th percentile that the terms "overweight" and "obesity" may be used interchangeably were not evident at the 85th and 90th percentile cutoff levels. Among men, the prevalence of overweight determined by the overweight methods generally overestimated the prevalence of obesity as determined by skinfold thickness measurements.

Among women ages 20-74 years at the 85th and 90th percentiles, the prevalence of women overweight determined by the overweight methods also was higher than the prevalence of women obese determined by skinfold thickness. The differences in prevalence rates were too large to reflect sampling variability alone.

The differences in prevalence rates of obesity between the overweight methods and the obese method in ages 55-74 years also were large enough to be statistically significant. The differences in percents between methods among women ages 20-54 years were not statistically significant.

The lack of agreement between the overweight measure and the obesity measure also was noted when triceps plus subscapular skinfold values were distributed according to relative desirable weight values using triceps plus subscapular skinfold measurements as the criterion of obesity. A large percent

of men and women who have a high relative desirable weight were not excessively obese.

At 20 percent or more above the desirable weight, an arbitrary estimate that presumes obesity, only about a quarter of the men and a third of the women were classified as obese at skinfold criterion of the 95 percentile. At the same percent or more above the desirable weight and a lower criterion of obesity of the 85 percentile, an appreciable percent of men and women could not be characterized as obese. Similar findings were observed when triceps plus subscapular skinfold values were distributed according to weight-height indexes using triceps and subscapular skinfold as the criterion of obesity.

One shortcoming in any effort to define an association between weight status and morbidity or mortality is the lack of information on obesity, contrasted with overweight. The estimates of obesity based on studies of the relationship of obesity to heart disease all measure obesity in terms of departure of observed weight from a weight-height standard; the departure from such a standard may be due to body components other than fat.

This possibility was suggested in reports by several investigators. A study by Seltzer and Mayer reported that, at least among females, there may be an association between increased mortality and body type, without regard to obesity.[20] Gertler and associates in clinical studies on young adults with coronary heart disease also found more dominant mesomorphs than endomorphs.[21] A necropsy study by Spain and others with special reference to somatotypes (body build classification) also suggested the association of dominant mesomorphs (tendency toward muscularity) with coronary heart disease.[22] Robinson and Brucer studied the relationship of obesity and body build to hypertension and concluded that body build is an important predisposing factor, and obesity was a small factor.[23] Harlan and others[24] reported that independent measures of body mass index and skinfold thickness (triceps plus subscapular) showed a consistent and strong relationship with blood pressure (systolic and diastolic levels). However, it is likely that primary relationship of body mass index to blood pressure represents a relationship between adiposity and blood pressure.

Because of this interest in the interrelationship of obesity and overweight, further estimates of obesity, as suggested by others,[25,26] were obtained by combining triceps plus subscapular skinfold values with each of the weight indexes, relative desirable weight or weight-height index. Although the weight indexes accounted only for height, with no special reference to body build, skeletal framework, and muscular development, the profile of weight indexes of individuals from NHANES I data suggested that, on the average, the higher weight index categories have larger mean body build values than lower weight index categories. The cross-classification of triceps

plus subscapular skinfold values with relative desirable weight or weight-height index produced categories of overweight and/or obesity, overweight not obese, overweight and obese, and obese not overweight. The height, weight, and a measurement of subcutaneous fat have been suggested as the "irreducible" basic data in the application of body measurements in nutritional research and appraisal.[2]

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List of detailed tables

Table 1. Mean values of relative desirable weight[1] and triceps plus subscapular skinfold[2] for persons overweight and/or obese below and above selected percentiles of criteria measures, by sex and age: United States, 1971-74

Age	Men Overweight Not obese Relative desirable weight	Triceps plus subscapular skinfold	Men Overweight Obese Relative desirable weight	Triceps plus subscapular skinfold	Men Not overweight Obese Relative desirable weight	Triceps plus subscapular skinfold	Women Overweight Not obese Relative desirable weight	Triceps plus subscapular skinfold	Women Overweight Obese Relative desirable weight	Triceps plus subscapular skinfold	Women Not overweight Obese Relative desirable weight	Triceps plus subscapular skinfold
85th percentile												
20-74 years	122	30	131	50	107	43	125	45	141	67	107	58
20-24 years	119	29	129	53	108	45	123	44	141	68	109	57
25-34 years	122	30	133	51	106	43	125	45	142	69	106	58
35-44 years	122	30	130	47	109	44	125	44	143	68	106	57
45-54 years	121	31	130	50	107	43	125	46	139	67	107	57
55-64 years	123	31	134	49	105	44	126	46	139	65	107	58
65-74 years	122	30	127	49	107	43	126	43	139	64	108	58
90th percentile												
20-74 years	125	34	137	55	110	48	135	50	149	73	114	64
20-24 years	124	35	134	57	112	49	137	51	150	74	115	66
25-34 years	124	34	144	56	112	48	134	51	151	74	114	64
35-44 years	126	34	136	53	111	48	135	50	152	73	112	64
45-54 years	124	33	137	56	111	47	132	51	149	73	115	63
55-64 years	126	33	139	52	103	47	136	51	147	72	115	64
65-74 years	125	33	131	53	111	48	135	47	146	69	116	63
95th percentile												
20-74 years	139	40	152	64	120	57	152	58	166	83	128	73
20-24 years	140	48	143	67	119	57	151	61	173	85	126	75
25-34 years	141	48	156	65	120	57	150	59	164	82	127	73
35-44 years	140	39	158	67	119	56	155	58	165	83	127	74
45-54 years	138	40	149	63	121	58	151	58	166	83	103	74
55-64 years	138	38	151	61	121	54	150	58	168	83	127	71
65-74 years	137	39	143	63	118	57	152	57	162	79	130	73

[1]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on average weight from regression equation of weight on height for men and women ages 20-29 years.

[2]Obesity—triceps plus subscapular skinfold.

Table 2. Mean values of weight-height index[1] and triceps plus subscapular skinfold[2] for persons overweight and/or obese below and above selected percentiles of criteria measures, by sex and age: United States, 1971-74

Age	Men						Women					
	Overweight				Not overweight		Overweight				Not overweight	
	Not obese		Obese		Obese		Not obese		Obese		Obese	
	Weight-height index	Triceps plus subscapular skinfold	Weight-height index	Triceps plus subscapular skinfold	Weight-height index	Triceps plus subscapular skinfold	Weight-height index	Triceps plus subscapular skinfold	Weight-height index	Triceps plus subscapular skinfold	Weight-height index	Triceps plus subscapular skinfold
					85th percentile							
20-74 years	30	31	32	50	26	43	37	45	42	67	32	58
20-24 years	29	31	32	53	26	45	37	44	42	68	32	57
25-34 years	30	30	26	52	33	43	37	45	42	69	31	58
35-44 years	30	30	32	47	27	44	37	44	42	68	31	57
45-54 years	30	31	32	50	26	43	37	46	41	67	32	57
55-64 years	30	31	33	49	26	44	37	45	41	65	32	58
65-74 years	30	30	31	49	26	43	37	43	41	64	32	58
					90th percentile							
20-74 years	31	34	34	55	27	48	40	50	44	73	34	64
20-24 years	31	36	33	58	28	49	41	52	45	75	35	65
25-34 years	31	34	34	56	27	48	40	52	45	75	34	65
35-44 years	31	34	34	54	27	48	41	51	45	74	34	64
45-54 years	31	33	34	56	27	47	40	51	44	73	34	63
55-64 years	31	33	35	52	25	47	40	51	44	72	34	64
65-74 years	31	33	32	53	27	48	40	48	44	69	35	64
					95th percentile							
20-74 years	34	40	37	64	29	57	46	59	49	83	38	73
20-24 years	34	48	35	68	29	56	45	62	52	86	37	75
25-34 years	34	42	38	66	29	57	46	60	49	82	38	73
35-44 years	34	39	39	67	29	57	47	60	49	83	38	73
45-54 years	34	40	37	63	30	58	46	60	50	83	39	74
55-64 years	35	38	37	61	30	54	45	58	50	84	38	71
65-74 years	34	39	34	63	29	57	45	57	48	80	39	73

[1]Overweight—weight-height index in kilogram/(meter^p), where p = 2 for men, and p = 1.5 for women.
[2]Obesity—triceps plus subscapular skinfold.

Table 3. Cumulative percent distribution of triceps plus subscapular skinfold of men, by age: United States, 1971-74

Triceps plus subscapular skinfold (in millimeters)	Age							
	20-74 years	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	20-29 years
	Percent distribution							
Under 8	0.5	0.7	0.3	0.3	0.5	0.8	0.4	0.5
Under 10	2.0	2.4	1.8	1.5	2.2	2.1	2.1	1.6
Under 12	5.5	9.8	5.5	4.5	4.0	4.6	5.4	8.2
Under 14	9.7	16.8	10.2	7.9	7.1	8.5	9.0	14.8
Under 16	15.2	26.5	16.8	11.2	11.2	13.0	13.8	24.0
Under 18	20.6	34.9	22.6	15.3	15.6	18.0	19.3	31.0
Under 20	26.3	42.3	27.9	21.1	20.8	22.7	25.8	37.6
Under 22	33.0	48.9	33.8	26.8	26.4	32.7	33.2	44.6
Under 24	39.5	53.9	41.0	33.3	34.9	37.6	39.6	51.1
Under 26	46.6	59.0	47.3	41.3	41.0	47.3	46.9	56.9
Under 28	53.2	65.0	53.9	47.8	47.6	53.4	55.2	62.6
Under 30	59.3	70.5	60.4	54.1	53.6	59.8	61.6	68.7
Under 32	65.6	75.3	65.8	64.0	59.4	64.7	67.4	73.2
Under 34	71.5	79.4	70.7	71.0	65.7	72.7	72.5	77.4
Under 36	76.9	84.1	75.3	74.9	73.3	78.0	79.4	81.8
Under 38	80.6	87.3	79.2	78.8	77.2	81.5	83.4	84.7
Under 40	84.1	89.7	82.8	83.7	80.7	84.1	87.3	87.4
Under 42	86.4	90.6	85.2	86.0	83.8	86.6	89.1	88.9
Under 44	89.0	91.2	87.6	89.3	87.9	88.9	91.3	90.4
Under 46	91.0	92.3	90.4	91.2	89.7	91.0	93.1	91.6
Under 48	92.9	93.6	91.5	94.2	91.3	93.7	94.4	92.6
Under 50	94.3	94.8	93.3	95.4	92.8	95.4	95.6	94.3
Under 52	95.3	95.6	94.0	96.4	93.9	96.5	96.2	95.2
Under 54	96.2	96.6	94.9	97.5	95.1	97.1	96.9	95.9
Under 56	96.7	97.1	95.3	97.6	95.8	98.1	97.6	96.4
Under 58	97.4	97.7	96.2	98.0	96.6	98.7	98.2	97.3
Under 60	97.9	97.8	97.1	98.1	97.6	98.9	98.6	97.5
Under 62	98.3	98.1	97.5	98.6	98.1	99.3	99.0	97.9
Under 64	98.6	98.1	98.1	98.6	98.6	99.4	99.2	98.0

Table 4. Cumulative percent distribution of triceps plus subscapular skinfold of women, by age: United States, 1971-74

Triceps plus subscapular skinfold (in millimeters)	Age							
	20-74 years	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	20-29 years
	Percent distribution							
Under 8	0.0	0.1	-	0.0	0.1	0.0	-	0.0
Under 10	0.3	0.3	0.0	0.2	0.2	0.6	0.3	0.2
Under 12	0.6	0.8	0.2	0.6	0.4	0.6	1.1	0.6
Under 14	1.0	1.4	0.7	1.0	0.8	0.8	1.6	1.2
Under 16	2.1	3.4	2.1	1.6	1.6	1.8	2.6	2.9
Under 18	3.7	6.6	3.9	3.2	2.4	3.3	3.8	5.4
Under 20	6.2	11.2	7.7	4.7	3.3	5.6	4.8	10.2
Under 22	9.4	17.8	12.6	7.4	4.7	7.5	6.3	16.5
Under 24	13.1	23.8	17.8	11.1	7.2	9.5	8.5	22.5
Under 26	17.0	29.5	22.4	15.5	11.5	11.0	10.8	27.9
Under 28	21.9	37.9	28.2	19.4	14.3	15.5	15.2	35.3
Under 30	26.6	45.1	34.4	24.1	16.7	19.1	18.7	42.0
Under 32	31.6	50.3	40.4	29.4	21.0	23.8	23.2	47.5
Under 34	36.3	56.2	45.5	33.8	25.5	27.0	28.3	53.1
Under 36	41.2	60.4	50.8	39.3	28.9	32.3	34.1	57.9
Under 38	45.2	63.8	55.2	43.2	32.5	36.0	39.2	61.5
Under 40	49.7	68.7	59.1	48.4	37.5	39.2	44.7	65.6
Under 42	54.2	73.4	63.4	52.1	41.7	43.5	51.5	70.1
Under 44	58.0	76.5	67.3	55.6	45.5	46.8	57.0	73.8
Under 46	62.1	79.8	71.0	59.5	51.6	49.6	61.2	77.3
Under 48	65.7	82.4	73.8	62.7	55.9	54.6	65.5	79.8
Under 50	69.2	84.7	77.1	66.3	59.1	58.5	70.3	82.6
Under 52	72.4	86.8	79.0	69.3	62.9	63.6	73.9	84.4
Under 54	75.2	88.3	80.8	72.9	66.5	67.4	76.5	86.1
Under 56	78.6	89.6	82.8	76.2	72.3	72.5	79.1	87.8
Under 58	81.0	91.4	84.9	78.7	74.7	75.0	83.1	89.3
Under 60	83.9	92.1	86.8	81.8	78.6	79.1	86.4	90.6
Under 62	85.9	92.6	88.0	84.4	81.8	81.6	88.9	91.4
Under 64	88.2	93.9	89.2	86.7	84.8	85.6	90.5	92.4
Under 66	90.3	95.7	91.2	88.2	87.5	88.0	92.6	94.2
Under 68	91.5	96.4	92.0	89.7	89.0	89.4	93.8	94.9
Under 70	92.9	96.7	93.1	92.1	90.1	92.1	94.9	95.7
Under 72	94.1	97.1	94.4	93.1	91.6	93.3	96.1	96.4
Under 74	94.9	97.4	95.3	93.9	92.4	95.0	96.7	97.0
Under 76	95.9	97.8	96.0	95.3	93.9	95.9	97.3	97.6
Under 78	96.4	98.1	96.4	96.0	94.6	96.4	98.3	97.9
Under 80	97.1	98.4	96.7	96.7	96.1	96.9	98.6	98.2
Under 82	97.6	98.5	97.3	97.1	96.8	97.7	98.8	98.3
Under 84	97.9	99.0	97.9	97.2	97.1	98.0	98.9	98.9
Under 86	98.2	99.2	98.2	97.4	97.4	98.4	99.3	99.1
Under 88	98.5	99.3	98.7	97.9	97.7	98.5	99.3	99.3
Under 90	98.8	99.3	98.8	98.0	98.8	98.7	99.5	99.3

Table 5. Number of examined persons, estimated population in thousands, and means, standard deviations, and selected percentiles of triceps plus subscapular skinfold of adults, by sex and age: United States, 1971-74

Sex and age	Number in sample	Estimated population in thousands	Mean	Standard deviation	Percentile								
					5th	10th	15th	25th	50th	75th	85th	90th	95th
Men			Triceps plus subscapular skinfold (in millimeters)										
20-74 years	5,001	57,507	28.3	12.5	11.5	14.0	15.5	19.0	26.5	35.0	40.5	44.5	51.0
20-24 years	513	8,110	24.9	12.7	10.0	12.0	13.0	15.0	22.0	31.0	36.1	40.0	50.1
25-34 years	804	13,003	28.5	13.6	11.5	13.5	15.0	19.0	26.0	35.5	41.1	45.0	54.0
35-44 years	664	10,676	29.2	11.6	12.0	15.0	17.5	21.0	28.0	36.0	41.0	44.0	48.5
45-54 years	765	11,150	29.9	12.6	13.0	15.0	17.5	21.0	28.0	37.0	42.0	46.0	53.0
55-64 years	598	9,073	28.2	11.7	12.0	14.0	16.5	20.0	26.0	34.1	40.1	44.0	48.1
65-74 years	1,657	5,496	27.7	11.5	11.5	14.0	16.0	19.5	26.0	34.1	38.5	42.6	49.0
20-29 years	984	15,458	25.9	13.0	10.5	12.0	14.0	16.0	23.0	32.0	38.0	43.0	51.1
Women													
20-74 years	8,130	64,158	42.3	17.4	18.5	22.0	24.8	29.0	40.0	53.5	60.6	65.1	74.0
20-24 years	1,243	9,215	35.1	15.4	17.0	19.0	21.0	24.0	31.5	43.0	50.0	56.0	65.0
25-34 years	1,896	13,933	39.3	17.3	18.5	20.5	22.5	26.5	35.1	48.1	58.0	64.1	73.0
35-44 years	1,664	11,593	43.6	18.0	20.0	23.0	25.5	30.0	40.5	55.0	62.0	68.0	75.1
45-54 years	836	12,163	46.6	17.4	22.0	25.0	28.0	33.5	45.0	58.0	64.0	69.5	78.6
55-64 years	669	9,976	45.8	17.5	19.0	25.0	27.5	33.0	46.0	58.0	63.5	68.0	73.1
65-74 years	1,822	7,277	42.8	15.3	20.0	25.0	27.5	32.1	41.0	52.5	59.0	63.0	70.0
20-29 years	2,280	16,789	36.2	16.0	17.5	19.5	21.1	24.5	32.5	44.0	52.0	58.5	68.0

Table 6. Number of examined persons, estimated population in thousands, and number and percent of persons obese at selected percentiles based on triceps plus subscapular skinfold, by sex and age: United States, 1971-74

Sex and age	Number of examined persons	Estimated population in thousands	Obesity at selected percentile[1]					
			85th percentile or more		90th percentile or more		95th percentile or more	
			Number	Percent	Number	Percent	Number	Percent
Men								
20-74 years	5,001	57,507	11,133	19.4	6,900	12.0	2,929	5.1
20-24 years	513	8,110	1,026	12.7	735	9.1	369	4.5
25-34 years	804	13,003	2,706	20.8	1,768	13.6	853	6.6
35-44 years	664	10,676	2,264	21.2	1,186	11.1	404	3.8
45-54 years	765	11,150	2,544	22.8	1,574	14.1	708	6.3
55-64 years	598	9,073	1,681	18.5	1,089	12.0	382	4.2
65-74 years	1,657	5,496	911	16.6	549	10.0	214	3.9
Women								
20-74 years	8,130	64,158	17,740	27.7	11,424	17.8	5,480	8.5
20-24 years	1,243	9,215	1,220	13.2	751	8.1	334	3.6
25-34 years	1,896	13,933	2,921	21.0	2,008	14.4	1,109	8.0
35-44 years	1,664	11,593	3,554	30.7	2,310	19.9	1,190	10.3
45-54 years	836	12,163	4,510	37.1	2,900	23.8	1,339	11.0
55-64 years	669	9,976	3,632	36.4	2,318	23.2	1,053	10.6
65-74 years	1,822	7,277	1,902	26.1	1,139	15.7	455	6.3

[1]Obesity measure is based on triceps plus subscapular skinfold and is defined at the sex-specific 85th, 90th, and 95th percentiles for persons ages 20-29 years.

Table 7. Cumulative percent distribution of relative standard weight of men, by age: United States, 1971-74

Relative standard weight[1]	Age							
	20-74 years	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	20-29 years
	Percent distribution							
Under 85	15.0	16.2	15.0	13.6	13.9	17.1	14.9	16.7
Under 90	26.3	28.9	29.3	24.5	23.1	27.1	23.8	31.2
Under 95	38.5	43.0	42.6	35.2	34.8	38.3	36.3	44.7
Under 100	52.1	56.0	55.6	48.9	49.4	51.9	49.6	57.6
Under 105	66.8	67.8	66.8	65.8	67.5	68.3	63.7	69.4
Under 110	77.6	78.7	77.3	77.7	76.4	78.5	77.4	80.0
Under 115	85.7	86.4	84.3	86.8	85.9	85.6	85.4	87.0
Under 120	91.0	91.6	89.6	92.6	91.4	90.2	91.0	91.5
Under 125	94.2	93.1	93.1	95.7	93.9	94.8	94.9	93.2
Under 130	96.1	95.7	94.9	97.6	96.2	95.9	97.0	95.1
Under 135	97.2	96.7	95.9	98.1	97.9	97.2	98.5	96.2
Under 140	98.1	98.4	97.1	98.7	97.9	98.4	98.9	98.0
Under 145	98.8	98.6	98.2	99.0	98.8	99.3	99.5	98.4
Under 150	99.0	98.7	98.5	99.2	99.0	99.4	99.6	98.6
Under 155	99.3	99.7	98.7	99.2	99.2	99.4	99.7	99.2
Under 160	99.4	99.7	99.0	99.2	99.5	99.4	99.9	99.4

[1]Based on average weights estimated from regression equations of weight on height for men of age-specific groups.

Table 8. Cumulative percent distribution of relative standard weight[1] of women, by age : United States, 1971-74

Relative standard weight[1]	Age							
	20-74 years	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	20-29 years
	Percent distribution							
Under 85	26.2	20.2	26.9	29.9	28.2	26.7	22.9	24.8
Under 90	38.7	34.4	40.2	44.8	38.1	37.4	34.7	38.9
Under 95	51.9	50.9	55.0	56.2	50.3	49.4	46.5	54.3
Under 100	61.7	62.2	64.4	64.2	60.9	58.4	57.5	64.8
Under 105	70.6	72.9	73.9	71.8	68.9	67.4	66.5	74.8
Under 110	77.3	79.5	79.1	77.2	76.5	75.3	74.9	80.4
Under 115	82.5	85.3	82.7	81.9	82.6	80.9	81.9	85.1
Under 120	86.8	90.3	85.7	85.3	86.5	87.0	87.0	88.9
Under 125	89.8	92.0	88.1	88.0	90.6	90.5	90.5	90.7
Under 130	92.2	93.7	91.1	90.6	92.3	92.9	93.5	92.8
Under 135	94.0	94.8	92.7	92.9	93.8	95.6	95.2	94.3
Under 140	95.3	95.7	93.8	94.2	95.3	96.8	97.1	95.2
Under 145	96.4	96.3	95.4	96.0	96.0	97.5	97.9	96.3
Under 150	97.3	97.1	96.6	97.1	96.5	98.4	98.6	97.1
Under 155	98.1	97.7	97.3	97.5	98.6	98.7	99.1	97.9
Under 160	98.5	98.3	98.1	98.0	98.7	98.8	99.3	98.5
Under 170	99.0	99.1	98.7	98.7	99.4	98.9	99.7	99.2
Under 180	99.3	99.2	99.1	98.9	99.5	99.4	99.8	99.4
Under 190	99.6	99.5	99.5	99.5	99.8	99.6	99.9	99.6

[1]Based on average weights estimated from regression equations of weight on height for women of age-specific groups.

Table 9. Cumulative percent distribution of relative desirable weight of men, by age: United States, 1971-74

Relative desirable weight[1]	Age						
	20-74 years	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years
	Percent distribution						
Under 85	10.5	20.3	9.6	6.4	8.5	9.7	11.2
Under 90	18.4	32.1	18.9	12.6	14.6	17.2	18.4
Under 95	29.9	48.1	32.8	23.0	23.2	27.0	27.9
Under 100	41.5	60.5	46.7	32.1	33.8	38.0	40.9
Under 105	54.0	71.7	58.4	44.8	48.2	49.7	53.7
Under 110	67.8	81.4	69.7	60.9	64.3	65.5	67.5
Under 115	78.0	89.0	78.6	73.0	74.4	76.7	79.4
Under 120	85.9	92.6	86.4	82.8	84.2	84.2	86.6
Under 125	90.7	94.7	90.2	89.6	89.5	89.6	91.9
Under 130	94.0	96.6	93.1	94.8	92.9	92.4	95.5
Under 135	95.8	98.0	94.9	96.4	95.2	94.5	97.3
Under 140	97.2	98.6	96.3	97.6	97.3	96.1	98.5
Under 145	97.9	98.6	97.1	98.1	97.9	97.6	98.8
Under 150	98.7	99.2	98.2	99.0	98.0	99.0	99.5
Under 155	99.1	99.7	98.5	99.0	98.8	99.3	99.7
Under 160	99.3	100.0	98.7	99.2	99.0	99.4	99.9

[1]Relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight based on height for men ages 20-29 years.

Table 10. Cumulative percent distribution of relative desirable weight of women, by age: United States, 1971-74

Relative desirable weight[1]	Age						
	20-74 years	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years
	Percent distribution						
Under 85	12.7	23.6	18.0	10.3	7.5	9.2	6.4
Under 90	22.2	37.0	31.4	19.5	14.9	14.5	13.0
Under 95	34.1	53.9	44.2	31.8	26.8	23.5	20.3
Under 100	45.3	65.7	57.4	45.2	36.4	31.5	30.3
Under 105	55.3	75.5	66.0	55.7	46.3	41.5	42.2
Under 110	63.7	80.7	74.7	63.5	56.8	50.4	51.0
Under 115	70.5	87.5	79.4	69.9	64.0	58.8	59.7
Under 120	76.4	90.5	82.8	75.7	72.0	66.0	68.5
Under 125	81.1	92.8	85.7	80.2	77.5	73.2	75.6
Under 130	84.7	93.8	88.1	82.8	83.1	78.1	81.5
Under 135	88.2	95.2	90.8	86.1	86.5	84.0	85.8
Under 140	90.8	95.9	92.4	88.7	89.7	88.3	89.9
Under 145	92.8	97.0	93.7	91.1	92.0	90.9	92.4
Under 150	94.4	97.2	95.2	93.1	93.3	93.3	94.5
Under 155	95.8	97.8	96.5	94.1	94.9	95.4	96.1
Under 160	96.6	98.4	97.0	95.8	95.5	96.6	97.2
Under 170	98.0	99.1	98.2	97.5	97.0	98.0	98.5
Under 180	98.8	99.3	98.8	98.0	98.8	98.7	99.3
Under 190	99.2	99.5	99.3	98.8	99.4	98.8	99.5

[1]Relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight based on height for women ages 20-29 years.

Table 11. Number of examined persons, estimated population in thousands, and means, standard deviations, and selected percentiles of relative standard weight of adults, by sex and age: United States, 1971-74

Sex and age	Number in sample	Estimated population in thousands	Mean	Standard deviation	Percentile								
					5th	10th	15th	25th	50th	75th	85th	90th	95th
Men					Relative standard weight[1]								
20-74 years	5,001	57,507	100	16	77	82	85	89	99	109	114	119	127
20-24 years	513	8,110	100	16	78	82	84	88	97	108	114	119	128
25-34 years	804	13,003	101	18	79	82	85	89	98	109	115	121	131
35-44 years	664	10,676	101	15	78	83	85	91	100	109	114	118	123
45-54 years	765	11,150	100	16	75	82	86	91	100	109	114	118	127
55-64 years	598	9,073	100	16	75	81	83	89	99	107	114	119	126
65-74 years	1,657	5,496	100	15	76	82	85	91	100	109	115	119	125
20-29 years	984	15,458	99	16	79	82	84	88	97	108	114	118	130
Women													
20-74 years	8,130	64,158	99	21	74	78	80	84	94	108	118	125	139
20-24 years	1,243	9,215	99	20	76	80	83	87	95	106	115	120	136
25-34 years	1,896	13,933	99	22	75	78	80	84	93	106	119	128	143
35-44 years	1,664	11,593	98	22	74	77	79	83	92	108	120	129	142
45-54 years	836	12,163	99	21	74	77	80	84	95	109	118	124	139
55-64 years	669	9,976	98	21	69	74	79	84	95	110	118	125	133
65-74 years	1,822	7,277	99	19	73	78	81	86	97	110	118	124	134
20-29 years	2,280	16,789	98	20	76	78	81	85	93	105	115	123	139

[1] Based on average weights estimated from regression of weight on height, of men and women for specified age groups.

Table 12. Number of examined persons, estimated populations in thousands, and means, standard deviations, and selected percentiles of relative desirable weight of adults, by sex and age: United States, 1971-74

Sex and age	Number in sample	Estimated population in thousands	Mean	Standard deviation	Percentile								
					5th	10th	15th	25th	50th	75th	85th	90th	95th
Men					Relative desirable weight[1]								
20-74 years	5,001	57,507	104	17	80	85	88	93	103	113	119	124	133
20-24 years	513	8,110	98	15	76	80	82	87	96	106	112	116	126
25-34 years	804	13,003	104	19	82	85	88	92	101	113	119	125	136
35-44 years	664	10,676	107	16	83	88	91	96	107	116	122	126	130
45-54 years	765	11,150	106	16	79	86	91	96	106	115	121	125	134
55-64 years	598	9,073	105	17	79	85	88	94	105	113	120	125	138
65-74 years	1,657	5,496	104	15	79	84	88	94	104	113	119	123	129
Women													
20-74 years	8,130	64,158	107	24	79	83	86	91	102	119	130	139	152
20-24 years	1,243	9,215	98	20	75	79	82	86	94	105	113	118	134
25-34 years	1,896	13,933	103	23	78	81	84	88	97	110	123	134	149
35-44 years	1,664	11,593	109	25	82	85	88	92	102	119	133	143	157
45-54 years	836	12,163	111	24	83	87	90	94	107	123	133	140	156
55-64 years	669	9,976	113	24	80	86	90	97	109	127	136	144	153
65-74 years	1,822	7,277	112	22	82	88	91	98	110	125	134	141	153

[1] Based on average weights estimated from regression of weight on height, of men and women for ages 20-29 years.

Table 13. Number of examined persons, estimated population in thousands, and number and percent of persons overweight at selected percentiles based on relative desirable weight[1], by sex and age: United States, 1971-74

Sex and age	Number of examined persons	Estimated population in thousands	Overweight at selected percentile					
			85th percentile or more		90th percentile or more		95th percentile or more	
			Number	Percent	Number	Percent	Number	Percent
Men								
20-74 years	5,001	57,507	13,340	23.2	9,850	17.1	3,454	6.0
20-24 years	513	8,110	987	12.2	673	8.3	278	3.4
25-34 years	804	13,003	2,950	22.7	2,356	18.1	897	6.9
35-44 years	664	10,676	3,015	28.2	2,139	20.0	550	5.2
45-54 years	765	11,150	3,013	27.0	2,177	19.5	790	7.1
55-64 years	598	9,073	2,158	23.8	1,609	17.7	688	7.6
65-74 years	1,657	5,496	1,217	22.1	897	16.3	250	4.5
Women								
20-74 years	8,130	64,158	18,935	29.5	13,353	20.8	6,153	9.6
20-24 years	1,243	9,215	1,153	12.5	740	8.0	391	4.2
25-34 years	1,896	13,933	2,867	20.6	2,149	15.4	1,118	8.0
35-44 years	1,664	11,593	3,488	30.1	2,540	21.9	1,366	11.8
45-54 years	836	12,163	4,383	36.0	3,016	24.8	1,328	10.9
55-64 years	669	9,976	4,112	41.2	2,936	29.4	1,194	12.0
65-74 years	1,822	7,277	2,931	40.3	1,972	27.1	756	10.4

[1] Relative desirable weight is observed weight divided by desirable weight times 100 based on average weights estimated from regression equation of weight based on height for men and women ages 20-29 years.

Table 14. Cumulative percent distribution of the weight-height index of men, by age: United States, 1971-74

Weight-height index[1] (in kilogram/meter^p)	Age							
	20-74 years	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	20-29 years
	Percent distribution							
Under 16	0.1	-	0.1	-	0.3	0.3	0.1	-
Under 17	0.7	0.3	0.5	0.4	1.0	1.0	1.3	0.2
Under 18	1.7	2.1	1.0	1.2	1.3	2.8	2.2	1.5
Under 19	3.5	5.7	2.4	2.3	4.2	3.4	4.2	4.3
Under 20	6.9	13.2	5.2	4.2	6.5	7.2	6.7	9.2
Under 21	11.4	23.0	10.2	7.1	8.9	10.2	12.2	17.5
Under 22	18.1	31.7	18.7	12.1	14.5	16.7	18.3	26.7
Under 23	27.4	44.6	31.1	20.3	20.8	24.7	25.3	40.8
Under 24	36.5	55.8	41.1	28.4	28.5	32.8	35.1	50.9
Under 25	47.0	66.2	51.9	37.5	40.9	42.5	46.0	61.8
Under 26	56.6	75.0	60.3	48.2	50.7	52.0	56.6	69.9
Under 27	68.3	81.8	70.1	61.2	64.9	66.5	68.1	78.0
Under 28	77.2	88.5	78.2	71.8	73.1	76.2	78.1	85.6
Under 29	83.5	92.4	82.7	80.9	81.2	82.3	84.0	89.7
Under 30	88.2	93.5	88.4	86.9	86.6	86.2	89.2	92.0
Under 31	91.8	95.4	90.7	91.9	91.0	90.2	93.2	93.6
Under 32	94.2	96.6	93.4	94.9	93.2	92.6	95.6	95.1
Under 33	95.7	98.0	94.2	96.4	95.1	94.5	97.1	96.4
Under 34	97.0	98.6	95.7	97.6	97.3	95.5	98.3	97.0
Under 35	97.6	98.6	96.8	98.1	97.9	96.4	98.8	97.9
Under 36	98.0	98.6	97.5	98.1	97.9	97.5	99.2	98.2
Under 37	98.8	99.7	98.5	99.0	98.3	98.5	99.5	99.1
Under 38	99.0	99.7	98.5	99.0	98.8	98.5	99.7	99.1

[1] Weight-height index, W/H^2, where p = 2 for men.

Table 15. Cumulative percent distribution of the weight-height index of women, by age: United States, 1971-74

Weight-height index[1] (in kilogram/meter^p)	Age							
	20-74 years	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	20-29 years
	Percent distribution							
Under 16	-	-	-	-	0.1	-	0.1	-
Under 17	-	-	-	-	0.1	-	0.1	-
Under 18	0.1	0.1	-	-	0.1	-	0.3	-
Under 19	0.2	0.2	-	-	0.1	0.5	0.6	0.1
Under 20	0.4	0.5	0.4	0.1	0.1	0.7	0.8	0.6
Under 21	0.8	1.4	0.8	0.5	0.5	0.9	1.2	1.1
Under 22	1.7	3.4	2.0	1.0	0.8	1.5	2.0	3.0
Under 23	3.7	8.2	4.3	1.7	1.7	4.0	3.3	6.8
Under 24	6.8	13.3	9.0	4.5	3.1	6.6	4.7	12.3
Under 25	11.7	21.8	16.3	9.0	7.1	8.5	6.3	20.6
Under 26	17.8	31.1	25.2	14.8	11.8	11.3	10.3	29.9
Under 27	25.0	40.7	34.0	22.5	17.8	16.8	15.2	39.1
Under 28	33.2	53.1	42.8	30.7	25.7	22.5	20.4	50.5
Under 29	40.7	60.5	52.4	39.8	32.5	27.1	26.8	58.8
Under 30	48.3	68.8	60.3	48.2	38.2	35.6	33.9	66.5
Under 31	54.8	74.9	65.5	55.6	44.9	41.7	41.8	72.2
Under 32	60.9	78.7	72.0	60.0	53.5	48.7	47.9	77.2
Under 33	66.1	82.6	76.1	65.3	59.4	53.7	55.4	81.1
Under 34	70.5	87.3	79.2	69.7	64.2	58.7	60.1	84.7
Under 35	74.3	89.9	81.5	73.7	68.8	63.7	65.6	87.1
Under 36	78.1	91.5	83.7	77.2	73.8	68.8	71.6	88.8
Under 37	81.2	92.9	85.7	80.5	77.6	73.2	76.4	90.3
Under 38	83.9	93.7	87.3	82.0	81.8	77.8	79.9	91.4
Under 39	86.0	94.3	88.8	84.4	83.8	80.6	83.6	92.3
Under 40	88.4	95.3	91.0	86.2	86.5	84.9	86.5	93.7
Under 41	90.3	95.8	91.8	88.0	89.0	87.7	89.5	94.4
Under 42	91.7	96.2	93.0	89.5	90.9	89.5	90.9	95.2
Under 43	92.9	97.0	93.8	91.0	92.3	91.1	92.9	95.9
Under 44	94.0	97.1	95.0	92.4	92.6	92.8	94.4	96.5
Under 45	94.9	97.4	95.7	93.5	93.8	94.6	95.2	96.9
Under 50	97.8	99.1	98.2	97.5	96.5	97.6	98.5	99.0
Under 55	99.0	99.5	99.1	98.4	98.9	98.8	99.4	99.5
Under 60	99.5	99.7	99.7	99.0	99.5	99.4	99.8	99.7

[1]Weight-height index, W/H$^{1.5}$, where p = 1.5 for women.

Table 16. Number of examined persons, estimated population in thousands, and means, standard deviations, and selected percentiles of weight-height index, by sex and age: United States, 1971-74

Sex and age	Number in sample	Estimated population in thousands	Mean	Standard deviation	Percentile								
					5th	10th	15th	25th	50th	75th	85th	90th	95th
Men					Weight-height index[1]								
20-74 years	5,001	57,507	26	4	20	21	22	23	25	28	29	30	33
20-24 years	513	8,110	24	4	19	20	20	21	23	26	27	28	31
25-34 years	804	13,003	25	5	20	21	22	23	25	28	29	31	33
35-44 years	664	10,676	26	4	20	22	22	24	26	28	30	31	32
45-54 years	765	11,150	26	4	19	21	22	24	26	28	30	31	33
55-64 years	598	9,073	26	4	19	21	22	23	26	28	30	31	34
65-74 years	1,657	5,496	25	4	19	21	22	23	25	28	29	30	32
20-29 years	984	15,458	24	4	19	20	21	22	24	27	28	29	32
Women													
20-74 years	8,130	64,158	32	7	23	25	26	27	30	35	39	41	45
20-24 years	1,243	9,215	29	6	22	23	24	25	28	31	34	35	40
25-34 years	1,896	13,933	30	7	23	24	25	26	29	33	37	40	44
35-44 years	1,664	11,593	32	7	24	25	26	27	30	35	39	42	47
45-54 years	836	12,163	33	7	25	26	27	28	32	36	40	41	46
55-64 years	669	9,976	33	7	24	25	27	29	32	37	40	42	45
65-74 years	1,822	7,277	33	6	24	26	27	29	32	37	40	41	45
20-29 years	2,280	16,789	29	6	23	24	24	26	28	32	34	37	42

[1]Weight-height in kilogram/(meter^p), where p = 2 for male, and p = 1.5 for female.

Table 17. Number of examined persons, estimated population in thousands, and number and percent of persons overweight at selected percentiles based on the weight-height index, by sex and age: United States, 1971-74

Sex and age	Number of examined persons	Estimated population in thousands	Overweight at selected percentile[1]					
			85th percentile or more		90th percentile or more		95th percentile or more	
			Number	Percent	Number	Percent	Number	Percent
Men			Weight-height index					
20-74 years	5,001	57,507	13,136	22.8	9,476	16.5	3,347	5.8
20-24 years	513	8,110	933	11.5	619	7.6	274	3.4
25-34 years	804	13,003	2,829	21.8	2,245	17.3	861	6.6
35-44 years	664	10,676	3,010	28.2	2,034	19.1	541	5.1
45-54 years	765	11,150	3,002	26.9	2,093	18.8	758	6.8
55-64 years	598	9,073	2,158	23.8	1,602	17.7	668	7.4
65-74 years	1,657	5,496	1,204	21.9	882	16.0	243	4.4
Women								
20-74 years	8,130	64,158	18,953	29.5	12,034	18.8	5,351	8.3
20-24 years	1,243	9,215	1,169	12.7	659	7.2	351	3.8
25-34 years	1,896	13,933	2,902	20.8	1,995	14.3	982	7.0
35-44 years	1,664	11,593	3,512	30.3	2,263	19.5	1,212	10.5
45-54 years	836	12,163	4,351	35.8	2,729	22.4	1,102	9.1
55-64 years	669	9,976	4,116	41.3	2,671	26.8	1,044	10.5
65-74 years	1,822	7,277	2,903	39.9	1,717	23.6	659	9.1

[1]Overweight measure is based on weight-height index, a power function of height in relation to weight where the optimal power value from NHANES data showed a value of p = 2 for men and p = 1.5 for women and is defined as at the sex-specific 85th, 90th, and 95th percentile for persons ages 20-29 years.

Table 18. Correlation coefficient of height and of weight with obesity and overweight measures, by sex and age: United States, 1971-74

Sex and age	Correlation coefficient of height with:			Correlation coefficient of weight with:		
	Triceps plus subscapular skinfold[1]	Relative desirable weight[2]	Weight-height index[3]	Triceps plus subscapular skinfold	Relative desirable weight	Weight-height index
Men						
20-74 years	0.0173	-0.0316	-0.0439	0.7109	0.8914	0.8824
20-24 years	0.0516	0.0221	0.0058	0.7398	0.8840	0.8760
25-34 years	0.0175	0.0103	-0.0037	7574	0.9118	0.9057
35-44 years	0.0633	0.0028	-0.0068	0.6836	0.8868	0.8823
45-54 years	-0.0210	-0.0766	-0.0841	0.6850	0.8926	0.8890
55-64 years	0.0329	-0.0390	-0.0572	0.6846	0.9006	0.8743
65-74 years	0.0094	-0.0450	-0.0409	0.6633	0.8834	0.8854
Women						
20-74 years	-0.0696	-0.0655	0.0390	0.7932	0.9548	0.9625
20-24 years	-0.0608	-0.0086	0.0193	0.7824	0.9488	0.9574
25-34 years	-0.0251	0.0002	0.0238	0.8175	0.9612	0.9676
35-44 years	-0.0422	-0.0101	0.0133	0.7831	0.9599	0.9660
45-54 years	-0.0209	-0.0422	-0.0169	0.7916	0.9569	0.9641
55-64 years	-0.0719	-0.0473	-0.0184	0.7812	0.9581	0.9662
65-74 years	-0.0454	-0.0494	-0.0155	0.7277	0.9460	0.9566

[1]Obesity—triceps plus subscapular skinfold.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight on height for men and women ages 20-29 years.
[3]Weight-height index in kilogram/(meter^p), where $p = 2$ for men, and $p = 1.5$ for women.

Table 19. Percent of men and women obese and overweight at selected percentile cutting points, by sex and age: United States, 1971-74

Age	Men			Women		
	Triceps plus subscapular skinfold[1]	Relative desirable weight[2]	Weight-height index[3]	Triceps plus subscapular skinfold	Relative desirable weight	Weight-height index
	85th percentile					
20-74 years	19.4	23.2	22.8	27.7	29.5	29.5
20-24 years	12.7	12.2	11.5	13.2	12.5	12.7
25-34 years	20.8	22.7	21.8	21.0	20.6	20.8
35-44 years	21.2	28.2	28.2	30.7	30.1	30.3
45-54 years	22.8	27.0	26.9	37.1	36.0	35.8
55-64 years	18.5	23.8	23.8	36.4	41.2	41.3
65-74 years	16.6	22.1	21.9	26.1	40.3	39.9
	90th percentile					
20-74 years	12.0	17.1	16.5	17.8	20.8	18.8
20-24 years	9.1	8.3	7.6	8.1	8.0	7.2
25-34 years	13.6	18.1	17.3	14.4	15.4	14.3
35-44 years	11.1	20.0	19.1	19.9	21.9	19.5
45-54 years	14.1	19.5	18.8	23.8	24.8	22.4
55-64 years	12.0	17.7	17.7	23.2	29.4	26.8
65-74 years	10.0	16.3	16.0	15.7	27.1	23.6
	95th percentile					
20-74 years	5.1	6.0	5.8	8.5	9.6	8.3
20-24 years	4.6	3.4	3.4	3.6	4.2	3.8
25-34 years	6.6	6.9	6.6	8.0	8.0	7.0
35-44 years	3.8	5.2	5.1	10.3	11.8	10.5
45-54 years	6.3	7.1	6.8	11.0	10.9	9.1
55-64 years	4.2	7.6	7.4	10.6	12.0	10.5
65-74 years	3.9	4.5	4.4	6.3	10.4	9.1

[1]Obesity—triceps plus subscapular skinfold.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight on height for men and women ages 20-29 years.
[3]Weight-height index in kilogram/(meter^p), where p = 2 for men, and 0 = 1.5 for women. Criteria of obesity and overweight are at the 85th, 90th, and 95th percentiles for men and women ages 20-29 years.

Table 20. Number of examined persons, estimated population in thousands, and coefficients of correlation of triceps plus subscapular skinfold with relative desirable weight and weight-height index, by sex and age: United States, 1971-74

Sex and age	Number of examined persons n	Estimated population in thousands N	Correlation of sum of skinfold with:[1]	
			Relative desirable weight[2] (W/W_H)	Weight-height index[3] (W/H^2)
Men				
20-24 years	513	8,110	0.819	0.819
25-34 years	804	13,003	0.828	0.827
35-44 years	664	10,676	0.737	0.739
45-54 years	765	11,150	0.749	0.748
55-64 years	598	9,073	0.730	0.723
65-74 years	1,657	5,496	0.729	0.728
Women				
20-24 years	1,243	9,215	0.843	0.842
25-34 years	1,896	13,933	0.857	0.857
35-44 years	1,664	11,593	0.823	0.822
45-54 years	836	12,163	0.824	0.824
55-64 years	669	9,976	0.825	0.825
65-74 years	1,822	7,277	0.769	0.770

[1]Obesity—triceps plus subscapular skinfold.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on regression equations of weight on height for men and women ages 20-29 years.
[3]Weight-height index in kilogram/(meter^p), where p = 2 for men, and p = 1.5 for women.

Table 21. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for relative desirable weights[1] of men ages 20-74 years, with mean and standard deviation: United States, 1971-74

Triceps plus subscapular skinfold values (in millimeters)	Relative desirable weight[1]								
	All relative weight values			Less than 85			85-89		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
01 Total	5,001	57,507	100.0	591	6,029	100.0	409	4,569	100.0
02 Less than 8	33	287	0.5	29	251	4.2	2	30	0.6
03 8-11	279	2,857	5.5	201	2,129	39.5	40	333	7.9
04 12-15	532	5,571	15.2	210	2,129	74.8	128	1,420	39.0
05 16-19	570	6,391	26.3	96	1,064	92.4	111	1,293	67.3
06 20-23	673	7,620	39.5	38	332	97.9	55	650	81.5
07 24-27	687	7,846	53.2	12	110	99.8	42	450	91.4
08 28-31	593	7,130	65.6	4	8	99.9	18	129	94.2
09 32-35	539	6,513	76.9	-	-	99.9	7	97	96.3
10 36-39	357	4,173	84.1	1	7	100.0	3	42	97.3
11 40-43	238	2,811	89.0	-	-	100.0	2	34	98.0
12 44-47	171	2,228	92.9	-	-	100.0	1	91	100.0
13 48-51	109	1,357	95.3	-	-	100.0	-	-	100.0
14 52-55	70	851	96.8	-	-	100.0	-	-	100.0
15 56-59	56	678	97.9	-	-	100.0	-	-	100.0
16 60-63	27	383	98.6	-	-	100.0	-	-	100.0
17 64-67	28	327	99.2	-	-	100.0	-	-	100.0
18 68-71	7	80	99.3	-	-	100.0	-	-	100.0
19 72-75	11	140	99.5	-	-	100.0	-	-	100.0
20 76 and over	21	265	100.0	-	-	100.0	-	-	100.0
21 Mean	...	...	28.3	...	...	13.3	...	...	18.7
22 Standard devaition	...	...	12.5	...	...	4.2	...	...	6.9

Triceps plus subscapular skinfold values (in millimeters)	Relative desirable weight[1]								
	110-114			115-119			120-124		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
23 Total	499	5,862	100.0	367	4,531	100.0	257	2,753	100.0
24 Less than 8	-	-	-	-	-	-	-	-	-
25 8-11	-	-	-	-	-	-	-	-	-
26 12-15	8	42	0.7	2	5	0.1	-	-	-
27 16-19	17	192	4.0	6	59	1.4	1	31	1.1
28 20-23	62	672	15.4	13	167	5.1	14	92	4.5
29 24-27	77	770	28.6	49	605	18.4	22	220	12.5
30 28-31	88	1,133	47.9	68	814	36.4	35	393	26.7
31 32-35	82	1,025	65.4	63	668	51.1	54	554	46.9
32 36-39	64	751	78.2	60	772	68.2	40	507	65.3
33 40-43	44	470	86.2	37	498	79.2	34	321	76.9
34 44-47	27	383	92.8	31	375	87.4	24	298	87.8
35 48-51	16	252	97.1	16	190	91.6	13	121	92.1
36 52-55	7	77	98.4	9	159	95.1	7	87	95.3
37 56-59	3	30	98.9	9	132	98.1	6	87	98.5
38 60-63	3	56	99.9	3	78	99.8	5	34	99.7
39 64-67	1	8	100.0	1	10	100.0	1	1	99.8
40 68-71	-	-	100.0	-	-	100.0	-	-	99.8
41 72-75	-	-	100.0	-	-	100.0	-	-	99.8
42 76 and over	-	-	100.0	-	-	100.0	1	7	100.0
43 Mean	...	...	33.0	...	...	36.3	...	...	37.5
44 Standard deviation	...	...	9.0	...	...	9.5	...	...	9.0

Table 21. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for relative desirable weights[1] of men ages 20-74 years, with mean and standard deviation: United States, 1971-74—Con.

Relative desirable weight[1]

	90-94			95-99			100-104			105-109			
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	
	530	6,589	100.0	602	6,681	100.0	614	7,166	100.0	651	7,949	100.0	01
	-	-	-	2	7	0.1	-	-	-	-	-	-	02
	25	276	4.2	8	93	1.5	4	24	0.3	1	2	-	03
	93	1,268	23.4	58	397	7.4	23	238	3.6	9	49	0.6	04
	120	1,445	45.4	104	1,056	23.3	68	626	12.4	46	618	8.4	05
	124	1,581	69.4	141	1,494	45.6	116	1,333	31.0	102	1,210	23.6	06
	86	1,085	85.8	108	1,239	64.2	138	1,753	55.5	140	1,536	42.9	07
	33	367	91.4	90	1,164	81.6	114	1,357	74.4	117	1,507	61.9	08
	27	358	96.8	57	900	95.1	76	906	87.0	105	1,356	79.0	09
	16	165	99.3	23	222	98.4	35	424	93.0	58	688	87.6	10
	5	42	100.0	5	67	99.4	23	318	97.4	40	610	95.3	11
	1	1	100.0	5	36	99.9	12	160	99.6	21	238	98.3	12
	-	-	100.0	-	-	99.9	3	6	99.7	9	94	99.5	13
	-	-	100.0	1	4	100.0	2	20	100.0	1	20	99.7	14
	-	-	100.0	-	-	100.0	-	-	100.0	-	-	99.7	15
	-	-	100.0	-	-	100.0	-	-	100.0	-	-	99.7	16
	-	-	100.0	-	-	100.0	-	-	100.0	2	23	100.0	17
	-	-	100.0	-	-	100.0	-	-	100.0	-	-	100.0	18
	-	-	100.0	-	-	100.0	-	-	100.0	-	-	100.0	19
	-	-	100.0	-	-	100.0	-	-	100.0	-	-	100.0	20
	...	...	21.1	...	...	25.0	...	...	27.5	...	...	29.8	21
	...	...	6.6	...	...	6.8	...	...	7.3	...	...	7.9	22

Relative desirable weight[1]

	125-129			110 and more			120 and more			130 and more			
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	
	167	1,923	100.0	1,604	18,523	100.0	738	8,130	100.0	314	3,454	100.0	23
	-	-	-	-	-	-	-	-	-	-	-	-	24
	-	-	-	-	-	-	-	-	-	-	-	-	25
	-	-	-	11	69	7.4	1	23	0.3	1	23	0.7	26
	1	6	0.3	25	288	23.3	2	37	0.7	-	-	0.7	27
	5	82	4.6	97	1,020	45.6	22	181	3.0	3	7	0.9	28
	8	65	8.0	161	1,673	64.2	35	298	6.6	5	13	1.3	29
	13	103	13.3	217	2,599	81.6	61	652	14.7	13	156	5.8	30
	31	325	30.2	267	2,895	95.1	122	1,201	29.4	37	322	15.1	31
	29	242	42.8	221	2,626	98.4	97	1,103	43.0	28	353	25.3	32
	18	225	54.5	163	1,739	99.4	82	771	52.5	30	224	31.8	33
	20	263	68.2	131	1,702	99.9	73	944	64.1	29	382	42.9	34
	15	236	80.5	97	1,257	99.9	65	815	74.1	37	458	56.1	35
	14	241	93.0	66	807	100.0	50	571	81.1	29	243	63.2	36
	5	40	95.1	56	678	100.0	44	516	87.5	33	388	74.4	37
	3	17	96.0	27	383	100.0	21	249	90.5	13	197	80.1	38
	4	38	98.0	26	304	100.0	24	286	94.0	19	247	87.3	39
	-	-	98.0	7	80	100.0	7	80	95.0	7	80	89.6	40
	1	39	100.0	11	140	100.0	11	140	96.7	10	102	92.5	41
	-	-	100.0	21	265	100.0	21	265	100.0	20	258	100.0	42
	...	...	42.2	...	...	38.9	...	...	44.6	...	...	51.5	43
	...	...	10.7	...	...	12.6	...	...	13.8	...	...	15.2	44

[1] Relative desirable weight is observed weight divided by desirable weight times 100 based on average weights estimated from regression equation of weight based on height for men and women ages 20-29 years.

Table 22. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for relative desirable weights of women ages 20-74 years, with means and standard deviations: United States, 1971-74

	Triceps plus subscapular skinfold values (in millimeters)	Relative desirable weight[1]								
		All relative weight values			Less than 85			85-89		
		Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
01	Total	8,130	64,158	100.0	1,008	8,180	100.0	757	6,059	100.0
02	Less than 8	4	18	0.0	4	18	0.2	-	-	-
03	8-11	58	349	0.6	51	286	3.7	6	62	1.0
04	12-15	140	981	2.1	113	736	12.7	16	104	2.7
05	16-19	349	2,615	6.2	232	1,843	35.2	68	454	10.2
06	20-23	560	4,434	13.1	246	2,021	59.9	137	1,094	28.3
07	24-27	674	5,671	21.9	167	1,562	79.0	161	1,338	50.4
08	28-31	754	6,219	31.6	104	905	90.1	165	1,339	72.5
09	32-35	756	6,136	41.2	52	505	96.3	98	842	86.4
10	36-39	711	5,480	49.7	28	171	98.4	49	363	92.3
11	40-43	683	5,320	58.0	7	96	99.5	27	241	96.3
12	44-47	615	4,932	65.7	-	-	99.5	17	152	98.8
13	48-51	521	4,264	72.3	3	31	99.9	6	23	99.2
14	52-55	474	3,988	78.6	-	-	99.9	2	31	99.7
15	56-59	446	3,397	83.9	1	8	100.0	1	5	99.8
16	60-63	344	2,776	88.2	-	-	100.0	4	11	100.0
17	64-67	291	2,098	91.5	-	-	100.0	-	-	100.0
18	68-71	213	1,666	94.1	-	-	100.0	-	-	100.0
19	72-75	157	1,171	95.9	-	-	100.0	-	-	100.0
20	76 and over	380	2,643	100.0	-	-	100.0	-	-	100.0
21	Mean	...	...	42.3	...	...	22.7	...	...	28.2
22	Standard deviation	...	...	17.4	...	...	6.8	...	...	7.6

	Triceps plus subscapular skinfold values (in millimeters)	Relative desirable weight[1]								
		110-114			115-119			120-124		
		Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
23	Total	572	4,367	100.0	491	3,769	100.0	388	3,031	100.0
24	Less than 8	-	-	-	-	-	-	-	-	-
25	8-11	-	-	-	-	-	-	-	-	-
26	12-15	-	-	-	-	-	-	-	-	-
27	16-19	-	-	-	-	-	-	-	-	-
28	20-23	2	5	0.1	3	8	0.2	2	13	0.4
29	24-27	10	105	2.5	7	34	1.1	-	-	0.4
30	28-31	22	200	7.1	7	21	1.7	6	25	1.2
31	32-35	31	195	11.6	28	165	6.0	10	54	3.0
32	36-39	78	540	23.9	36	177	10.8	15	118	6.9
33	40-43	78	534	36.2	62	335	19.6	31	202	13.6
34	44-47	90	666	51.4	61	485	32.5	43	293	23.3
35	48-51	76	638	66.0	71	705	51.2	61	577	42.3
36	52-55	56	493	77.3	63	521	65.0	56	436	56.6
37	56-59	55	405	86.6	52	477	77.7	58	444	71.3
38	60-63	34	318	93.9	45	355	87.1	30	296	81.1
39	64-67	22	157	97.5	28	305	95.2	34	249	89.3
40	68-71	8	56	98.7	16	109	98.1	23	196	95.8
41	72-75	4	17	99.1	9	49	99.4	11	87	98.6
42	76 and over	6	38	100.0	3	21	100.0	8	41	100.0
43	Mean	...	...	47.6	...	...	51.8	...	...	54.3
44	Standard deviation	...	...	10.4	...	...	9.9	...	...	10.1

Table 22. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for relative desirable weights of women ages 20-74 years, with mean and standard deviation: United States, 1971-74—Con.

Relative desirable weight[1]

	90-94			95-99			100-104			105-109		
Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	
874	7,661	100.0	894	7,185	100.0	781	6,369	100.0	677	5,403	100.0	01
-	-	-	-	-	-	-	-	-	-	-	-	02
1	1	0.0	-	-	-	-	-	-	-	-	-	03
8	120	1.6	1	8	0.1	2	13	0.2	-	-	-	04
28	184	4.0	16	106	1.6	1	4	0.3	3	22	0.4	05
102	890	15.6	47	255	5.1	10	56	1.1	10	85	2.0	06
157	1,335	33.0	101	794	16.2	44	376	7.0	26	126	4.3	07
179	1,571	53.5	144	1,160	32.3	85	714	18.3	36	226	8.5	08
146	1,224	69.5	162	1,299	50.4	139	1,197	37.1	77	541	18.5	09
107	924	81.6	145	1,313	68.7	134	1,016	53.0	93	700	31.5	10
74	729	91.1	125	999	82.6	135	1,054	69.6	93	776	45.8	11
38	358	95.7	76	638	91.5	86	683	80.3	125	1,196	68.0	12
21	185	98.2	33	275	95.3	65	461	87.5	73	623	79.5	13
6	48	98.8	22	188	97.9	41	467	94.8	63	512	89.0	14
5	39	99.3	12	76	99.0	29	228	98.4	40	334	95.1	15
2	54	100.0	6	44	99.6	7	69	99.5	20	158	98.1	16
-	-	100.0	3	28	100.0	1	29	100.0	9	62	99.2	17
-	-	100.0	-	-	100.0	2	3	100.0	3	16	99.5	18
-	-	100.0	-	-	100.0	-	-	100.0	3	16	99.8	19
-	-	100.0	1	3	100.0	-	-	100.0	3	10	100.0	20
...	...	32.0	...	...	36.0	...	...	39.8	...	...	44.1	21
...	...	8.4	...	...	8.5	...	...	8.9	...	...	9.4	22

Relative desirable weight[1]

	125-129			110 and more			120 and more			130 and more		
Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	
315	2,319	100.0	3,139	23,302	100.0	2,076	15,166	100.0	1,373	9,817	100.0	23
-	-	-	-	-	-	-	-	-	-	-	-	24
-	-	-	-	-	-	-	-	-	-	-	-	25
-	-	-	-	-	-	-	-	-	-	-	-	26
-	-	-	1	1	1.6	1	1	0.0	1	1	0.0	27
-	-	-	8	34	5.1	3	20	0.1	1	7	0.1	28
1	1	0.0	18	140	16.2	1	1	0.1	-	-	-	29
3	43	1.9	41	305	32.3	12	83	0.7	3	15	0.2	30
5	45	3.8	82	528	50.4	23	169	1.8	8	70	0.9	31
12	70	6.8	155	994	68.7	41	277	3.6	14	89	1.9	32
19	133	12.5	222	1,425	82.6	82	556	7.3	32	221	4.1	33
34	170	19.9	273	1,905	91.5	122	754	12.3	45	291	7.1	34
32	204	28.7	320	2,667	95.3	173	1,324	21.0	80	544	12.6	35
43	328	42.8	340	2,742	97.9	221	1,728	32.4	122	965	22.4	36
42	423	61.0	358	2,707	99.0	251	1,825	44.4	151	959	32.2	37
45	362	76.6	305	2,442	99.6	226	1,769	56.1	151	1,111	43.5	38
33	156	83.4	278	1,979	100.0	228	1,517	66.1	161	1,112	54.9	39
26	266	94.8	208	1,647	100.0	184	1,482	75.9	135	1,020	65.3	40
5	47	96.9	154	1,155	100.0	141	1,088	83.0	125	954	75.0	41
15	73	100.0	376	2,630	100.0	367	2,570	100.0	344	2,456	100.0	42
...	...	56.5	...	...	58.3	...	...	63.1	...	...	67.3	43
...	...	10.5	...	...	15.0	...	...	14.9	...	...	15.2	44

[1] Relative desirable weight is observed weight divided by desirable weight times 100 based on average weights estimated from regression equation of weight based on height for men and women ages 20-29 years.

Table 23. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for weight-height index of men ages 20-74 years, with means and standard deviations: United States, 1971-74

Triceps plus subscapular skinfold values (in millimeters)	Weight-height index[1]								
	All relative weight values			Less than 18			18-19		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
01 Total	5,001	57,507	100.0	95	957	100.0	286	2,984	100.0
02 Less than 8	33	287	0.5	12	94	9.8	13	103	3.4
03 8-11	279	2,857	5.5	56	610	73.5	98	1,074	39.4
04 12-15	532	5,571	15.2	22	241	98.7	104	1,070	75.3
05 16-19	570	6,391	26.3	3	8	99.5	44	572	94.5
06 20-23	673	7,620	39.5	2	4	100.0	18	116	98.4
07 24-27	687	7,846	53.2	-	-	100.0	5	35	99.5
08 28-31	593	7,130	65.6	-	-	100.0	3	7	99.8
09 32-35	539	6,513	76.9	-	-	100.0	-	-	99.8
10 36-39	357	4,173	84.1	-	-	100.0	1	7	100.0
11 40-43	238	2,811	89.0	-	-	100.0	-	-	100.0
12 44-47	171	2,228	92.9	-	-	100.0	-	-	100.0
13 48-51	109	1,357	95.3	-	-	100.0	-	-	100.0
14 52-55	70	851	96.8	-	-	100.0	-	-	100.0
15 56-59	56	678	97.9	-	-	100.0	-	-	100.0
16 60-63	27	383	98.6	-	-	100.0	-	-	100.0
17 64-67	28	327	99.2	-	-	100.0	-	-	100.0
18 68-71	7	80	99.3	-	-	100.0	-	-	100.0
19 72-75	11	140	99.5	-	-	100.0	-	-	100.0
20 76 and over	21	265	100.0	-	-	100.0	-	-	100.0
21 Mean	...	...	28.3	...	...	10.4	...	...	13.3
22 Standard deviation	...	...	12.5	...	...	2.3	...	...	4.0

Triceps plus subscapular skinfold values (in millimeters)	Weight-height index[1]								
	28-29			30-31			32 and over		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
23 Total	540	6,364	100.0	311	3,425	100.0	299	3,347	100.0
24 Less than 8	-	-	-	-	-	-	-	-	-
25 8-11	-	-	-	-	-	-	-	-	-
26 12-15	2	5	0.1	-	-	-	1	23	0.7
27 16-19	9	114	1.9	1	6	0.2	-	-	0.7
28 20-23	27	270	6.1	11	107	3.3	3	7	0.9
29 24-27	67	834	19.2	18	166	8.1	5	13	1.3
30 28-31	91	1,043	35.6	33	323	17.6	11	151	5.8
31 32-35	95	1,017	51.6	63	666	37.0	35	305	14.9
32 36-39	85	1,031	67.8	48	503	51.7	28	353	25.5
33 40-43	64	721	79.1	34	384	62.9	28	197	31.3
34 44-47	44	551	87.8	37	450	76.0	27	370	42.4
35 48-51	23	289	92.3	24	300	84.8	35	446	55.8
36 52-55	14	226	95.8	19	282	93.0	27	231	62.7
37 56-59	10	140	98.0	11	125	96.6	32	383	74.1
38 60-63	6	107	99.7	5	22	97.3	13	197	80.0
39 64-67	2	11	99.9	6	54	98.9	17	231	86.9
40 68-71	-	-	99.9	-	-	98.9	7	80	89.3
41 72-75	-	-	99.9	1	39	100.0	10	102	92.3
42 76 and over	1	7	100.0	-	-	100.0	20	258	100.0
43 Mean	...	...	36.2	...	...	40.6	...	...	51.6
44 Standard deviation	...	...	9.6	...	...	10.1	...	...	15.3

[1]Weight/height^p in kilograms/(meter^p), where p = 2.

Table 23. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for weight-height index of men ages 20-74 years, with mean and standard deviation: United States, 1971-74—Con.

Weight-height index[1]												
20-21			22-23			24-25			26-27			
Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	
603	6,485	100.0	909	10,566	100.0	982	11,559	100.0	976	11,820	100.0	01
6	83	1.3	2	7	0.1	-	-	-	-	-	-	02
84	773	13.2	33	321	3.1	7	77	0.7	1	2	0.0	03
209	2,193	47.0	140	1,602	18.3	38	355	3.7	16	82	0.7	04
155	1,691	73.1	189	2,134	38.5	115	1,225	14.3	54	641	6.1	05
71	850	86.2	212	2,534	62.4	200	2,263	33.9	129	1,469	18.6	06
45	481	93.6	154	1,828	79.8	213	2,573	56.2	180	1,916	34.8	07
19	130	95.6	86	975	89.0	176	2,258	75.7	174	2,244	53.8	08
7	108	97.3	58	847	97.0	123	1,483	88.5	158	2,086	71.4	09
3	42	98.0	26	236	99.2	60	714	94.7	106	1,287	82.3	10
3	41	98.6	8	81	100.0	26	367	97.9	75	1,021	90.9	11
1	91	100.0	1	1	100.0	17	196	99.6	44	569	95.7	12
-	-	100.0	-	-	100.0	4	24	99.8	23	297	98.3	13
-	-	100.0	-	-	100.0	3	24	100.0	7	89	99.0	14
-	-	100.0	-	-	100.0	-	-	100.0	3	30	99.3	15
-	-	100.0	-	-	100.0	-	-	100.0	3	56	99.7	16
-	-	100.0	-	-	100.0	-	-	100.0	3	31	100.0	17
-	-	100.0	-	-	100.0	-	-	100.0	-	-	100.0	18
-	-	100.0	-	-	100.0	-	-	100.0	-	-	100.0	19
-	-	100.0	-	-	100.0	-	-	100.0	-	-	100.0	20
...	...	17.5	...	...	22.2	...	...	27.0	...	...	31.6	21
...	...	6.6	...	...	6.8	...	...	7.2	...	...	8.6	22

Table 24. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for weight-height index of women ages 20-74 years, with means and standard deviations: United States, 1971-74

Triceps plus subscapular skinfold values (in millimeters)	Weight-height index[1]								
	All relative weight values			Less than 18			18-19		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
Total	8,130	64,158	100.0	7	40	100.0	27	221	100.0
Less than 8	4	18	0.0	2	14	34.2	1	3	1.2
8-11	58	349	0.6	3	19	82.6	10	33	16.0
12-15	140	981	2.1	-	-	82.6	8	98	60.5
16-19	349	2,615	6.2	1	3	91.0	4	36	76.9
20-23	560	4,434	13.1	1	4	100.0	3	33	91.8
24-27	674	5,671	21.9	-	-	100.0	1	18	100.0
28-31	754	6,219	31.6	-	-	100.0	-	-	100.0
32-35	756	6,136	41.2	-	-	100.0	-	-	100.0
36-39	711	5,480	49.7	-	-	100.0	-	-	100.0
40-43	683	5,320	58.0	-	-	100.0	-	-	100.0
44-47	615	4,932	65.7	-	-	100.0	-	-	100.0
48-51	521	4,264	72.3	-	-	100.0	-	-	100.0
52-55	474	3,988	78.6	-	-	100.0	-	-	100.0
56-59	446	3,397	83.9	-	-	100.0	-	-	100.0
60-63	344	2,776	88.2	-	-	100.0	-	-	100.0
64-67	291	2,098	91.5	-	-	100.0	-	-	100.0
68-71	213	1,666	94.1	-	-	100.0	-	-	100.0
72-75	157	1,171	95.9	-	-	100.0	-	-	100.0
76 and over	380	2,643	100.0	-	-	100.0	-	-	100.0
Mean	...	...	42.3	...	...	9.8	...	...	16.7
Standard deviation	...	...	17.4	...	...	5.0	...	...	4.9

Triceps plus subscapular skinfold values (in millimeters)	Weight-height index[1]								
	20-21			22-23			24-25		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
Total	116	832	100.0	412	3,285	100.0	859	7,024	100.0
Less than 8	1	2	0.2	-	-	-	-	-	-
8-11	17	88	10.8	18	127	3.9	5	36	0.5
12-15	30	161	30.1	46	322	13.6	42	238	3.9
16-19	31	250	60.1	111	853	39.6	124	934	17.2
20-23	18	128	75.5	115	894	66.8	195	1,626	40.3
24-27	16	173	96.3	57	506	82.3	176	1,545	62.3
28-31	2	22	98.9	34	289	91.1	152	1,259	80.3
32-35	-	-	98.9	19	181	96.6	94	862	92.5
36-39	1	9	100.0	9	55	98.2	42	281	96.5
40-43	-	-	100.0	2	40	99.5	16	138	98.5
44-47	-	-	100.0	-	-	99.5	6	68	99.5
48-51	-	-	100.0	1	18	100.0	4	25	99.8
52-55	-	-	100.0	-	-	100.0	-	-	99.8
56-59	-	-	100.0	-	-	100.0	1	8	99.9
60-63	-	-	100.0	-	-	100.0	2	5	100.0
64-67	-	-	100.0	-	-	100.0	-	-	100.0
68-71	-	-	100.0	-	-	100.0	-	-	100.0
72-75	-	-	100.0	-	-	100.0	-	-	100.0
76 and over	-	-	100.0	-	-	100.0	-	-	100.0
Mean	...	...	18.7	...	...	22.0	...	...	26.0
Standard deviation	...	...	5.4	...	...	6.7	...	...	6.9

See footnote at end of table.

Table 24. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for weight-height index of women ages 20-74 years, with means and standard deviations: United States, 1971-74—Con.

Triceps plus subscapular skinfold values (in millimeters)	Weight-height index[1]								
	26-27			28-29			30-31		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
Total	1,151	9,880	100.0	1,200	9,703	100.0	978	8,100	100.0
Less than 8	-	-	-	-	-	-	-	-	-
8-11	5	46	0.5	-	-	-	-	-	-
12-15	11	141	1.9	2	18	0.2	1	4	0.0
16-19	53	383	5.8	20	128	1.5	3	21	0.3
20-23	146	1,281	18.7	60	330	4.9	12	94	1.5
24-27	228	1,931	38.3	125	954	14.7	43	352	5.8
28-31	246	2,120	59.7	189	1,544	30.6	76	597	13.2
32-35	167	1,388	73.8	223	1,832	49.5	145	1,196	27.9
36-39	127	1,047	84.4	194	1,691	66.9	156	1,235	43.2
40-43	85	828	92.8	160	1,284	80.2	162	1,330	59.6
44-47	44	397	96.8	107	953	90.0	137	1,121	73.4
48-51	23	166	98.5	55	411	94.2	95	828	83.7
52-55	8	79	99.3	32	304	97.4	72	688	92.2
56-59	5	43	99.7	18	123	98.6	49	397	97.1
60-63	3	30	100.0	10	101	99.7	14	137	98.8
64-67	-	-	100.0	3	28	99.9	9	88	99.8
68-71	-	-	100.0	1	2	100.0	1	1	99.8
72-75	-	-	100.0	-	-	100.0	1	3	99.9
76 and over	-	-	100.0	1	3	100.0	2	9	100.0
Mean	...	...	30.9	...	...	36.5	...	...	41.8
Standard deviation	...	...	8.3	...	...	8.7	...	...	9.3

Triceps plus subscapular skinfold values (in millimeters)	Weight-height index[1]								
	32-33			34-35			36-37		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
Total	817	6,120	100.0	629	4,890	100.0	471	3,739	100.0
Less than 8	-	-	-	-	-	-	-	-	-
8-11	-	-	-	-	-	-	-	-	-
12-15	-	-	-	-	-	-	-	-	-
16-19	1	5	0.1	-	-	-	-	-	-
20-23	5	22	0.4	3	12	0.3	1	3	0.1
24-27	21	165	3.1	7	26	0.8	-	-	0.1
28-31	34	269	7.5	11	42	1.6	7	63	1.8
32-35	56	343	13.1	32	193	5.6	11	65	3.5
36-39	107	711	24.8	41	239	10.5	16	93	6.0
40-43	117	821	38.2	73	424	19.1	32	215	11.7
44-47	137	1,123	56.5	79	619	31.8	51	324	20.4
48-51	105	842	70.3	95	909	50.4	52	449	32.4
52-55	77	682	81.4	82	627	63.2	73	619	48.9
56-59	70	493	89.5	72	682	77.2	64	572	64.2
60-63	44	369	95.5	53	450	86.4	53	505	77.8
64-67	22	147	97.9	39	395	94.5	48	323	86.4
68-71	9	60	98.9	25	178	98.1	33	303	94.5
72-75	6	30	99.4	10	58	99.3	13	112	97.5
76 and over	6	36	100.0	7	36	100.0	17	94	100.0
Mean	...	...	46.5	...	...	52.1	...	...	55.9
Standard deviation	...	...	10.1	...	...	10.0	...	...	10.2

Table 24. Number of examined persons, estimated population in thousands, and cumulative percent distribution of triceps plus subscapular skinfold for weight-height index of women ages 20-74 years, with means and standard deviations: United States, 1971-74—Con.

Triceps plus subscapular skinfold values (in millimeters)	Weight-height index[1]								
	38-39			40-41			42 and over		
	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution	Number of examined persons	Estimated population in thousands	Cumulative percent distribution
Total	412	2,898	100.0	284	2,076	100.0	767	5,351	100.0
Less than 8	-	-	-	-	-	-	-	-	-
8-11	-	-	-	-	-	-	-	-	-
12-15	-	-	-	-	-	-	-	-	-
16-19	-	-	-	1	1	-	-	-	-
20-23	1	7	0.3	-	-	-	-	-	-
24-27	-	-	-	-	-	-	-	-	-
28-31	2	9	0.6	1	6	0.4	-	-	-
32-35	6	64	2.8	2	7	0.7	1	7	0.1
36-39	10	81	5.5	3	23	1.8	5	16	0.4
40-43	19	122	9.8	11	92	6.2	6	24	0.9
44-47	28	131	14.3	14	111	11.6	12	85	2.5
48-51	38	246	22.8	25	209	21.7	28	161	5.5
52-55	49	366	35.4	32	292	35.7	49	333	11.7
56-59	59	371	48.2	54	341	52.2	54	368	18.6
60-63	56	397	61.9	28	189	61.3	81	593	29.7
64-67	48	285	71.7	37	268	74.2	85	563	40.2
68-71	42	419	86.2	26	199	83.8	76	504	49.6
72-75	22	198	93.0	21	151	91.1	84	620	61.2
76 and over	32	203	100.0	29	186	100.0	286	2,076	100.0
Mean	...	...	59.6	...	...	60.4	...	...	73.3
Standard deviation	...	...	11.4	...	...	10.8	...	...	15.6

[1]Weight/height^p in kilograms/(meter^p), where p = 1.5.

Table 25. Number of examined persons, estimated population in thousands, and number and percent of men obese for relative desirable weight according to triceps plus subscapular skinfold levels of obesity for ages 20-74 years: United States, 1971-74

Relative desirable weight categories and selected percentiles[1]	Number of examined persons	Estimated population in thousands	Triceps plus subscapular skinfold level of obesity							
			≥85th (≥38 millimeters)		≥85th - <90th (≥38 - ≤42.9 millimeters)		≥90th - <95th (≥43.0 - ≤50.9 millimeters)		≥95th (≥51.0 millimeters)	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Less than 85	591	6,029	7	0.1	7	0.1	-	-	-	-
85-89	409	4,569	137	3.0	46	1.0	91	2.0	-	-
90-94	530	6,589	115	1.7	96	1.5	19	0.3	-	-
95-99	602	6,681	253	3.8	181	2.7	68	1.0	4	0.1
100-104	614	7,166	609	8.5	375	5.2	211	2.9	23	0.3
105-109	651	7,949	1,275	16.0	725	9.1	484	6.1	67	0.8
110-114	499	5,862	1,588	27.1	738	12.6	647	11.0	203	3.5
115-119	367	4,531	1,953	43.1	942	20.8	632	13.9	379	8.4
120 or more	738	8,130	5,196	63.9	1,123	13.8	1,819	22.4	2,254	27.7
130 or more	314	3,454	2,722	78.8	275	8.0	826	23.9	1,621	46.9
140 or more	143	1,592	1,519	95.4	75	4.7	424	26.6	1,020	64.1
Selected percentiles										
Greater than or equal to 85th - less than 90th (114 - less than or equal to 117.9)	295	3,490	1,266	36.3	595	17.0	474	13.6	197	5.6
Greater than or equal to 90th - less than 95th (118 - less than or equal to 129.9)	559	6,397	3,335	52.1	1,253	19.6	1,258	19.7	824	12.9
Greater than or equal to 95th (greater than or equal to 130)	314	3,454	2,722	78.8	275	8.0	826	23.9	1,621	46.9

[1] Relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight on height for men ages 20-29 years.

Table 26. Number of examined persons, estimated population in thousands, and number and percent of women obese for relative desirable weight according to triceps plus subscapular skinfold levels of obesity for ages 20-74 years: United States, 1971-74

Relative desirable weight categories and selected percentiles[1]	Number of examined persons	Estimated population in thousands	Triceps plus subscapular skinfold level of obesity							
			≥85th (≥52.0 millimeters)		≥85th - <90th (≥52.0 - ≤58.4 millimeters)		≥90th - <95th (≥58.5 - ≤67.0 millimeters)		≥95th (≥68.0 millimeters)	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Less than 85	1,008	8,180	8	0.1	-	-	8	0.1	-	-
85-89	757	6,059	47	0.8	36	0.6	11	0.2	-	-
90-94	874	7,661	142	1.9	77	1.0	65	0.9	-	-
95-99	894	7,185	338	4.7	264	3.7	71	1.0	3	-
100-104	781	6,369	795	12.5	636	10.0	156	2.4	3	-
105-109	677	5,403	1,107	20.5	765	14.2	300	5.6	42	0.8
110-114	572	4,367	1,484	34.0	852	19.5	521	11.9	111	2.5
115-119	491	3,769	1,839	48.8	798	21.2	861	22.8	180	4.8
120 and more	2,076	15,166	11,980	79.0	2,886	19.0	3,953	26.1	5,141	33.9
130 and more	1,373	9,817	8,577	87.4	1,575	16.0	2,571	26.2	4,431	45.1
140 and more	848	5,898	5,519	93.6	730	12.4	1,431	24.3	3,358	56.9
Selected percentiles										
Greater than or equal to 85th - less than 90th (115 - less than or equal to 122.9)	728	5,581	2,916	52.2	1,228	22.0	1,337	24.0	351	6.3
Greater than or equal to 90th - less than 95th (123 - less than or equal to 138.9)	961	7,200	5,164	71.7	1,647	22.9	1,960	27.2	1,557	21.6
Greater than or equal to 95th (greater than or equal to 139)	878	6,153	5,739	93.3	809	13.1	1,517	24.7	3,414	55.5

[1] Relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight on height for women ages 20-29 years.

Table 27. Number of examined persons, estimated population in thousands, and number and percent of men obese for weight-height index according to triceps plus subscapular skinfold levels of obesity for ages 20-74 years: United States, 1971-74

Weight-height index categories and selected percentiles[1]	Number of examined persons	Estimated population in thousands	Triceps plus subscapular skinfold level of obesity							
			≥85th (≥38 millimeters)		≤85th - <90th (≥38 - ≤42.9 millimeters)		≥90th - <95th (≥43 - ≤50.9 millimeters)		≥95th (≥51 millimeters)	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Less than 16	9	78	-	-	-	-	-	-	-	-
16-17	62	660	-	-	-	-	-	-	-	-
18-19	286	2,984	7	0.2	7	0.2	-	-	-	-
20-21	603	6,485	145	2.2	54	0.8	91	1.4	-	-
22-23	909	10,566	221	2.1	192	1.8	29	0.3	-	-
24-25	982	11,559	823	7.1	50	4.3	30	2.6	27	0.2
26-27	976	11,820	2,663	22.5	1,382	11.7	1,021	8.6	260	2.2
28-29	540	6,364	2,687	42.2	1,239	19.5	951	14.9	497	7.8
30-31	311	3,425	1,951	57.0	612	17.9	768	22.4	571	16.7
32-33	148	1,612	1,003	62.2	172	10.7	389	24.1	442	27.4
34-35	62	583	522	89.5	30	5.1	108	18.5	384	65.9
36-37	45	549	509	92.7	40	7.3	160	29.1	309	56.3
38-39	17	170	170	100.0	5	2.9	37	21.8	128	75.3
40-41	9	79	79	100.0	0	-	22	27.8	56	70.9
42-43	7	199	199	100.0	0	-	96	48.2	103	51.8
44-45	3	25	25	100.0	0	-	0	-	25	100.0
46 and more	8	128	128	100.0	0	-	0	-	128	100.0
Selected percentiles										
Greater than or equal to 85th - less than 90th (28 - less than or equal to 28.9)	303	3,660	1,404	38.4	642	17.5	513	14.0	249	6.8
Greater than or equal to 90th - less than 95th (29 - less than or equal to 31.9)	548	6,129	3,132	51.1	1,209	19.7	1,105	18.0	818	13.3
Greater than or equal to 95th (greater than or equal to 32)	299	3,347	2,637	78.8	247	7.4	814	24.3	1,575	47.1

[1]Weight-height index in kilogram/(meter[p]), where p = 2 for men.

Table 28. Number of examined persons, estimated population in thousands, and number and percent of women obese for weight-height index according to triceps plus subscapular skinfold levels of obesity for ages 20-74 years: United States, 1971-74

Weight-height index categories and selected percentiles[1]	Number of examined persons	Estimated population in thousands	Triceps plus subscapular skinfold level of obesity							
			≥85th (≥52.0 millimeters)		≥85th - <90th (≥52 - ≤58.4 millimeters)		≥90th - <95th (≥85 - ≤67.9 millimeters)		≥95th (≥68.0 millimeters)	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Less than 16	2	18	-	-	-	-	-	-	-	-
16-17	5	22	-	-	-	-	-	-	-	-
18-19	27	221	-	-	-	-	-	-	-	-
20-21	116	832	-	-	-	-	-	-	-	-
22-23	412	3,285	-	-	-	-	-	-	-	-
24-25	859	7,024	12	0.2	12	0.2	-	-	-	-
26-27	1,151	9,880	152	1.5	111	1.1	41	0.4	-	-
28-29	1,200	9,703	560	5.8	391	4.0	164	1.7	5	0.1
30-31	978	8,100	1,322	16.3	1,014	12.5	295	3.6	13	0.2
32-33	817	6,120	1,818	29.7	1,099	18.0	593	9.7	126	2.1
34-35	629	4,890	2,426	49.6	1,043	21.3	1,112	22.7	271	5.5
36-37	471	3,739	2,528	67.6	986	26.4	1,033	27.6	509	13.6
38-39	412	2,898	2,239	77.3	611	21.1	807	27.8	820	28.3
40-41	284	2,076	1,626	78.3	456	22.0	634	30.5	536	25.8
42-43	221	1,485	1,367	92.1	275	18.5	458	30.8	634	42.7
44-45	179	1,235	1,118	90.5	199	16.1	320	25.9	599	48.5
46 and more	367	2,631	2,571	97.7	129	4.9	475	18.1	1,967	74.8
Selected percentiles										
Greater than or equal to 85th - less than 90th (43 - less than or equal to 36.9)	893	6,919	3,681	53.2	1,498	21.7	1,685	24.4	498	7.2
Greater than or equal to 90th - less than 95th (37 - less than or equal to 41.9)	903	6,684	5,138	76.9	1,599	23.9	1,901	28.4	1,638	24.5
Greater than or equal to 95th - (greater than or equal to 42)	767	5,351	5,056	94.5	603	11.3	1,253	23.4	3,200	59.8

[1]Weight-height index in kilogram/(meter^p), where p = 1.5 for women.

Table 29. Number of examined persons, estimated population in thousands, and number and percent of persons overweight and/or obese at below and above the 85th percentile cutting point estimated from the cross-classification of triceps plus subscapular skinfold and relative desirable weight and weight-height index, by sex and age: United States, 1971-74

Sex and age	Number of persons examined	Estimated population in thousands	Skinfold thickness[1] and relative desirable weight[2]						Skinfold thickness[1] and weight-height index[3]					
			Overweight				Not overweight		Overweight				Not overweight	
			Not obese		Obese		Obese		Not obese		Obese		Obese	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Men														
20-74 years	5,001	57,507	6,016	10.5	7,324	12.7	3,802	6.6	5,862	10.2	7,274	12.6	3,852	6.7
20-24 years	513	8,110	283	3.5	705	8.7	321	4.0	228	*2.8	705	8.7	321	4.0
25-34 years	804	13,003	1,001	7.7	1,949	15.0	757	5.8	916	7.0	1,913	14.7	793	6.1
35-44 years	664	10,676	1,582	14.8	1,433	13.4	831	7.8	1,582	14.8	1,428	13.4	835	7.8
45-54 years	765	11,150	1,357	12.2	1,656	14.9	889	8.0	1,352	12.1	1,650	14.8	895	8.0
55-64 years	597	9,073	1,152	12.7	1,006	11.1	675	7.4	1,152	12.7	1,006	11.1	675	7.4
65-74 years	1,657	5,496	654	11.9	575	10.5	330	6.0	632	11.5	572	10.4	332	6.0
Women														
20-74 years	8,130	64,158	5,109	8.0	13,817	21.5	3,921	6.1	5,078	7.9	13,875	21.6	3,864	6.0
20-24 years	1,243	9,215	304	3.3	849	9.2	371	4.0	294	3.2	875	9.5	344	3.7
25-34 years	1,896	13,933	543	3.9	2,318	16.6	603	4.3	580	4.2	2,321	16.7	600	4.3
35-44 years	1,664	11,593	773	6.7	2,713	23.4	841	7.3	764	6.6	2,748	23.7	806	7.0
45-54 years	836	12,163	1,034	8.5	3,349	27.5	1,161	9.5	1,007	8.3	3,344	27.5	1,166	9.6
55-64 years	670	9,976	1,118	11.2	2,994	30.0	638	6.4	1,111	11.1	3,005	30.1	627	6.3
65-74 years	1,822	7,277	1,335	18.3	1,595	21.9	307	4.2	1,323	18.2	1,581	21.7	321	4.4

[1]Obesity—triceps plus subscapular skinfold.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on regression equations of weight on height for men and women ages 20-29 years.
[3]Weight-height index in kilogram/(meter^p), where $p = 2$ for men, and $p = 1.5$ for women.

NOTE: Criteria of obesity and overweight are at the 85th percentile or more measurements for men and women ages 20-29 years. Where an asterisk is printed next to the cell value, the relative standard error was more than 30 percent.

Table 30. Number of examined persons, estimated population in thousands, and number and percent of persons overweight and/or obese at below and above the 90th percentile cutting point estimated from the cross-classification of triceps plus subscapular skinfold and relative desirable weight and weight-height index, by sex and age: United States, 1971-74

Sex and age	Number of persons examined	Estimated population in thousands	Skinfold thickness[1] and relative desirable weight[2]						Skinfold thickness[1] and weight-height index[3]					
			Overweight				Not overweight		Overweight				Not overweight	
			Not obese		Obese		Obese		Not obese		Obese		Obese	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Men														
20-74 years	5,001	57,507	5,322	9.3	4,529	7.9	2,371	4.1	5,063	8.8	4,413	7.7	2,487	4.3
20-24 years	513	8,110	201	2.5	471	5.8	264	*3.3	175	*2.2	414	5.1	291	3.6
25-34 years	804	13,003	1,072	8.2	1,285	9.9	483	3.7	984	7.6	1,261	9.7	507	3.9
35-44 years	664	10,676	1,401	13.1	738	6.9	448	4.2	1,355	12.7	679	6.4	507	4.7
45-54 years	765	11,150	1,210	10.9	967	8.7	607	5.4	1,125	10.1	967	8.7	607	5.4
55-64 years	597	9,073	891	9.8	718	7.9	371	4.1	884	9.7	718	7.9	371	4.1
65-74 years	1,657	5,496	548	10.0	350	6.4	199	3.6	539	9.8	343	6.2	205	3.7
Women														
20-74 years	8,130	64,158	4,905	7.6	8,447	13.2	2,977	4.6	4,042	6.3	7,993	12.5	3,431	5.3
20-24 years	1,243	9,215	201	2.2	539	5.8	212	2.3	181	2.0	478	5.2	273	3.0
25-34 years	1,896	13,933	671	4.8	1,478	10.6	529	3.8	563	4.0	1,432	10.3	576	4.1
35-44 years	1,664	11,593	767	6.6	1,773	15.3	537	4.6	561	4.8	1,702	14.7	608	5.2
45-54 years	836	12,163	958	7.9	2,059	16.9	841	6.9	746	6.1	1,983	16.3	917	7.5
55-64 years	670	9,976	1,253	12.6	1,683	16.9	635	6.4	1,116	11.2	1,555	15.6	762	7.6
65-74 years	1,822	7,277	1,056	14.5	915	12.6	223	3.1	873	12.0	843	11.6	296	4.1

[1] Obesity—triceps plus subscapular skinfold.
[2] Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on regression equations of weight on height for men and women ages 20-29 years.
[3] Weight-height index in kilogram/(meter^p), where p = 2 for men, and p = 1.5 for women.

NOTE: Criteria of obesity and overweight are at the 90th percentile or more measurements for men and women ages 20-29 years. Where an asterisk is printed next to the cell value, the relative standard error was more than 30 percent.

Table 31. Number of examined persons, estimated population in thousands, and number and percent of persons overweight and/or obese at below and above the 95th percentile cutting point estimated from the cross-classification of triceps plus subscapular skinfold and relative desirable weight and weight-height index, by sex and age: United States, 1971-74

Sex and age	Number of persons examined	Estimated population in thousands	Skinfold thickness[1] and relative desirable weight[2]						Skinfold thickness[1] and weight-height index[3]					
			Overweight				Not overweight		Overweight				Not overweight	
			Not obese		Obese		Obese		Not obese		Obese		Obese	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Men														
20-74 years	5,001	57,507	1,833	3.2	1,620	2.8	1,309	2.3	1,772	3.1	1,575	2.7	1,354	2.4
20-44 years	1,981	31,788	807	[4]2.5	918	[4]2.9	707	[4]2.2	797	[4]2.5	879	[4]2.8	746	[4]2.3
20-24 years	513	8,110	103	*1.3	175	*2.2	194	*2.4	103	*1.3	171	*2.1	198	*2.4
25-34 years	804	13,003	345	*2.7	552	4.2	301	*2.3	335	*2.6	526	4.0	327	*2.5
35-44 years	664	10,675	359	3.4	191	1.8	212	*2.0	359	3.4	182	*1.7	221	*2.1
45-64 years	1,363	20,223	880	[4]4.4	598	[4]3.0	492	[4]2.4	834	[4]4.1	593	[4]2.9	497	[4]2.5
45-54 years	765	11,150	440	3.9	351	3.1	357	3.2	414	3.7	345	3.1	362	3.3
55-64 years	598	9,073	440	4.9	248	2.7	135	*1.5	420	4.6	248	2.7	135	*1.5
65-74 years	1,657	5,496	146	2.7	104	1.9	110	2.0	141	2.6	103	1.9	111	2.0
Women														
20-74 years	8,130	64,158	2,739	4.3	3,414	5.3	2,066	3.2	2,150	3.4	3,200	5.0	2,279	3.6
20-44 years	4,803	34,741	1,125	3.2	1,750	5.0	883	2.5	892	2.6	1,654	4.8	979	2.8
20-24 years	1,243	9,215	208	2.3	183	2.0	151	1.6	172	1.9	180	1.9	155	1.7
25-34 years	1,896	13,933	372	2.7	746	5.4	363	2.6	275	2.0	707	5.1	402	2.9
35-44 years	1,664	11,593	545	4.7	821	7.1	369	3.2	445	3.8	767	6.6	422	3.6
45-64 years	1,505	22,140	1,118	5.0	1,404	6.3	988	4.5	839	3.8	1,307	5.9	1,086	4.9
45-54 years	836	12,163	499	4.1	829	6.8	510	4.2	334	2.7	768	6.3	571	4.7
55-64 years	670	9,976	619	6.2	575	5.8	478	4.8	505	5.1	539	5.4	515	5.2
65-74 years	1,822	7,277	496	6.8	260	3.6	195	2.7	420	5.8	240	3.3	215	3.0

[1] Obesity—triceps plus subscapular skinfold.
[2] Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on regression equations of weight on height for men and women ages 20-29 years.
[3] Weight-height index in kilogram/(meter^p), where $p = 2$ for men, and $p = 1.5$ for women.
[4] A pooled value necessitated by unreliable estimates computed from smaller groupings (see standards of reliability and precision in appendix I).

NOTES: Criteria of obesity and overweight are at the 85th, 90th, and 95th percentile or more measurements for men and women ages 20-29 years. Where an asterisk is printed next to the cell value, the relative standard error was more than 30 percent.

Table 32. Percent of men overweight and/or obese at below and above selected percentile cutting points, by age and method of determining weight status: United States, 1971-74

Age	Overweight — Not obese — Cross-classification of triceps plus subscapular skinfold[1] with: Relative desirable weight[2]	Weight-height index[3]	Overweight — Obese — Cross-classification of triceps plus subscapular skinfold[1] with: Relative desirable weight[2]	Weight-height index[3]	Not overweight — Obese — Cross-classification of triceps plus subscapular skinfold[1] with: Relative desirable weight[2]	Weight-height index[3]
	Below and above 85th percentile					
20-74 years	10.5	10.2	12.7	12.6	6.6	6.7
20-24 years	3.5	*2.8	8.7	8.7	4.0	4.0
25-34 years	7.7	7.0	15.0	14.7	5.8	6.1
35-44 years	14.8	14.8	13.4	13.4	7.8	7.8
45-54 years	12.2	12.1	14.9	14.8	8.0	8.0
55-64 years	12.7	12.7	11.1	11.1	7.4	7.4
65-74 years	11.9	11.5	10.5	10.4	6.0	6.0
	Below and above 90th percentile					
20-74 years	9.3	8.8	7.9	7.7	4.1	4.3
20-24 years	2.5	*2.2	5.8	5.1	*3.3	3.6
25-34 years	8.2	7.6	9.9	9.7	3.7	3.9
35-44 years	13.1	12.7	6.9	6.4	4.2	4.7
45-54 years	10.9	10.1	8.7	8.7	5.4	5.4
55-64 years	9.8	9.7	7.9	7.9	4.1	4.1
65-74 years	10.0	9.8	6.4	6.2	3.6	3.7
	Below and above 95th percentile					
20-74 years	3.2	3.1	2.8	2.7	2.3	2.4
20-44 years	[4]2.5	[4]2.5	[4]2.9	[4]2.8	[4]2.2	[4]2.3
20-24 years	*1.3	*1.3	*2.2	*2.1	*2.4	*2.4
25-34 years	*2.7	*2.6	4.2	4.0	*2.3	*2.5
35-44 years	3.4	3.4	1.8	*1.7	*2.0	*2.1
45-64 years	[4]4.4	[4]4.1	[4]3.0	[4]2.9	[4]2.4	[4]2.5
45-54 years	3.9	3.7	3.1	3.1	3.2	3.3
55-64 years	4.9	4.6	2.7	2.7	*1.5	*1.5
65-74 years	2.7	2.6	1.9	1.9	2.0	2.0

[1]Obesity—triceps plus subscapular skinfold.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equations of weight on height for men and women ages 20-29 years.
[3]Weight-height index in kilogram/(meter^p), where p = 2 for men.
[4]A pooled value necessitated by unreliable estimates computed from smaller groupings (see standards of reliability and precision in appendix I).

NOTES: Criteria of obesity and overweight are at the 85th, 90th, and 95th percentiles or more measurements for men and women ages 20-29 years. Where an asterisk is printed next to the cell value, the relative standard error was more than 30 percent.

Table 33. Percent of women overweight and/or obese at below and above selected percentile cutting points, by age and method of determining weight status: United States, 1971-74

Age	Overweight				Not overweight	
	Not obese		Obese		Obese	
	Cross-classification of triceps plus subscapular skinfold[1] with:		Cross-classification of triceps plus subscapular skinfold[1] with:		Cross-classification of triceps plus subscapular skinfold[1] with:	
	Relative desirable weight[2]	Weight-height index[3]	Relative desirable weight[2]	Weight-height index[3]	Relative desirable weight[2]	Weight-height index[3]
Below and above 85th percentile						
20-74 years	8.0	7.9	21.5	21.6	6.1	6.0
20-24 years	3.3	3.2	9.2	9.5	4.0	3.7
25-34 years	3.9	4.2	16.6	16.7	4.3	4.3
35-44 years	6.7	6.6	23.4	23.7	7.3	7.0
45-54 years	8.5	8.3	27.5	27.5	9.5	9.6
55-64 years	11.2	11.1	30.0	30.1	6.4	6.3
65-74 years	18.3	18.2	21.9	21.7	4.2	4.4
Below and above 90th percentile						
20-74 years	7.6	6.3	13.2	12.5	4.6	5.3
20-24 years	2.2	2.0	5.8	5.2	2.3	3.0
25-34 years	4.8	4.0	10.6	10.3	3.8	4.1
35-44 years	6.6	4.8	15.3	14.7	4.6	5.2
45-54 years	7.9	6.1	16.9	16.3	6.9	7.5
55-64 years	12.6	11.2	16.9	15.6	6.4	7.6
65-74 years	14.5	12.0	12.6	11.6	3.1	4.1
Below and above 95th percentile						
20-74 years	4.3	3.4	5.3	5.0	3.2	3.6
20-44 years	3.2	2.6	5.0	4.8	2.5	2.8
20-24 years	2.3	1.9	2.0	1.9	1.6	1.7
25-34 years	2.7	2.0	5.4	5.1	2.6	2.9
35-44 years	4.7	3.8	7.1	6.6	3.2	3.6
45-64 years	5.0	3.8	6.3	5.9	4.5	4.9
45-54 years	4.1	2.7	6.8	6.3	4.2	4.7
55-64 years	6.2	5.1	5.8	5.4	4.8	5.2
65-74 years	6.8	5.8	3.6	3.3	2.7	3.0

[1]Obesity—triceps plus subscapular skinfold.

[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on regression equations of weight on height for men and women ages 20-29 years.

[3]Weight-height index in kilogram/(meter^p), where p = 2 for men and p = 1.5 for women.

NOTE: Criteria of obesity and overweight are at the 85th, 90th, and 95th percentile or more measurements for men and women ages 20-29 years.

Appendixes

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Appendix I. Statistical notes

Survey design

Individuals examined during NHANES I were selected by means of a three-stage, stratified probability sample of loose clusters of persons by geographic location. The sample was designed to be representative of the civilian noninstitutionalized population ages 1-74 years living in the coterminous United States. All persons residing upon reservation lands set aside for use of American Indians were excluded.

In the first stage of the design, 1960 decennial census lists of addresses and the almost 1,900 primary sampling units (PSU's) into which the coterminous United States is divided were examined. (Each PSU is either a standard metropolitan statistical area, a single county, or two or three contiguous counties.) These PSU's were then grouped into 40 strata based on geographic region and population density to select target PSU's for NHANES I.

Of the 40 strata, 15 were composed of single large metropolitan areas with more than 2 million persons. These 15 metropolitan areas were chosen for the sample with certainty. A modified Goodman-Kish controlled selection technique was used to choose two PSU's from each of the remaining 25 noncertainty strata with probability proportionate to the 1960 PSU population. In this manner, a total first-stage sample of 65 (15 + (2 × 25)) PSU's or "stands" were selected for study.

Within each PSU, a systematic sample of segments (loose clusters of households) was chosen. Selection was made using the most up-to-date information on census enumeration districts (ED's) at the time of the visit—1960 census data for the first 44 stands and 1970 data for the remaining 21 stands. To make the sample representative of the current U.S. population, lists were supplemented by a sample of housing units that had been constructed since the most recent decennial census.

ED's having addresses (the majority of the areas visited) were divided into segments containing an average of six households each (in the first 44 stands) or eight households each (in the remaining 21 stands). The change was made primarily for operational advantages and was supported by research by the U.S. Bureau of the Census indicating that the precision of estimates would not be affected appreciably. For ED's without addresses that could be used (generally located in rural areas), area sampling was employed.

Enumeration districts were divided into two economic classes. The first class, identified as the "poverty stratum," was composed of "current poverty areas" that had been identified by the U.S. Bureau of the Census in 1960 or 1970 and other ED's in the PSU with a mean family income of less than $3,000 in 1959 (based on the 1960 census). The second economic class, the "nonpoverty stratum," comprised all ED's not designated as belonging to the poverty stratum.

Target segments were then selected from each of the two strata. All sample segments classified into the poverty stratum were sampled with probability 1. For the first 42 stands, sample segments in nonpoverty stratum ED's were divided into eight random subgroups, and one of the subgroups was chosen to remain in the NHANES I sample. Ongoing research indicated that the efficiency of estimates could be increased by changing the ratio of poverty to nonpoverty segments from 8:1 to 2:1. Therefore, in the remaining 23 stands, the selected segments in the nonpoverty ED's were divided into two random subgroups, and one of the subgroups was chosen to remain in the sample.

After identification of the sample segments, a list of all current addresses within the segment boundaries was made, and a person in the household was interviewed to determine the age and sex of each person as well as demographic and socioeconomic information required for the survey. If no one was at home after repeated calls or if the household members refused to be interviewed, the interviewer tried to determine the household composition from neighbors.

To select the persons in sample segments to be examined in NHANES I and oversample certain groups at high risk of malnutrition, all household members ages 1-74 in each segment were first listed on a sample selection worksheet with each household in the segment listed serially. The number of household members in each of six age-sex groups were then listed on the worksheet under the appropriate age-sex group column. The sample selection worksheets were put in segment-number order, and a systematic random sample of persons in each age-sex group was selected to be examined using the following sampling

Age and sex	Rate
1-5 years (males and females)	1/2
6-19 years (males and females)	1/4
20-44 years (males)	1/4
20-44 years (females)	1/2
45-64 years (males and females)	1/4
65-74 years (males and females)	1

The persons selected in the 65-stand sample of NHANES I constituted a representative sample of the target population. The sample was composed of 28,043 persons ages 1-74 years, of whom 20,749 (74 percent) were examined. When adjustments were made for differential sampling for high-risk groups, the response rate was 75 percent.

All data presented in this report are based on weighted observations—data recorded for each person were inflated to characterize the subuniverse from which that person was drawn. The weight for each examined person is a product of the reciprocal of the probability of selecting the person, an adjustment for nonresponse cases (i.e., persons not examined), and a poststratified ratio adjustment that increases precision by closely alining survey results with U.S. Bureau of the Census population figures for 20 age, race, and sex groups in the United States as of November 1, 1972 (the approximate midpoint of NHANES I).

A more detailed description of the survey design and selection technique may be found in a previous *Vital and Health Statistics* report.

Nonresponse

In any survey, after the sample is identified and the sample persons are requested to participate, the survey meets one of its more severe problems—nonresponse. The problem is more severe in a health examination survey; often many persons will not participate in the examination. A potential for bias results if the persons in the sample who do not participate differ from the persons in the sample examined with respect to the characteristics under investigation. Intensive efforts were made in NHANES I to develop and implement procedures and inducements that would reduce the number of nonrespondents and thereby reduce the potential bias due to nonresponse.[1]

Despite these intensive efforts, 26 percent of the persons in the 65-location nutrition sample, and 30 percent of the persons from the 100-location detailed sample were not examined. Consequently, the potential for sizable bias exists in the estimates in this publication. However, because the response rate for the medical questionnaire was more than 95 percent, the characteristics of the nonrespondents and the nature of nonresponse could be examined. This examination indicated that the likelihood of sizable bias is small.

Efforts have been made using data from NHANES I and an earlier survey to examine possible health-related differences between examined and nonexamined persons. Reasons for nonparticipation in NHANES I were investigated[27] for a sample of 406 people (290 examined persons, 35 who had appointments for examinations but never came to the mobile examination center for examination, and 81 persons who refused to participate in the survey). The people in the sample for this study came from four stand locations—St. Louis, Monterey, New York, and Philadelphia. People in the study were asked to indicate why they did not choose to be examined in NHANES I. The primary reasons given were (1) they had no need for a physical (48 percent) and (2) examination times were inconvenient because of work schedule or other demands (15 percent). Only 6 percent of the persons not examined in the NHANES I subsample (4 stands) indicated that they refused the examination because of sickness, and 3 percent based their refusal on a fear of possible findings.

An analysis using data on examined and unexamined (but interviewed) persons was conducted[28] using data from the first 35 stands of NHANES I. This study found that for health characteristics compared, the two groups of people were quite similar. For example, 20 percent of the examined people reported that a doctor told them they had arthritis compared with 17 percent for the unexamined people; similarily, 18 percent of the examined and the unexamined people were told by a doctor that they had high blood pressure. Twelve percent of both groups reported that they were on a special diet, and 6 percent of both groups said they regularly used medication for nerves.

A study[29] in which factors relating to response in a health examination survey were investigated and that used data from Cycle I of the Health Examination Survey found that 36 percent of the unexamined people believed they were in excellent health compared with 31 percent of the examined people. A self-appraisal of poor health was made by 5 percent of the unexamined persons and by 6 percent of the people examined. In addition, a different study of the Cycle I data[30] found that comparisons between

two extreme groups—persons who participated in the survey with no persuasion efforts and those who participated only after a great deal of persuasion—indicated that differences between these two groups generally had little effect on estimates based on numerous selected examination and questionnaire items. This was interpreted as evidence that no large bias existed between these two groups for the items investigated and was offered as further support for the belief that little bias was introduced to the findings because of differences in health characteristics between examined and unexamined people.

As was mentioned earlier, the data in this report were based on weighted observations, and one of the components of the weight assigned to an examined person was an adjustment for nonresponse. A procedure was adopted that multiplied the reciprocal of the probability of selection of examined persons in the sample by a factor that raised estimates based on examined persons to a level that would have been achieved if all persons in the sample had been examined. The nonresponse adjustment factor was calculated by dividing the sum of the reciprocals of the probability of selection for all selected persons in each of five income groups within each stand by the sum of the reciprocals of the probability of selection for examined persons in the same stand and income group. The five income groups were (1) under $3,000, (2) $3,000-$6,999, (3) $7,000-$9,999, (4) $10,000-$14,999, and (5) $15,000 and over. To weight the sample, income group was imputed for 5.6 percent of the persons in the sample using educational level of the head of household. To the extent that the income-within-stand classes were homogenous with respect to the health characteristics under study, the adjustment procedure was effective in reducing the bias due to nonresponse. The percent distribution of the nonresponse adjustment factors computed for the 65-stand sample of NHANES I is shown in table I.

Missing data

Examination surveys are subject to loss of information not only through failure to examine all persons in a sample but also from failure to obtain and record all items of information for examined persons. Age, sex, and race were known for every examined person. However, for several examinees, one or more of the anthropometric measurements were not available. The number of missing measurements is indicated in table II.

Estimates for missing anthropometric data generally were made based on a multiple-regression decision, substituting measurements of an individual of the same age, sex, and race who had other dimensions similar to those available for the examinee with incomplete data. For examined persons with no anthropometric measurements, a respondent of the

Table I. Percent distribution of nonresponse adjustment factors: United States, 1971-74

Size of factor	Percent distribution
Total	100.0
1.00-1.24.	32.6
1.25-1.49.	38.5
1.50-1.74.	18.2
1.75-1.99.	7.4
2.00-2.49.	2.8
2.50-2.99.	0.3
3.00[1].	0.3

[1] A size of 3.00 was assigned for all factors greater than 3.00. The final poststratified ratio adjustment corrects for this truncation.

Table II. Number of examinees with one or more missing anthropometric measurements: National Health and Nutrition Examination Survey—United States, 1971-74

Measurement missing	Number of examinees
Height	40
Weight	69
Elbow breadth.	36
Triceps skinfold.	114
Subscapular skinfold	164
Upper arm girth.	41

same age, sex, and race group was selected at random and the measurements assigned to the unexamined person.

Skinfold thickness values also were imputed in circumstances in which the skin was so tightly bound to the underlying skin that it could not be pulled into a double fold by the technician. The technician recorded that the skinfold thickness measurement could not be read rather than implying that the skinfold existed but was so small that it measured zero.

Standard errors

The probability design of this survey determined the estimation of standard errors that corresponded to the weighted estimates. The NHANES I sampling design was a highly clustered, multistage probability sample of the U.S. civilian noninstitutionalized population. Estimates from this type of design are different from and generally larger than standard errors calculated under the assumption of simple random sampling.

The standard error is primarily a measure of sampling variability, that is, the variations that might occur by chance because only a sample of the population is surveyed. As calculated for this report, the standard error also reflects part of the variation that arises in the measurement process. Estimates of any biases that might lie in the data are not included. The chances are about 68 out of 100 that an estimate

from the sample would differ from a complete census by less than the standard error. The chances are about 95 out of 100 that the difference would be less than twice the standard error and about 99 out of 100 that it would be less than 2½ times as large.

Estimates of the standard errors of the percents used in this report are presented in tables III-V. Standard errors of the percents were calculated by a technique referred to as "balanced repeated replication."[31] The need for this specialized technique for estimating standard errors arose because of the complex sample design of NHANES I; it was inappropriate to calculate standard errors by a technique that would not account for the multistage cluster sample design. (It must be noted that estimates of standard errors are subject to errors that may be large if the number of cases upon which the estimates are based is small or the number of PSU's and number of strata used in the variance calculation is small.)

Data limitations and reliability

The first criterion for reliability of percents was that a sample size of at least 25 was required. If the first criterion of sample size was satisfied, then the second criterion must have been demonstrated as well. If the coefficient of variation, that is, the standard error of the percent divided by the percent times 100 was greater than 30 percent, the variation with respect to the percent was considered too large, and

the estimate was neither precise nor stable enough to meet the standards.

Asterisks in the tables denote failure to meet the second criterion. When successive cells contained an unreliable estimate, the cells containing the unreliable percents were pooled with either the adjacent cell or cells. The percents reported met the specified criteria for inclusion after pooling.

Hypothesis testing

In testing the equality of two proportions, p_A and p_B, i.e., in testing the hypothesis

$$H_o : p_A = p_B$$

against an alternative such as

$$H_A : p_A \neq p_B$$

$$H_A : p_A > p_B$$

the statistic

$$Z = \frac{\hat{p}_A - \hat{p}_B}{\text{S.E.} (\hat{p}_A - \hat{p}_B)} \qquad (1)$$

was used. $\hat{p}_A$ and $\hat{p}_B$ are estimates of p_A and p_B, respectively, and S.E. $(\hat{p}_A - \hat{p}_B)$, the standard error of $\hat{p}_A - \hat{p}_B$, can be estimated by

Table III. Standard error of the prevalence of persons obese and overweight for selected percentiles, by age: United States, 1971-74

Sex and age	85th percentile or more			90th percentile or more			95th percentile or more		
	Skinfold thickness[1]	Relative desirable weight[2]	Weight-height index[3]	Skinfold thickness[1]	Relative desirable weight[2]	Weight-height index[3]	Skinfold thickness[1]	Relative desirable weight[2]	Weight-height index[3]
Men				Standard error in percent					
20-74 years	0.80	0.82	0.86	0.69	0.69	0.65	0.41	0.44	0.46
20-24 years	1.97	1.83	1.71	1.46	1.41	1.38	1.14	0.76	0.76
25-34 years	1.51	2.05	2.08	1.61	1.91	1.84	1.28	1.16	1.16
35-44 years	2.43	2.25	2.25	1.53	2.01	2.04	0.92	1.07	1.10
45-54 years	1.91	2.06	2.04	1.73	1.55	1.65	1.03	1.10	1.10
55-64 years	2.17	1.90	1.90	1.96	1.73	1.73	0.90	1.23	1.22
65-74 years	1.36	1.34	1.33	0.92	0.99	1.04	0.58	0.61	0.61
Women									
20-74 years	0.82	0.74	0.73	0.72	0.78	0.76	0.55	0.54	0.49
20-24 years	1.29	1.21	1.14	0.96	0.90	0.87	0.61	0.59	0.53
25-34 years	0.98	0.85	0.85	0.84	0.93	0.90	0.67	0.69	0.69
35-44 years	1.58	1.46	1.48	1.39	1.24	1.17	0.94	1.04	0.97
45-54 years	2.02	2.32	2.29	1.97	2.02	2.12	1.58	1.51	1.43
55-64 years	2.03	1.96	1.99	1.60	2.08	1.82	1.26	1.39	1.31
65-74 years	1.51	1.81	1.84	1.15	1.59	1.60	0.83	1.02	0.94

[1]Obesity—triceps plus subscapular skinfold thickness.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight on height for men and women ages 20-29 years.
[3]Weight-height index in kilogram/(meter^p), where p = 2 for men, and p = 1.5 for women

NOTE: Criteria of obesity and overweight are at the 85th, 90th, and 95th percentiles or more measurements for men and women ages 20-29 years.

Sex and age	Coefficient of correlation [1]r	[2]b_0	b_1[3]	$s_{y \cdot x}$[4]
Men				
20-24 years	0.417	−143.30	4.441	27.3
25-34 years	0.420	−168.67	4.941	30.5
35-44 years	0.460	−187.49	5.277	27.4
45-54 years	0.390	−131.83	4.454	28.4
55-64 years	0.426	−173.99	5.069	28.5
65-74 years	0.404	−131.64	4.385	26.0
20-29 years	0.381	−160.88	4.697	28.4
Women				
20-24 years	0.274	−70.82	3.197	28.7
25-34 years	0.263	−88.62	3.587	32.1
35-44 years	0.270	−94.02	3.815	35.0
45-54 years	0.246	−77.17	3.587	33.8
55-64 years	0.249	−68.24	3.492	33.4
65-74 years	0.285	−76.38	3.583	29.0
20-29 years	0.247	−67.64	3.167	29.2

[1]r = coefficient of correlation.
[2]b_0 = intercept in regression equation.
[3]b_1 = regression coefficient.
[4]$s_{y \cdot x}$ = standard error of estimate.

$$\text{S.E.}(\hat{p}_A - \hat{p}_B) = \sqrt{s_A^2 + s_B^2 - 2 \operatorname{cov}(\hat{p}_A, \hat{p}_B)}$$

where

$$s_A = \text{estimated standard error of } p_A,$$
$$s_B = \text{estimated standard error of } p_B, \text{ and}$$
$$\operatorname{cov}(\hat{p}_A, \hat{p}_B) = \text{the estimated covariance of } p_A \text{ and } p_B.$$

s_A and s_B were estimated using the balanced half sample replication method.

The calculation of the covariance of $\hat{p}_A$ and $\hat{p}_B$ depended on the type of hypothesis tested. Basically, the hypotheses may be classified as follows:

1. Testing for the equality of the proportion of obese in a given sex and age subgroup and the proportion of overweight on the basis of a given method in that same subgroup.

2. Testing for the equality of proportions of persons in different overweight and/or obesity categories for a given age and sex subgroup on the basis of methods A and B, respectively, (for example, one might be interested in testing for the equality of percentages of men 20-24 years who are overweight not obese and obese not overweight on the basis of method A or B).

3. Testing the equality of the percents of men and women for a given overweight and/or obesity category on the basis of method A or B.

In testing hypotheses of type 1, the covariance of p_A and p_B is calculated by the identity

$$\operatorname{cov}(\hat{p}_A, \hat{p}_B) = s_A^2 s_B^2 r_{A,B}$$

where

$$r_{A,B} = \frac{\sum (x_{i,A} - \hat{p}_A)(x_{i,B} - \hat{p}_B) w_i}{\sqrt{\sum w_i (x_{i,A} - \hat{p}_A)^2 \sum w_i (x_{i,B} - \hat{p}_B)^2}}$$

and

$$x_{i,j} = \begin{cases} 1 \text{ if the } i\text{th sampled person in a given age-sex group is } j \text{ on the basis of a given method} \\ 0 \text{ otherwise} \end{cases}$$

and

j = A (overweight), B (obese).

In testing hypotheses of type 2, $\operatorname{cov}(\hat{p}_A, \hat{p}_B)$ was estimated using the identity

$$\operatorname{Var}(\hat{p}_A + \hat{p}_B) = \operatorname{Var}(\hat{p}_A) + \operatorname{Var}(\hat{p}_B) + 2 \operatorname{cov}(\hat{p}_A, \hat{p}_B)$$

where

$$\operatorname{Var}(\hat{p}_A) = s_A^2, \operatorname{Var}(\hat{p}_B) = s_B^2$$

and

$$\operatorname{Var}(\hat{p}_A + \hat{p}_B) = [\text{S.E.}(\hat{p}_A + \hat{p}_B)]^2$$

were estimated using the NCHS variance program.[32]

Table V. Standard error of the prevalence of men overweight and/or obese for selected percentiles, by age: United States, 1971-74

Age	Overweight				Not overweight	
	Not obese		Obese		Obese	
	Cross-classification of triceps plus subscapular skinfold[1] with:		Cross-classification of triceps plus subscapular skinfold with:		Cross-classification of triceps plus subscapular skinfold with:	
	Relative desirable weight[2]	Weight-height index[3]	Relative desirable weight	Weight-height index	Relative desirable weight	Weight-height index
	Below and above 85th percentile					
20-74 years	0.59	0.59	0.58	0.60	0.56	0.56
20-24 years	0.97	0.79	1.51	1.51	1.02	1.02
25-34 years	1.22	1.15	1.62	1.66	0.98	1.03
35-44 years	1.77	1.77	1.79	1.79	1.41	1.41
45-54 years	1.22	1.22	1.59	1.58	1.51	1.51
55-64 years	1.39	1.39	1.53	1.53	1.48	1.48
65-74 years	1.06	1.04	0.96	0.95	0.76	0.76
	Below and above 90th percentile					
20-74 years	0.60	0.58	0.43	0.42	0.49	0.49
20-24 years	0.72	0.69	1.16	1.14	1.03	1.06
25-34 years	1.39	1.30	1.35	1.35	0.76	0.77
35-44 years	1.71	1.70	1.15	1.19	1.07	1.11
45-54 years	1.17	1.27	1.16	1.16	1.56	1.56
55-64 years	1.26	1.26	1.48	1.48	1.24	1.24
65-74 years	0.97	0.97	0.74	0.75	0.46	0.47
	Below and above 95th percentile					
20-74 years	0.36	0.36	0.28	0.27	0.36	0.36
20-44 years	0.48	0.48	0.43	0.44	0.39	0.40
20-24 years	0.58	0.58	0.74	0.74	0.76	0.77
25-34 years	0.93	0.93	0.90	0.89	0.77	0.79
35-44 years	0.84	0.84	0.51	0.55	0.67	0.68
45-64 years	0.72	0.71	0.41	0.41	0.55	0.55
45-54 years	0.89	0.89	0.77	0.77	0.82	0.83
55-64 years	1.12	1.10	0.73	0.73	0.55	0.55
65-74 years	0.48	0.47	0.49	0.49	0.40	0.40

[1]Obesity—triceps plus subscapular skinfold thickness.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight on height for men and women ages 20-29 years.
[3]Weight-height index in kilogram/(meter^p), where $p = 2$ for men, and $p = 1.5$ for women.

NOTE: Criteria of obesity and overweight are at the 85th, 90th, and 95th percentiles or more measurements for men and women ages 20-29 years.

In testing hypotheses of type 3, the covariance was calculated directly from the HES variance-covariance program.

In testing hypotheses of types 1, 2, and 3, more than one hypothesis is implied, because there are two sex groups and several age groups. It is desirable to have the overall probability of falsely rejecting the null hypothesis less than a predetermined α level. Therefore, in determining the critical value for each value defined in equation 1, the Bonferroni method was used.

This method is applied in the following manner:

Let n denote the total number of age and sex subgroups for which the hypothesis is to be tested, and let $A_i(i = 1, \ldots, n)$ represent the rejection of the hypothesis $H_0: p_A = p_B$ when it is true for the ith age and sex subgroup.

Then if the critical value of α is chosen so that

$$P(A_i) \leqslant \frac{\alpha}{n} \qquad i = 1, \ldots, n$$

it follows immediately from Bonferroni's inequality

$$P\left(\bigcup_{i=1}^{n} A_i\right) \leqslant \sum_{i=1}^{n} P(A_i)$$

that $P\left(\bigcup_{i=1}^{n} A_i\right) \leqslant \alpha$ is the desired overall rejection level. In this report, an α level of 0.05 was used.

In testing hypotheses of type 1, a two-sided alternative was used, and six comparisons were made—ages 20-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, and 65-74 years. In addition, these hy-

potheses were tested for men and women separately. Hence a critical value of 2.64 from the normal tables was used. This also was true in testing hypotheses of type 2 for women at the 85th, 90th, and 95th percentiles or more and for men at the 85th and 90th percentiles or more. In testing hypotheses of type 2 at the 95th percentile or more for men, a two-sided alternative was used, and three comparisons were made—ages 20-44 years, 45-64 years, and 65-74 years. Hence a critical value of 2.39 was used.

Hypotheses of type 3 at the 85th and 90th percentiles or more were tested against a two-sided alternative assuming six comparisons similar to the six age groups indicated above; again a critical value at 2.64 was used. Hypotheses of type 3 at the 95th percentile or more were tested assuming three comparisons, with the three ages indicated previously. A critical value of 2.39 was used.

In testing for age-related trends, there were five implied comparisons and the null hypothesis: $H_o : p_A = p_B$ was tested against the one-sided alternative $H_A : p_A > p_B$. Hence a critical value of 2.326 was used.

Derivation of regression coefficients

In this report, predicted values of weight ($\hat{y}_i$) based on height (X_i) were used in the construction of a measure of overweight. These values were calculated by means of the method of weighted least squares. In applying this method, the following assumptions were made.

Let y_i denote the observed weight of a person and w_i the sample weight (i.e., the number of persons in the population represented by the sample person). It is assumed that y_i can be expressed as a linear combination of m continuous variables X_{ji} plus error term e_i, that is:

$$y_i = \beta_0 + X_{1i}\beta_1 + X_{2i}\beta_2 + \ldots + X_{mi}\beta_m$$
$$+ e_i \quad i = 1, \ldots, n \tag{2}$$

where the e_i are independent normally distributed random variables with zero mean and variance equal to $w_i^{-1}\sigma^2$.

Equation (2) can be written in matrix notation as follows:

$$y = X\beta + e \tag{3}$$

where

$$y' = (y_1, y_2, \ldots, y_n)$$

$$X = \begin{bmatrix} 1 & X_{11} & X_{21} & .. & X_{m1} \\ 1 & X_{12} & X_{22} & .. & X_{m2} \\ 1 & X_{13} & X_{23} & .. & X_{m3} \\ . & & & & . \\ . & . & & & . \\ . & & & & . \\ 1 & X_{1n} & X_{2n} & .. & X_{mn} \end{bmatrix}$$

$$\beta' = (\beta_0, \beta_1, \beta_2, \ldots, \beta_m)$$

and

$$e' = (e_1, e_2, \ldots, e_n)$$

The estimators b_j of β_j ($j = 0, \ldots, m$) then can be calculated by the method of weighted least squares as follows:

$$b = (X'V^{-1}X)^{-1} X'V^{-1}y \tag{4}$$

where

$$b = (b_0, b_1, \ldots, b_m)$$

$$V = \begin{bmatrix} \frac{1}{w_1} & 0 & \ldots & 0 \\ 0 & \frac{1}{w_2} & \ldots & 0 \\ . & . & & . \\ . & . & & . \\ . & . & & . \\ 0 & 0 & \ldots & \frac{1}{w_0} \end{bmatrix} \sigma^2$$

with

$$\text{Var}(b) = (X'V^{-1}X)^{-1} \tag{5}$$

In the case where predicted weight is based on height (X_1) alone equation (3) has the form

$$\begin{bmatrix} y_1 \\ y_2 \\ . \\ . \\ . \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & X_{11} \\ 1 & X_{12} \\ . & . \\ . & . \\ . & . \\ 1 & X_{1n} \end{bmatrix} \begin{bmatrix} b_0 \\ b_1 \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \\ . \\ . \\ . \\ e_n \end{bmatrix} \tag{6}$$

so that predicted values of weight ($\hat{y}_i$) on height (X_i)($i = 1, \ldots, n$) can be calculated by

$$\hat{y}_i = b_0 + X_{1i}b_1, (i = 1, \ldots, n)$$

where the estimators b_1 of β_1 and b_0 of β_0

$$b_1 = \dfrac{\displaystyle\sum_{i=1}^{n} w_i X_i y_i - \dfrac{\left(\displaystyle\sum_{i=1}^{n} w_i X_i\right)\left(\displaystyle\sum_{i=1}^{n} w_i y_i\right)}{\displaystyle\sum_{i=1}^{n} w_i}}{\displaystyle\sum_{i=1}^{n} w_i X_{1i}^2 - \dfrac{\left(\displaystyle\sum_{i=1}^{n} w_i X_{1i}\right)^2}{\displaystyle\sum_{i=1}^{n} w_i}}$$

and

$$b_0 = \overline{Y} - b_1 \overline{X}_1$$

where

$$\overline{Y} = \dfrac{\displaystyle\sum_{i=1}^{n} w_i y_i}{\displaystyle\sum_{i=1}^{n} w_i}$$

and

$$\overline{X}_1 = \dfrac{\displaystyle\sum_{i=1}^{n} w_i X_{1i}}{\displaystyle\sum_{i=1}^{n} w_i}$$

An estimate of the variance of b_1 can be obtained from equation 4 as follows:

$$\mathrm{Var}\,(b_1) = \dfrac{\sigma^2}{\displaystyle\sum_{i=1}^{n} w_i (X_{1i} - \overline{X}_1)^2}$$

The goodness of fit of the regression lines given by these equations to the observed data is determined by the usual standard error of estimate formula

$$s_{y \cdot x} = \sqrt{\dfrac{\displaystyle\sum_{i=1}^{n} w_i (Y_i - \hat{Y}_i)^2}{N - 2}}$$

where Y is the observed value of weight, $\hat{Y}$ is the predicted value of weight, and $N = \displaystyle\sum_{i=1}^{n} w_i$

The resultant estimates for the regression coefficients for weight based on height alone are presented in table IV with the standard errors of the estimates for the 12 age and sex groups.

The standard mean weights for given heights of men and women were obtained from linear regression equations for the six age groups 20-24, 25-34, 35-44, 45-54, 55-64, and 65-74 years, and the mean desir-

able weights for given heights of men and women were obtained from the linear regression equation for the age group 20-29 years. The equations of weight on height were fitted by the least squares method, which holds that the line of "best fit" is the one for which the sum of the squares of the residual errors is a minimum. The linear regression of weight on height was used, which describes the change in weight that accompanied a unit of change in height. The estimates of the regression coefficient (β_1), the Y intercept (β_0) in the regression equation $Y = \beta_0 + A_1 x + e$, and the standard error of estimate around these regression lines for age and sex groups are shown in table IV.

This approach of predicting weight from height for each age group showed a correlation that ranged from the order of +0.460 at ages 35-44 years to +0.390 at ages 45-54 years for men of ages 20-74 years. Corresponding correlation values for women ranged from +0.285 at ages 65-74 years to +0.246 at ages 45-54 years. The highest correlation for men showed that about 21 percent of the variance of weight is accounted for by the variance of height. For women, this value was about 8 percent.

Desirable weight predicted from the weight-height relationship of men and women ages 20-29 years showed a correlation of +0.381 for men and +0.247 for women, with about 15 percent of the variance of weight explained by height for men and about 6 percent for women.

The subject's observed weight then was compared to the predicted weight, one based on each age, the other on desirable weight for ages 20-29 years, and an index of relative body weight was calculated.

Weight-height index

The weight-height index (W/H^p) used as a measure of overweight in this report was obtained by a method suggested by Benn.[11] Assuming the existence of a linear relationship of weight W on height H of the form:

$$W(H) = W_o + (H - H_o)b \qquad (7)$$

where W_o and H_o represent some central locations of weight and height, and b is the slope of the regression line, Benn showed that p could be calculated as:

$$p = b\dfrac{H_o}{W_o} \qquad (8)$$

In applying Benn's method to NHANES I data, equations of the form given in (7) were derived for age groups 20-24, 25-34, 34-44, 45-54, 55-64, 65-74, and 20-29 years. H_o was interpreted as the mid-range of height values, and W_o was interpreted as the average weight for height H_o. Table VII shows the mid-range

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Table VI. Standard error of the prevalence of women overweight and/or obese for selected percentiles, by age: United States, 1971-74

Sex and age	Overweight				Not overweight	
	Not obese		Obese		Obese	
	Cross-classification of triceps plus subscapular skinfold[1] with:		Cross-classification of triceps plus subscapular skinfold with:		Cross-classification of triceps plus subscapular skinfold with:	
	Relative desirable weight[2]	Weight-height index[3]	Relative desirable weight	Weight-height index	Relative desirable weight	Weight-height index
	Below and above 85th percentile					
20-74 years	0.57	0.57	0.77	0.75	0.44	0.46
20-24 years	0.58	0.59	1.08	1.05	0.77	0.73
25-34 years	0.45	0.50	0.88	0.88	0.50	0.49
35-44 years	0.86	0.86	1.39	1.39	0.80	0.80
45-54 years	1.28	1.29	2.21	2.19	1.58	1.55
55-64 years	1.64	1.66	1.94	1.94	1.16	1.17
65-74 years	1.58	1.58	1.36	1.37	0.55	0.66
	Below and above 90th percentile					
20-74 years	0.55	0.49	0.57	0.53	0.40	0.44
20-24 years	0.52	0.52	0.74	0.68	0.52	0.60
25-34 years	0.62	0.54	0.77	0.80	0.58	0.60
35-44 years	0.76	0.65	1.14	1.11	0.66	0.63
45-54 years	1.17	1.07	1.66	1.65	1.21	1.27
55-64 years	1.77	1.60	1.42	1.38	1.06	1.23
65-74 years	1.32	1.15	0.99	1.02	0.52	0.72
	Below and above 95th percentile					
20-74 years	0.37	0.29	0.41	0.41	0.25	0.26
20-44 years	0.34	0.27	0.40	0.39	0.24	0.26
20-24 years	0.47	0.43	0.40	0.40	0.46	0.46
25-34 years	0.50	0.44	0.59	0.61	0.34	0.37
35-44 years	0.64	0.53	0.78	0.74	0.49	0.51
45-64 years	0.73	0.62	0.86	0.87	0.55	0.56
45-54 years	0.76	0.66	1.20	1.19	0.98	0.99
55-64 years	1.12	1.03	0.95	0.96	0.80	0.82
65-74 years	0.83	0.77	0.68	0.62	0.44	0.46

[1]Obesity—triceps plus subscapular skinfold thickness.
[2]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight on height for men and women ages 20-29 years.
[3]Weight-height index in kilogram/(meter^p), where p = 2 for men, and p = 1.5 for women.

NOTE: Criteria of obesity and overweight are at the 85th, 90th, and 95th percentiles or more measurements for men and women ages 20-29 years.

of height H_o, mean weight for height H_o, regression coefficient b of weight on height, and calculated p for each sex-age subgroup.

The power value of $p = 2$ was selected as a standard for men based on ages 20-29 years, and the power value of $p = 1.5$ was selected as a standard for women based on ages 20-29 years.

The weight-height index described above was validated in the following manner. For a given height H in a given age and sex subgroup, a predicted weight W was calculated using the formula developed by Behnke[33]:

$$W = H^p K$$

where

$$K = \frac{W_o}{H_o^{\,p}} \qquad (9)$$

H_o is the mid-range of values of height for a given sex and age group, and W_o is the average weight at height H_o. For each sex, age, and height group, the weight determined from the regression equation of weight on height was compared with the weight obtained from equation (9). Table VIII shows the difference between these two values. With the exception of taller men ages 45-54 and 65-74 years, the maximum difference between these two values is 2 pounds. A similar comparison also was made for women when $p = 2$. There were marked differences between the two values (table IX).

Table VII. Mid-range of height (H_o), mean weight at height H_o, regression coefficient of weight on height, power of height, and nearest half integer for p, by sex and age: United States, 1971-74

Sex and age	Mid-range of height H_o (in inches)	Mean weight at height H_o (in pounds)	Regression coefficient b	Power of height p^1	p rounded to the nearest 0.5 integer
Men					
20-24 years	68	160	4.441	1.89	2.0
25-34 years	68	170	4.941	1.98	2.0
35-44 years	68	174	5.277	2.06	2.0
45-54 years	68	173	4.454	1.75	1.5 or 2.0
55-64 years	68	173	5.069	1.99	2.0
65-74 years	68	169	4.385	1.76	1.5
20-29 years	68	163	4.697	1.96	2.0
Women					
20-24 years	62.5	130.5	3.197	1.53	1.5
25-34 years	62.5	137.5	3.587	1.63	1.5
35-44 years	62.5	146	3.815	1.63	1.5
45-54 years	62.5	148.5	3.857	1.51	1.5
55-64 years	62.5	151.5	3.492	1.44	1.5
65-74 years	62.5	149	3.583	1.50	1.5
20-29 years	62.5	132	3.167	1.62	1.5

Table VIII. Calculated mean weight[1] from mean group weight relative to mean group height and mean weight[2] estimated from regression equation of weight on height by sex and age: United States, 1971-74

Weight in pounds

Men

Sex and height	20-24 years			25-34 years			35-44 years			45-54 years		
	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1
62 inches	133	134	+1	141	141	-	145	143	-2	144	147	+3
63 inches	137	139	+2	146	145	-1	149	148	-1	148	152	+4
64 inches	142	143	+1	150	151	+1	154	153	-1	153	156	+3
65 inches	146	148	-2	155	156	+1	159	158	-1	158	160	+2
66 inches	151	152	+1	160	160	-	164	163	-1	163	164	+1
67 inches	155	157	+2	165	165	-	169	168	-1	168	169	+1
68 inches	160	160	-	170	170	-	174	174	-	173	173	-
69 inches	165	165	-	175	174	-1	179	179	-	178	177	-1
70 inches	170	169	-1	180	179	-1	184	184	-	183	182	-1
71 inches	174	174	-	185	184	-1	190	190	-	189	187	-2
72 inches	179	178	-1	191	189	-2	195	194	-1	194	191	-3
73 inches	184	183	-1	196	194	-2	201	200	-1	199	196	-3
74 inches	189	187	-2	201	199	-2	206	205	-1	205	200	-5

Women

Sex and height	20-24 years			25-34 years			35-44 years			45-54 years		
57 inches	114	112	-2	120	118	-2	127	125	-2	129	129	-
58 inches	117	116	-1	123	121	-2	131	129	-2	133	133	-
59 inches	120	120	-	126	125	-1	134	133	-1	136	136	-
60 inches	123	123	-	129	128	-1	137	137	-	140	140	-
61 inches	126	126	-	133	132	-1	141	141	-	143	143	-
62 inches	129	129	-	136	135	-1	144	144	-	147	147	-
63 inches	132	132	-	139	139	-	148	148	-	150	150	-
64 inches	135	135	-	142	142	-	151	152	+1	154	154	-
65 inches	138	138	-	146	146	-	155	156	+1	157	158	+1
66 inches	142	142	-	149	150	+1	158	159	+1	161	161	-
67 inches	145	145	-	153	153	-	162	163	+1	165	164	-1
68 inches	148	148	-	156	157	+1	166	167	+1	169	168	-1

Weight in pounds

Men

Sex and height	55-64 years			65-74 years			20-29 years		
	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1
62 inches	144	143	-1	140	143	+3	136	136	-
63 inches	148	147	-1	145	147	+2	140	140	-
64 inches	153	153	-	150	151	+1	144	145	+1
65 inches	158	158	-	154	156	+2	149	150	+1
66 inches	163	163	-	159	160	+1	154	155	+1
67 inches	168	168	-	164	164	-	158	159	+1
68 inches	173	173	-	169	169	-	163	163	-
69 inches	178	178	-	174	173	-1	168	168	-
70 inches	183	183	-	179	177	-2	173	173	-
71 inches	189	189	-	184	182	-2	178	178	-
72 inches	194	193	-1	189	186	-3	183	182	-1
73 inches	199	197	-2	195	190	-5	188	187	-1
74 inches	205	203	-2	200	194	-6	193	192	-1

Women

Sex and height	55-64 years			65-74 years			20-29 years		
57 inches	132	132	-	130	130	-	115	113	-2
58 inches	135	136	+1	133	134	+1	118	117	-1
59 inches	139	140	+1	137	137	-	121	120	-1
60 inches	142	143	+1	140	140	-	124	123	-1
61 inches	146	147	+1	144	144	-	127	127	-
62 inches	150	150	-	147	147	-	130	130	-
63 inches	153	153	-	151	151	-	134	134	-
64 inches	157	157	-	154	154	-	137	137	-
65 inches	161	160	-1	158	158	-	140	140	-
66 inches	164	164	-	162	161	-1	143	144	+1
67 inches	168	167	-1	165	165	-	146	147	+1
68 inches	172	171	-1	169	169	-	150	151	+1

[1]Mean weight calculated from Weight (in pounds) = K height^p, where p = 2 for men and p = 1.5 for women; K (constant) derived from mean group weight relative to mean group height.
[2]Estimated from regression equations of weight (y) on height (x) for specified age groups.

Table IX. Calculated mean weight[1] from group weight relative to mean group height and mean weight[2] estimated from regression equation of weight on height, by sex and age for women: United States, 1971-74

Sex and height	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1	Calculated mean weight 1	Estimated mean weight 2	Excess 2 over 1
Women	20-24 years			25-34 years			35-44 years			45-54 years		
57 inches	109	112	+3	114	118	+4	121	125	+4	124	129	+5
58 inches	112	116	+4	118	121	+3	126	129	+3	128	133	+5
59 inches	116	120	+4	123	125	+2	130	133	+3	132	136	+4
60 inches	120	123	+3	127	128	+1	135	137	+2	137	140	+3
61 inches	124	126	+2	131	132	+1	139	141	+2	141	143	+2
62 inches	128	129	+1	135	136	+1	144	144	-	146	147	+1
63 inches	133	132	-1	140	139	-1	148	148	-	151	150	-1
64 inches	137	135	-2	144	142	-2	153	152	-1	156	154	-2
65 inches	141	138	-3	149	146	-3	158	156	-2	161	158	-3
66 inches	146	142	-4	153	150	-3	163	159	-4	166	161	-5
67 inches	150	145	-5	158	153	-5	168	163	-5	171	165	-6
68 inches	154	148	-6	163	157	-6	173	167	-6	176	168	-8
Women	55-64 years			65-74 years			20-29 years					
57 inches	126	132	+6	124	130	+6	110	113	+3			
58 inches	130	136	+6	128	134	+6	114	117	+3			
59 inches	135	140	+5	133	137	+4	118	120	+2			
60 inches	140	143	+3	137	140	+3	122	123	+1			
61 inches	144	147	+3	142	144	+2	126	127	+1			
62 inches	149	150	+1	147	147	-	130	130	-			
63 inches	154	153	-1	151	151	-	134	134	-			
64 inches	159	157	-2	156	154	-2	138	137	-1			
65 inches	164	160	-4	161	158	-3	143	140	-3			
66 inches	169	164	-5	166	161	-5	148	144	-4			
67 inches	174	167	-7	171	165	-6	152	147	-5			
68 inches	179	171	-8	176	169	-7	156	151	-5			

Weight in pounds

[1]Mean weight calculated from weight (in pounds) = K height^p, where p = 2 for women; K (constant) derived from mean group weight relative to mean group height.
[2]Estimated from regression equations of weight (y) on height (x) for specified age groups.

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Appendix II. Demographic terms

Age.—The age recorded for each examinee was the age at last birthday as of the date of examination. The age criterion for inclusion in the sample was age at time of census interview. Some persons 74 years old at the time of interview were 75 years old by the time of examination; there were 20 such cases. In the adjustment and weighting procedures used to produce national estimates, these persons were included in the group of 74-year-olds.

Appendix III. Profile of body measurements of persons from cross-classification of overweight and obesity measures

A profile of selected body measurements of overweight and/or obese categories of persons was made at selected percentiles by sex and age. In addition to height and weight data from NHANES I, body build measurements, elbow breadth and arm muscle diameter were included (figure I). Elbow breadth was selected as representative of bony dimensions (table X) and arm muscle diameter as representative of muscular development (table XI). The variations in body build measurements that influence weight were not identified specifically in the overweight measures (relative desirable weight and weight-height index).
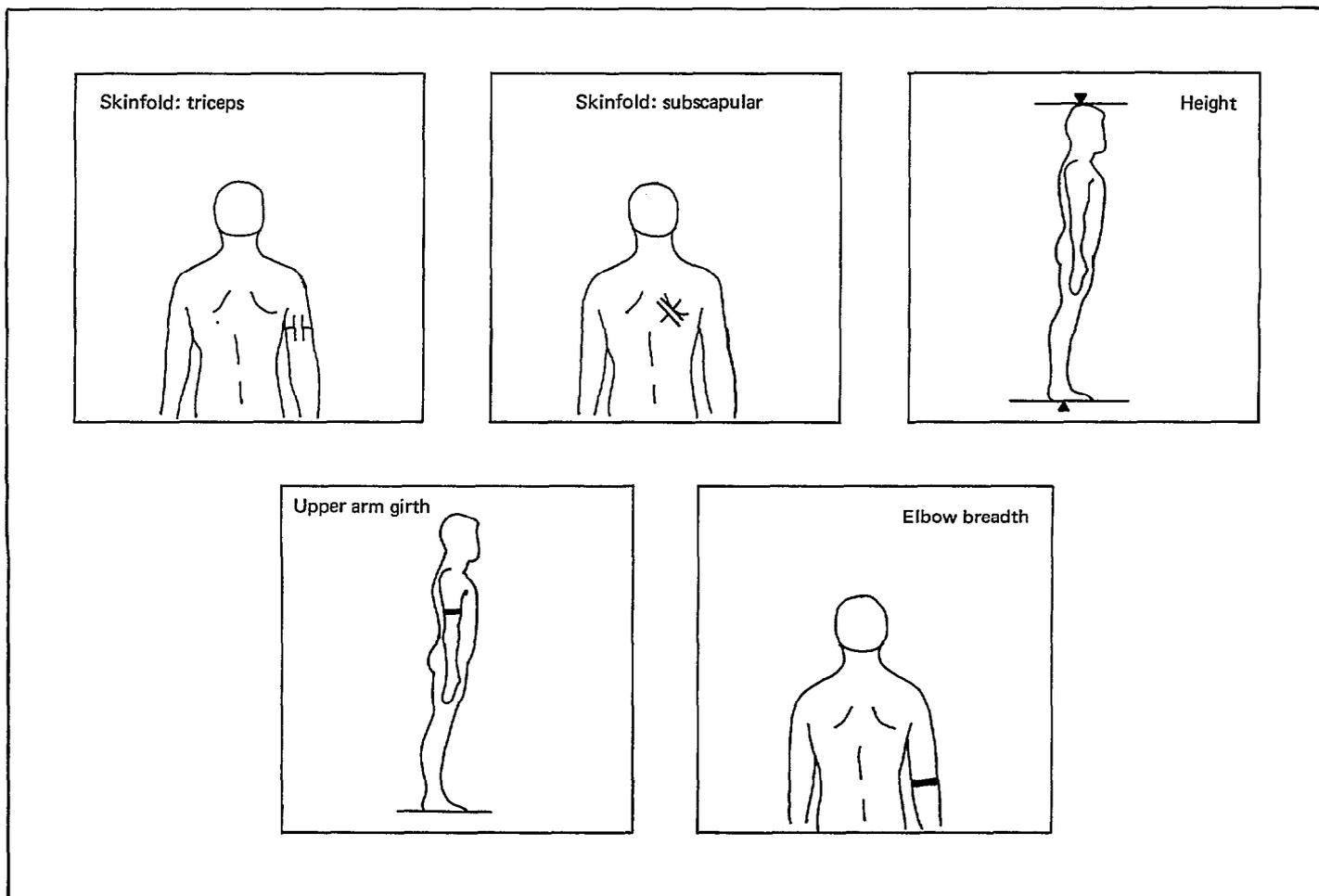
Figure I. Diagram of anthropometric measurements

Table X. Elbow breadth of adults, number of examined persons, estimated population in thousands, mean, standard deviation, and selected percentiles, by sex and age: United States, 1971-74

Sex and age	Sample size	Population in thousands	Mean	Standard deviation	Estimated percentile								
					5th	10th	15th	25th	50th	75th	85th	90th	95th
Men					Elbow breadth in centimeters								
20-74 years	5,001	57,507	7.2	0.4	6.5	6.7	6.8	7.0	7.2	7.5	7.7	7.8	7.9
20-24 years	513	8,110	7.1	0.4	6.3	6.5	6.7	6.8	7.1	7.4	7.5	7.6	7.8
25-34 years	804	13,003	7.2	0.4	6.4	6.6	6.8	6.9	7.2	7.4	7.6	7.7	7.9
35-44 years	664	10,676	7.2	0.4	6.6	6.7	6.8	7.0	7.2	7.5	7.6	7.7	8.0
45-54 years	765	11,150	7.3	0.4	6.6	6.8	6.9	7.0	7.3	7.5	7.7	7.8	7.9
55-64 years	598	9,073	7.3	0.4	6.7	6.8	6.9	7.0	7.3	7.6	7.7	7.8	8.0
65-74 years	1,657	5,496	7.3	0.4	6.6	6.8	6.9	7.0	7.3	7.6	7.7	7.8	8.0
20-29 years	984	15,458	7.1	0.4	6.4	6.6	6.7	6.8	7.1	7.4	7.6	7.7	7.8
Women													
20-74 years	8,130	64,158	6.3	0.5	5.6	5.8	5.9	6.0	6.2	6.5	6.7	6.9	7.1
20-24 years	1,243	9,215	6.1	0.4	5.4	5.6	5.7	5.8	6.1	6.3	6.4	6.5	6.7
25-34 years	1,896	13,933	6.2	0.4	5.6	5.7	5.8	5.9	6.1	6.4	6.5	6.6	6.8
35-44 years	1,664	11,593	6.3	0.4	5.6	5.8	5.9	6.0	6.2	6.5	6.7	6.8	7.1
45-54 years	836	12,163	6.4	0.5	5.7	5.9	5.9	6.1	6.4	6.7	6.8	6.9	7.2
55-64 years	669	9,976	6.5	0.5	5.8	6.0	6.0	6.2	6.4	6.7	6.9	7.0	7.3
65-74 years	1,822	7,277	6.4	0.4	5.8	5.9	6.0	6.2	6.4	6.7	6.9	7.0	7.2
20-29 years	2,280	16,789	6.1	0.4	5.5	5.6	5.7	5.8	6.1	6.3	6.5	6.6	6.7

Table XI. Arm muscle diameter of adults, number of examined persons, estimated population in thousands, mean, standard deviation and selected percentiles, by sex and age: United States, 1971-74

Sex and age	Sample size	Population in thousands	Mean	Standard deviation	Estimated percentile								
					5th	10th	15th	25th	50th	75th	85th	90th	95th
Men					Arm muscle diameter in millimeters								
20-74 years	5,001	57,507	89.3	8.5	76.0	79.1	81.1	84.0	89.1	95.0	98.1	100.1	104.0
20-24 years	513	8,110	87.8	8.1	76.0	78.1	80.1	83.0	87.1	92.1	96.0	99.0	103.1
25-34 years	804	13,003	90.1	8.5	77.0	80.1	82.1	84.1	89.1	96.0	99.1	101.1	105.0
35-44 years	664	10,676	91.7	8.2	80.0	81.1	83.1	86.1	91.1	96.1	101.0	102.1	105.1
45-54 years	765	11,150	89.7	8.5	76.1	79.1	82.0	84.1	89.1	95.1	98.1	100.1	104.1
55-64 years	598	9,073	88.6	8.5	73.1	78.0	81.0	83.1	89.0	94.1	97.0	99.1	101.1
65-74 years	1,657	5,496	85.3	8.1	71.1	75.1	77.1	80.1	86.0	91.0	93.1	95.1	98.0
20-29 years	984	15,458	88.8	8.3	76.0	79.1	81.1	83.1	88.1	94.0	98.0	99.1	104.1
Women													
20-74 years	8,130	64,158	70.8	9.5	59.0	61.0	62.0	65.0	69.1	75.1	79.1	83.0	87.1
20-24 years	1,243	9,215	66.8	7.8	57.0	89.0	60.0	62.0	66.0	71.0	73.1	75.1	80.0
25-34 years	1,896	13,933	69.1	8.5	58.1	60.0	62.0	64.0	68.0	73.0	77.0	79.1	85.0
35-44 years	1,664	11,593	71.5	10.2	59.0	61.0	63.0	66.0	70.1	76.1	80.1	83.1	87.1
45-54 years	836	12,163	72.3	9.3	60.0	62.0	63.1	66.0	71.1	77.1	82.0	85.0	89.0
55-64 years	669	9,976	72.7	10.0	59.0	62.0	64.0	66.1	72.1	78.0	81.1	84.0	89.1
65-74 years	1,822	7,277	72.6	9.4	59.1	62.0	64.0	66.1	72.0	78.0	82.0	84.1	89.1
20-29 years	2,280	16,789	67.5	8.0	57.1	59.1	61.0	62.1	66.1	71.1	74.1	76.1	81.0

Because this limits the overweight measures accounting only for height, the influence of the body build measures on the overweight measures was examined.

Upper arm girth

The examinee's right arm was flexed 90° at the elbow, and the distance from the acromion to the end of the humerus was measured with a steel tape to the nearest 0.1 centimeter. The lateral part of the arm then was marked at the midpoint. With the examinee's arm hanging freely, a steel tape was used to measure the circumference of the upper arm at this level without compressing tissue. The recorder kept the tape horizontal and measured at the mark on the arm. This measurement was made at the same level as the triceps skinfold measurement.

Elbow breadth

In addition to gross body size, some dimensions provide measures of body breadth across bony land marks. Elbow breadth measures indicate skeletal breadth, unaffected by degree of adiposity, and are closely representative of bony dimensions. To measure this site, the examinee extended the right arm until it was perpendicular to the body. The arm was bent so the angle at the elbow was 90° with the fingers pointing up and the dorsal part of the wrist toward the examiner. With the sliding caliper along the axis of the upper arm, the greatest breadth across the elbow joint was measured to the nearest 0.1 cm.

Limb circumferences provide an estimate of relative muscularity, and thus, insight into the body's composition. The arm, for example, comprises successive layers of bone, muscle, and fat. When the upper arm circumference is corrected for the thickness of the outer layer of subcutaneous fat at the triceps site, an estimate of the lean component of the arm's composition is obtained.

Arm muscle diameter is obtained from the arm circumference when the thickness of the subcutaneous fat of the arm is measured at the same level, assuming that the arm is a cylinder for such measurements. The circumference of the upper arm was measured with a steel tape to measure triceps skinfold. The muscular development of the arm is calculated on the basis of the formula:

$$d = \frac{c}{\pi} - S_t$$

where d is the muscle-bone diameter, c is the upper arm circumference, π is 3.1429, and S_t is the triceps skinfold measure.

Table XII presents the mean body measurements of men by age in each of the weight categories at selected percentile cutting points based on the classification of relative desirable weight and triceps plus subscapular skinfold measurement. The mean values presented in this table are shown graphically in figures II and III. At all percentile cutting points, the mean heights of men in all ages were similar—about 69 inches. The National Center for Health Statistics has reported that the average height of men in the United States ages 20-74 years was 69 inches.[34]

The mean weight and mean arm muscle diameter values of weight categories were distinctly different from one another. The highest mean weights were observed for the overweight and obese men, followed in descending order by overweight not obese men, obese not overweight men, average weight or medium obese men, and underweight and lean men. Obese men not overweight ages 20-74 years at the 85th percentile cutting point had an average weight of 179 pounds, which was an average of 6 pounds above the

reported average for men in the general population.[34] Corresponding data for obese not overweight men at the 90th percentile cutting points showed that the mean observed weight was 12 pounds above the mean weight of the general male population.

The highest mean arm muscle diameter values were found among overweight men with or without obesity. Although on the average, men overweight and obese weighed more than men overweight not obese, the muscular development of men overweight not obese, on the average was more than that of men overweight and obese. The mean arm muscle diameter of men average weight or medium obese was higher than that of men obese not overweight and men underweight and lean. In this comparison, another reversal in differences in mean body measurement between weight categories occurred. Although men obese not overweight, on the average weighed more than men average weight and medium obese men did, the muscle development of the men average or medium obese was more than that of the men obese not overweight. As expected, the lowest arm muscle diameter was observed for the men underweight and lean.

Observed differences in mean elbow breadth of men overweight and obese and men overweight not obese were small. The bony dimensions of both overweight categories, with or without obesity, were on the average higher than those of men obese not overweight, average weight and medium obese, and underweight and lean. The mean elbow breadth of men obese not overweight and men average weight and medium obese was higher than that of men underweight and lean. At the 85th and 90th percentile cutting points, in the older ages, the mean elbow breadth of men average weight and medium obese was generally higher than that of men obese not overweight.

A similar profile was made for women of comparable ages (table XIII and figures IV and V). The mean height of women in all weight categories at selected percentile cutting points was about 63 inches, which was about equal to the mean height of women of comparable ages in the general population.[34]

The pattern in differences in mean weight among weight categories found for men also were found for women. On the average, the heaviest women were women overweight and obese, followed by women overweight not obese. The weight of women obese not overweight was higher than that of women average weight and medium obese women and women underweight and lean women. Women obese not overweight ages 20-74 years at the 85th percentile cutting point had an average weight of 142 pounds, which was on the average 2 pounds below the reported average of 144 pounds for all women ages 20-74 years. For women obese not overweight at the 90th percentile cutting point, the average weight was

Table XII. Mean body measurements of men by weight categories at selected percentile cutting points based on cross-classification of relative desirable weight[1] and triceps plus subscapular skinfold, by age: United States, 1971-74

Age	Less than 15th percentile, underweight and lean	≥15th-<85th percentile — Average weight and medium obese	Below and above 85th percentile — Overweight		Below and above 85th percentile — Not overweight	≥15th-<90th percentile — Average weight and medium obese	Below and above 90th percentile — Overweight		Below and above 90th percentile — Not overweight	Below and above 95th percentile — Overweight		Below and above 95th percentile — Not overweight
			Not obese	Obese	Obese		Not obese	Obese	Obese	Not obese	Obese	Obese
Height in inches												
20-74 years	69	69	69	69	69	69	69	69	69	69	69	69
20-24 years	70	70	72	70	70	70	70	70	69	69	70	71
25-34 years	70	70	70	70	69	70	69	70	70	70	69	71
35-44 years	70	69	69	70	70	69	69	69	70	71	69	69
45-54 years	68	69	69	69	69	69	69	69	69	69	68	70
55-64 years	68	68	68	68	69	68	68	68	68	68	68	68
65-74 years	68	67	67	68	68	67	67	67	67	67	67	67
Weight in pounds												
20-74 years	128	166	201	218	179	169	206	227	185	232	249	202
20-24 years	132	166	213	221	183	168	211	231	188	231	245	207
25-34 years	133	167	207	226	178	169	206	238	191	243	261	208
35-44 years	129	168	202	219	184	172	211	226	192	244	257	197
45-54 years	124	167	201	214	180	170	205	225	186	230	240	204
55-64 years	119	165	193	215	174	168	205	221	168	223	242	194
65-74 years	121	159	190	203	171	162	196	208	176	215	225	186
Elbow breadth in centimeters												
20-74 years	7.0	7.2	7.5	7.5	7.2	7.2	7.5	7.5	7.2	7.6	7.6	7.3
20-24 years	6.9	7.1	7.5	7.3	7.3	7.1	7.5	7.3	7.4	7.5	7.3	7.4
25-34 years	6.9	7.1	7.5	7.4	7.1	7.1	7.4	7.4	7.2	7.6	7.5	7.4
35-44 years	7.1	7.2	7.4	7.5	7.2	7.2	7.5	7.4	7.2	7.7	7.7	7.2
45-54 years	7.2	7.3	7.4	7.5	7.2	7.2	7.5	7.6	7.1	7.6	7.8	7.3
55-64 years	7.0	7.3	7.5	7.5	7.3	7.3	7.6	7.5	7.1	7.5	7.7	7.3
65-74 years	7.1	7.3	7.5	7.5	7.2	7.3	7.5	7.5	7.2	7.6	7.6	7.3
Arm muscle diameter in millimeters												
20-74 years	79	89	98	95	85	89	99	95	86	103	97	88
20-24 years	80	88	100	94	86	89	100	96	86	101	98	88
25-34 years	82	89	99	96	85	89	98	97	88	101	100	89
35-44 years	81	90	99	97	87	91	101	95	87	107	98	88
45-54 years	79	89	99	94	86	89	100	94	86	105	92	88
55-64 years	75	88	97	94	85	89	99	94	83	101	98	89
65-74 years	75	85	94	90	83	85	94	90	84	98	89	85

[1]Relative desirable weight is observed weight divided by desirable weight times 100, based on regression equation of weight on height for men ages 20-29 years.

152 pounds, which was on the average 8 pounds above the average weight previously reported for women in the general population.[34]

Overweight women with or without the obesity showed the highest mean arm muscle diameter values. The differences in mean values between these weight categories were small at the 85th percentile cutting point and at the higher percentile cutting points; both weight categories showed about the same mean arm muscle diameter. Women average weight and medium obese at the 85th percentile cutting point showed a slightly higher mean value than that of women obese not overweight did. At the 90th per-centile, women in both weight categories had about the same mean arm muscle diameter. As expected, women underweight and lean showed the lowest mean arm muscle diameter.

Women overweight and obese showed the highest mean elbow breadth. The mean elbow breadth of women overweight not obese was lower than that of women overweight and obese. After these weight categories, in descending order of their mean value, the weight categories were generally obese not over-weight, average weight and medium obese, and under-weight and lean. At the 85th percentile cutting point, most differences in mean elbow breadth between
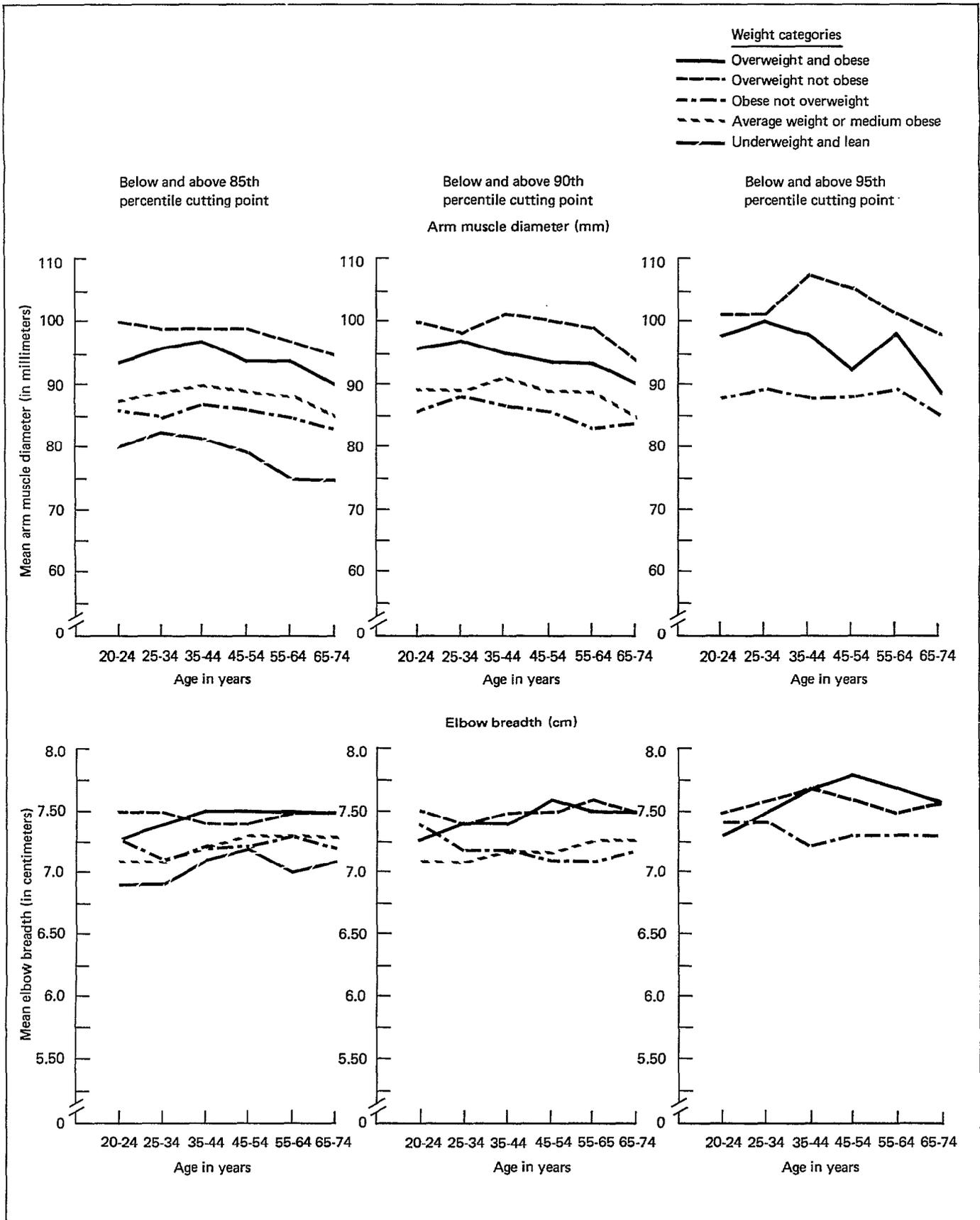
Figure II. Mean arm muscle diameter and elbow breadth measurements of men by weight category at selected percentile cutting points based on cross-classification of triceps plus subscapular skinfold and relative desirable weight, by age: United States, 1971-74
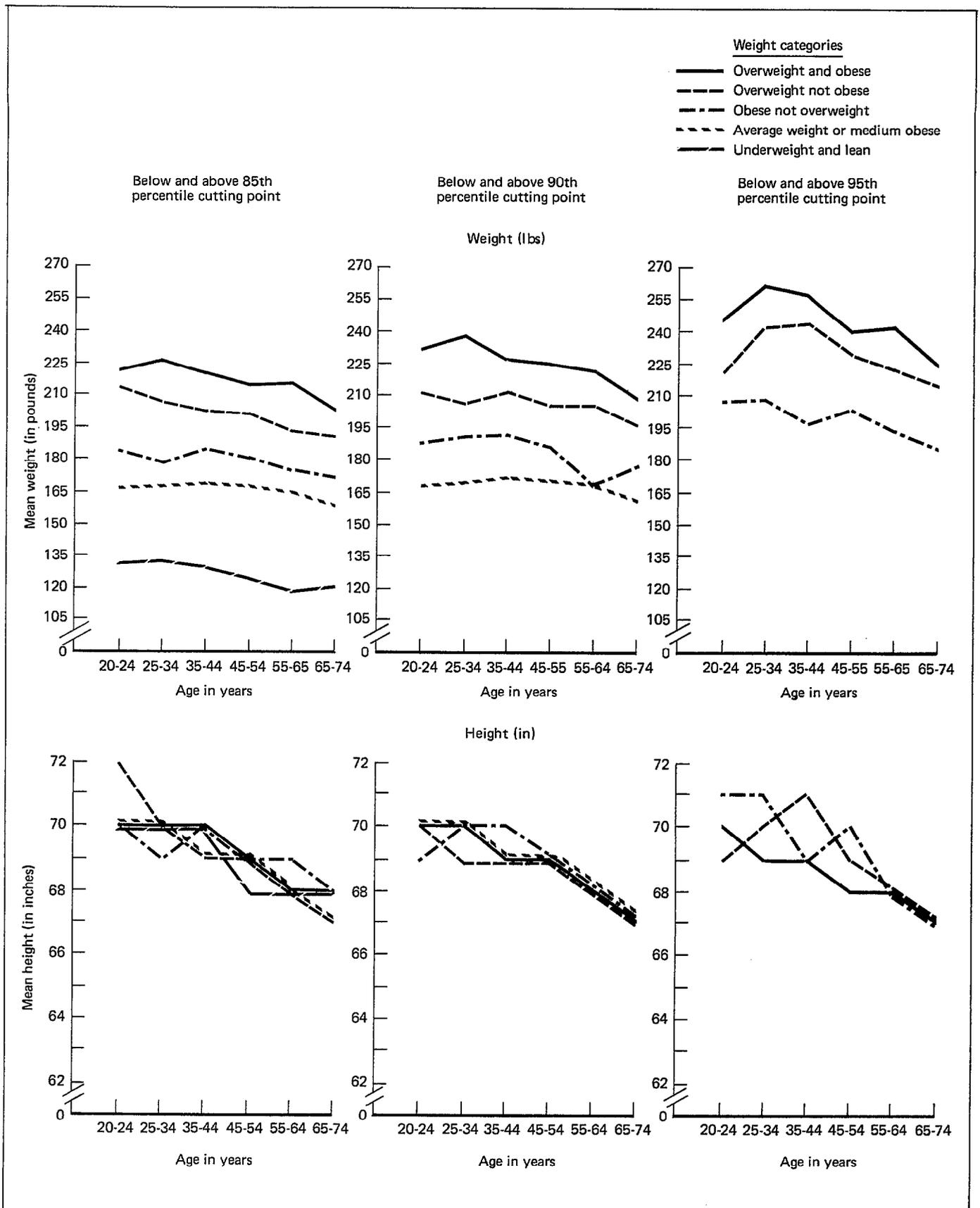
Figure III. Mean weight and height of men by weight category at selected percentile cutting points based on cross-classification of triceps plus subscapular skinfold and relative desirable weight, by age: United States, 1971-74

Table XIII. Mean body measurements of women by weight categories at selected percentile cutting points based on cross-classification of relative desirable weight[1] and triceps plus subscapular skinfold, by age: United States, 1971-74

Age	Less than 15th percentile, underweight and lean	≥15th-<85th percentile — Average weight and medium obese	Below and above 85th percentile — Overweight (Not obese)	Below and above 85th percentile — Overweight (Obese)	Below and above 85th percentile — Not overweight (Obese)	≥15th-<90th percentile — Average weight and medium obese	Below and above 90th percentile — Overweight (Not obese)	Below and above 90th percentile — Overweight (Obese)	Below and above 90th percentile — Not overweight (Obese)	Below and above 95th percentile — Overweight (Not obese)	Below and above 95th percentile — Overweight (Obese)	Below and above 95th percentile — Not overweight (Obese)
Height in inches												
20-74 years	63	64	63	63	63	64	63	63	63	63	64	63
20-24 years	64	64	64	64	64	64	64	64	63	64	64	63
25-34 years	64	64	64	64	63	64	64	64	64	64	64	64
35-44 years	63	64	64	64	64	64	64	64	64	64	65	64
45-54 years	62	64	64	63	64	64	63	63	64	63	63	64
55-64 years	62	63	63	63	63	63	62	62	63	63	63	62
65-74 years	62	63	62	62	62	63	62	62	62	62	62	62
Weight in pounds												
20-74 years	100	131	166	187	142	134	177	199	152	201	222	170
20-24 years	102	130	166	191	146	132	186	203	153	204	237	165
25-34 years	103	130	171	193	141	132	179	205	153	203	225	171
35-44 years	103	132	167	194	142	135	182	206	152	211	226	171
45-54 years	97	132	169	185	145	136	175	198	154	199	219	176
55-64 years	96	132	164	181	140	136	176	191	151	196	220	165
65-74 years	92	130	163	179	140	135	174	188	148	194	209	168
Elbow breadth in centimeters												
20-74 years	5.9	6.2	6.5	6.7	6.3	6.2	6.6	6.8	6.3	6.7	7.0	6.5
20-24 years	5.9	6.0	6.3	6.5	6.2	6.1	6.3	6.6	6.2	6.4	6.9	6.4
25-34 years	5.9	6.1	6.3	6.5	6.1	6.1	6.4	6.6	6.2	6.6	6.8	6.3
35-44 years	5.9	6.2	6.5	6.6	6.2	6.2	6.5	6.7	6.4	6.7	7.0	6.4
45-54 years	6.0	6.2	6.5	6.7	6.4	6.3	6.6	6.8	6.4	6.8	7.0	6.7
55-64 years	6.0	6.3	6.6	6.8	6.4	6.4	6.7	6.9	6.5	6.9	7.2	6.6
65-74 years	6.0	6.3	6.6	6.7	6.4	6.4	6.6	6.8	6.4	6.8	7.1	6.6
Arm muscle diameter in millimeters												
20-74 years	63	68	78	80	67	69	81	82	69	85	86	73
20-24 years	62	66	76	78	66	66	79	81	67	84	87	70
25-34 years	64	67	78	78	65	68	80	80	66	85	85	70
35-44 years	63	68	77	81	67	69	81	83	69	87	87	74
45-54 years	64	69	79	80	68	70	82	82	71	85	86	76
55-64 years	62	69	78	80	67	70	82	82	70	84	88	74
65-74 years	60	69	78	79	69	70	81	81	70	87	85	73

[1] Relative desirable weight is observed weight divided by desirable weight times 100, based on average weights estimated from regression equation of weight on height for women ages 20-29 years.

women obese not overweight and women average weight and medium obese occurred after ages 35 years and over.

A profile of selected body measurements of men and women also was prepared from the cross-classification of weight-height index and triceps plus subscapular skinfold measurement. Tables XIV and XV present body measurements for men and women by age at selected percentile cutting points. The mean values presented in these tables are shown graphically in figures VI-IX. The mean body measurements previously found for the weight categories obtained by the cross-classification of relative desirable weight and triceps plus subscapular skinfold generally were found for similar weight categories obtained by the cross-classification of weight-height index and triceps plus subscapular skinfold measurement.

A limitation of the weight indexes, relative desirable weight and weight-height index is that the effect of variation in body build, bony dimensions and muscular development was not considered specifically. The influence of body build on the weight status of individuals defined by relative desirable weight and skinfold measurements is presented in
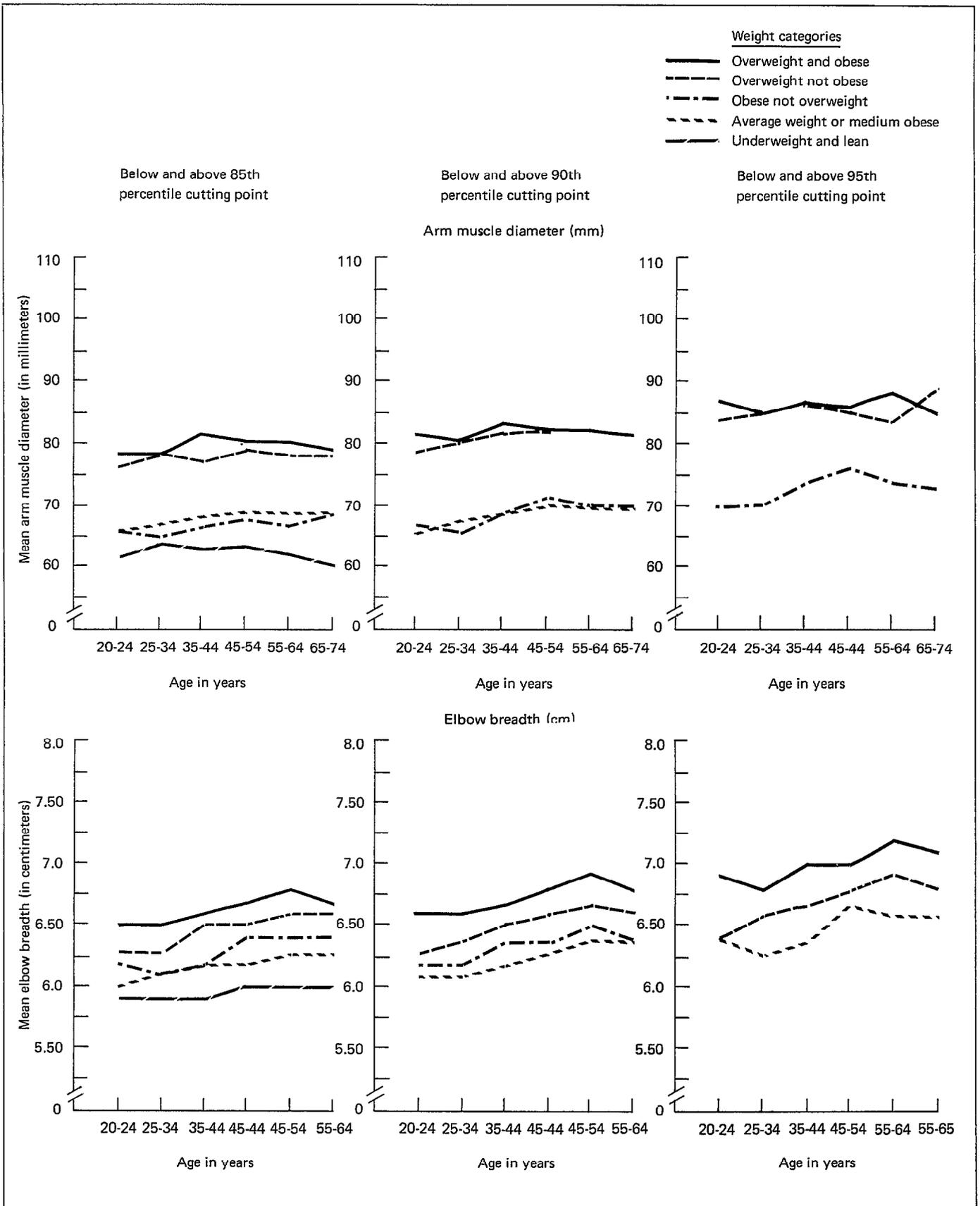
Figure IV. Mean arm muscle diameter and elbow breadth measurements of women by weight category at selected percentile cutting points based on cross-classification of triceps plus subscapular skinfold and relative desirable weight, by age: United States, 1971-74
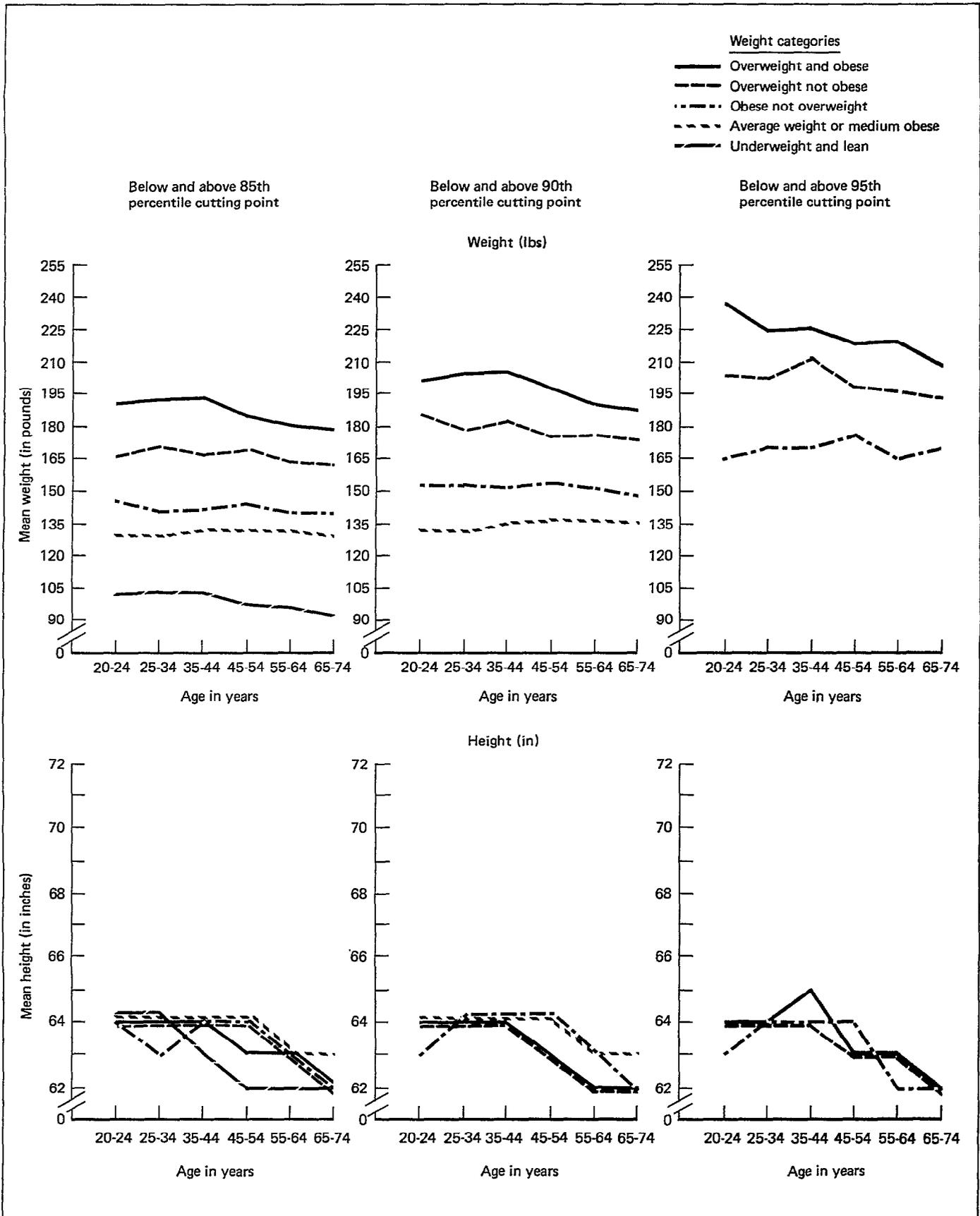
Figure V. Mean weight and height of women by weight category at selected percentile cutting points based on cross-classification of triceps plus subscapular skinfold and relative desirable weight, by age: United States, 1971-74

Table XIV. Mean body measurements of men by weight categories at selected percentile cutting points based on cross-classification of weight-height index[1] and triceps plus subscapular skinfold, by age: United States, 1971-74

Age	Less than 15th percentile, underweight and lean	≥15th-<85th percentile — Average weight and medium obese	Below and above 85th percentile — Overweight — Not obese	Below and above 85th percentile — Overweight — Obese	Below and above 85th percentile — Not overweight — Obese	≥15th-<90th percentile — Average weight and medium obese	Below and above 90th percentile — Overweight — Not obese	Below and above 90th percentile — Overweight — Obese	Below and above 90th percentile — Not overweight — Obese	Below and above 95th percentile — Overweight — Not obese	Below and above 95th percentile — Overweight — Obese	Below and above 95th percentile — Not overweight — Obese
Height in inches												
20-74 years	69	69	69	69	69	69	69	69	70	69	69	70
20-24 years	70	70	70	70	70	70	70	70	70	69	70	71
25-34 years	70	70	69	70	69	70	69	70	70	70	69	71
35-44 years	70	69	69	70	70	69	69	69	71	71	69	69
45-54 years	68	69	69	69	69	69	69	69	69	69	68	70
55-64 years	68	68	68	68	69	68	68	68	68	68	68	68
65-74 years	68	67	67	68	68	67	67	67	67	67	67	67
Weight in pounds												
20-74 years	130	167	201	218	179	170	206	228	186	233	250	203
20-24 years	135	168	207	221	183	170	211	230	192	231	245	207
35-44 years	134	168	208	226	179	170	206	238	192	243	263	209
35-44 years	130	168	202	219	184	172	211	228	194	244	258	199
45-54 years	124	167	201	214	180	171	205	225	186	230	240	205
55-64 years	122	165	199	215	174	168	205	221	168	223	242	194
65-74 years	123	160	191	203	171	163	196	208	176	217	225	186
Elbow breadth in centimeters												
20-74 years	7.0	7.2	7.5	7.5	7.2	7.2	7.5	7.5	7.2	7.6	7.6	7.3
20-24 years	6.9	7.1	7.4	7.3	7.3	7.1	7.5	7.3	7.4	7.5	7.3	7.4
25-34 years	6.9	7.1	7.5	7.4	7.1	7.2	7.4	7.4	7.2	7.6	7.5	7.3
35-44 years	7.1	7.2	7.4	7.5	7.2	7.2	7.5	7.5	7.2	7.8	7.7	7.2
45-54 years	7.2	7.2	7.5	7.5	7.2	7.2	7.5	7.6	7.1	7.6	7.8	7.3
55-64 years	7.1	7.3	7.5	7.5	7.3	7.3	7.6	7.5	7.1	7.5	7.7	7.3
65-74 years	7.2	7.3	7.5	7.5	7.2	7.3	7.5	7.5	7.2	7.7	7.6	7.3
Arm muscle diameter in millimeters												
20-74 years	80	89	98	95	85	89	99	97	86	103	97	88
20-24 years	81	89	98	94	86	89	100	96	87	101	99	88
25-34 years	82	90	99	96	85	90	98	97	88	101	101	89
35-44 years	82	90	99	97	87	91	101	96	88	107	98	88
45-54 years	79	89	99	94	86	89	100	94	86	105	92	89
55-64 years	77	89	97	94	85	89	94	94	83	101	98	89
65-74 years	76	85	94	90	83	86	94	90	84	98	89	85

[1]Weight-height index in kilogram/(meter^p), where p = 2 for men.

table XVI. Men and women with higher relative desirable weight categories, independent of obesity, on the average show higher body build values than lower relative desirable weight categories did. This observation also was evident when the average body build values of higher weight-height index categories were compared with those of lower weight-height index categories (table XVII).

Table XV. Mean body measurements of women by weight categories at selected percentile cutting points based on cross-classification of weight-height index[1] and triceps plus subscapular skinfold, by age: United States, 1971-74

Age	Less than 15th percentile, underweight and lean	≥15th-<85th percentile Average weight and medium obese	Below and above 85th percentile Overweight Not obese	Below and above 85th percentile Overweight Obese	Not overweight Obese	≥15th-<90th percentile Average weight and medium obese	Below and above 90th percentile Overweight Not obese	Below and above 90th percentile Overweight Obese	Not overweight Obese	Below and above 95th percentile Overweight Not obese	Below and above 95th percentile Overweight Obese	Not overweight Obese
						Height in inches						
20-74 years	63	64	63	63	63	64	63	63	63	63	64	63
20-24 years	64	64	64	64	64	64	64	64	63	64	64	63
25-34 years	64	64	65	64	63	64	64	64	64	64	65	64
35-44 years	63	64	64	64	63	64	64	64	64	64	65	64
45-54 years	62	64	64	63	64	64	63	63	64	63	63	64
55-64 years	62	63	63	63	63	63	63	62	62	63	63	62
65-74 years	62	63	62	62	62	62	62	62	62	62	62	62
						Weight in pounds						
20-74 years	100	131	167	187	142	135	181	201	154	205	225	172
20-24 years	102	130	168	190	145	132	188	208	156	209	238	165
25-34 years	103	130	171	193	141	133	182	206	155	208	227	173
35-44 years	102	132	168	194	141	136	188	208	153	215	228	174
45-54 years	97	132	169	185	144	137	179	199	155	207	222	177
55-64 years	96	132	164	181	139	137	179	194	152	199	223	166
65-74 years	92	131	164	179	140	136	177	190	151	196	213	169
						Elbow breadth in centimeters						
20-74 years	5.9	6.2	6.5	6.7	6.3	6.2	6.6	6.8	6.4	6.8	7.0	6.5
20-24 years	5.9	6.0	6.4	6.5	6.1	6.1	6.3	6.6	6.2	6.4	6.9	6.4
25-34 years	5.9	6.1	6.3	6.5	6.1	6.1	6.4	6.6	6.3	6.6	6.9	6.3
35-44 years	5.9	6.2	6.5	6.6	6.2	6.2	6.5	6.8	6.4	6.7	7.0	6.5
45-54 years	6.0	6.2	6.6	6.7	6.4	6.3	6.6	6.8	6.4	6.8	7.1	6.6
55-64 years	6.0	6.3	6.6	6.8	6.4	6.4	6.8	6.9	6.5	6.9	7.3	6.6
65-74 years	6.0	6.3	6.6	6.7	6.3	6.4	6.7	6.8	6.4	6.8	7.1	6.6
						Arm muscle diameter in millimeters						
20-74 years	63	68	78	79	67	69	82	82	70	87	87	74
20-24 years	62	66	77	78	65	66	79	82	68	85	87	70
25-34 years	64	67	78	78	65	68	81	81	67	86	85	71
35-44 years	64	68	78	81	67	69	83	83	70	88	87	74
45-54 years	64	69	79	80	68	70	83	82	71	89	86	77
55-64 years	62	69	78	80	67	70	82	82	71	85	88	74
65-74 years	60	69	78	79	69	71	82	82	71	88	85	73

[1]Weight-height index in kilogram/(meter^P), where p = 1.5 for women.
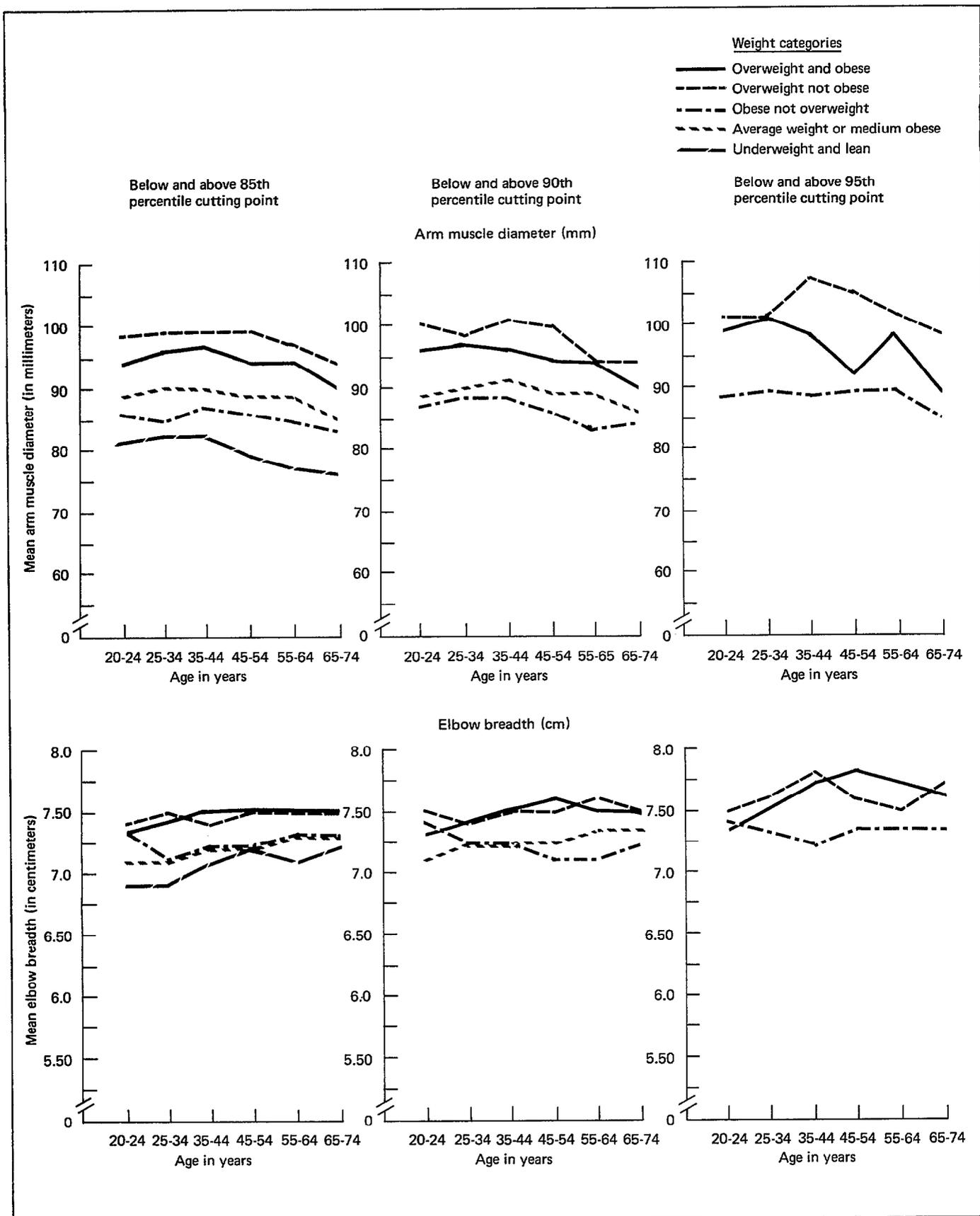
Figure VI. Mean arm muscle diameter and elbow breadth measurements of men by weight category at selected percentile cutting points based on cross-classification of triceps plus subscapular skinfold and weight-height index, by age: United States, 1971-74
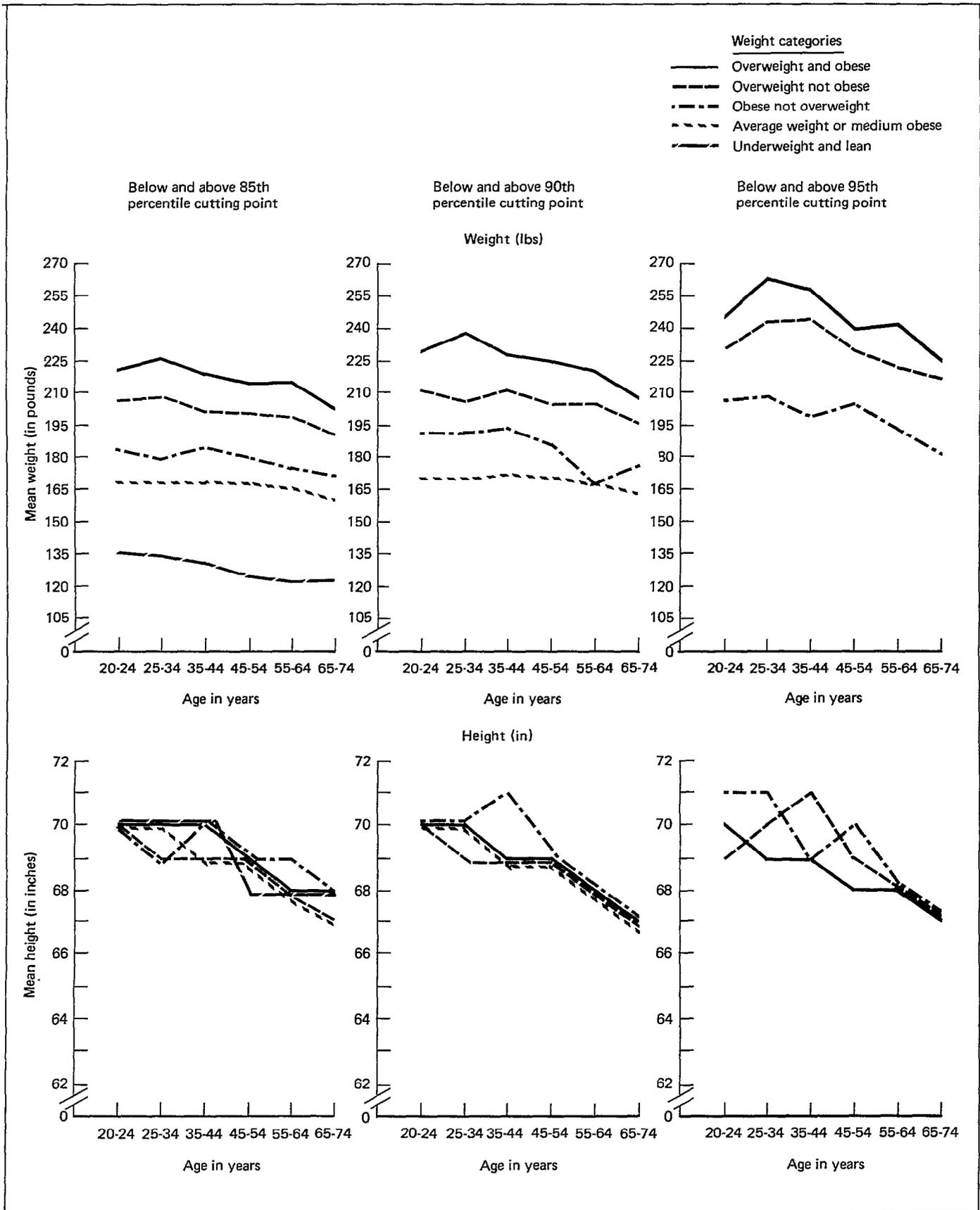
Figure VII. Mean weight and height of men by weight category at selected percentile cutting points based on cross-classification of triceps plus subscapular skinfold and weight-height index, by age: United States, 1971-74
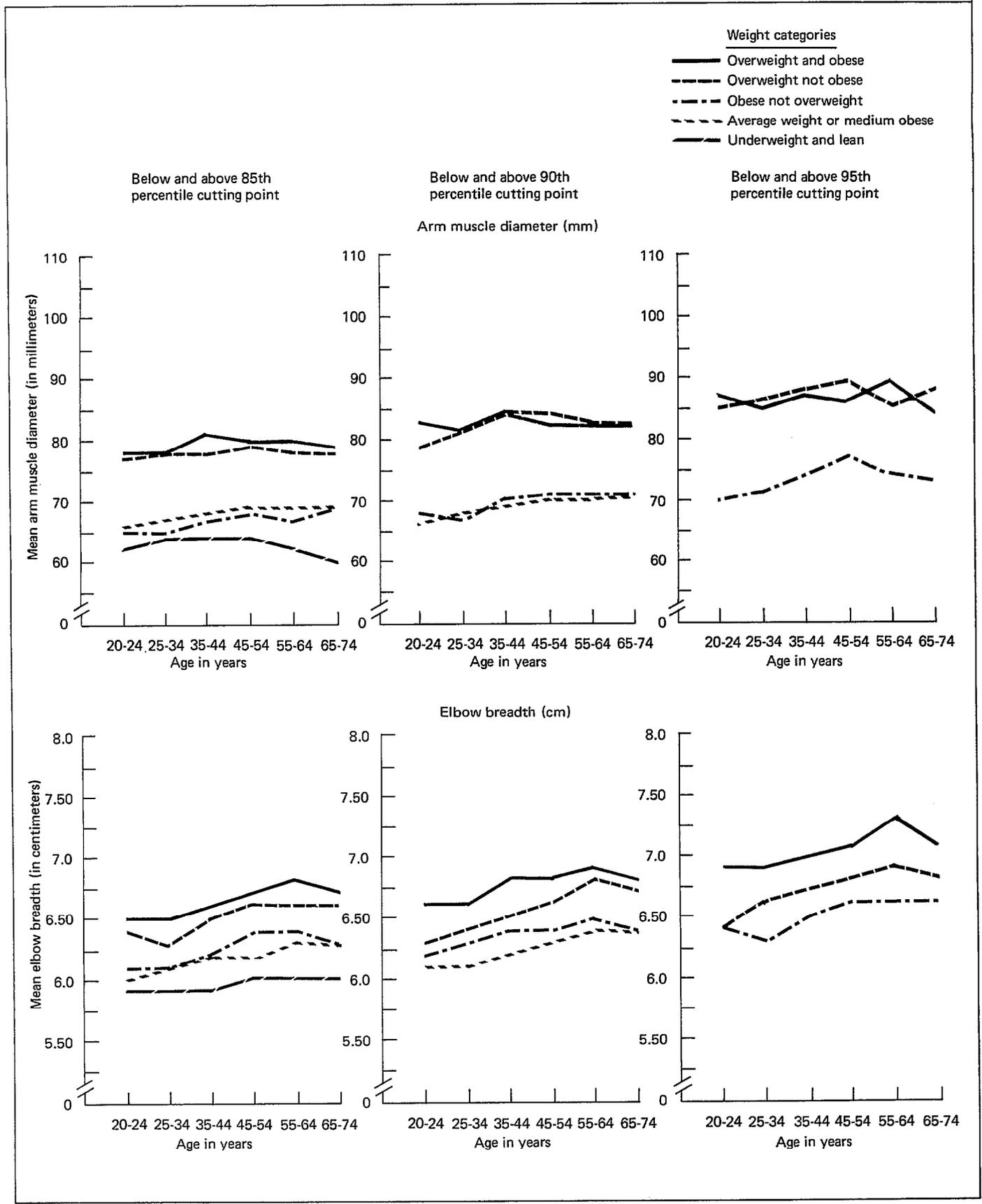
Figure VIII. Mean arm muscle diameter and elbow breadth measurements of women by weight category at selected percentile cutting points based on cross-classification of triceps plus subscapular skinfold and weight-height index, by age: United States, 1971-74

Weight categories

——————— Overweight and obese
— — — — Overweight not obese
—·—·—·— Obese not overweight
~ ~ ~ ~ Average weight or medium obese
——·——· Underweight and lean

Below and above 85th
percentile cutting point

Below and above 90th
percentile cutting point

Below and above 95th
percentile cutting point

Weight (lbs)
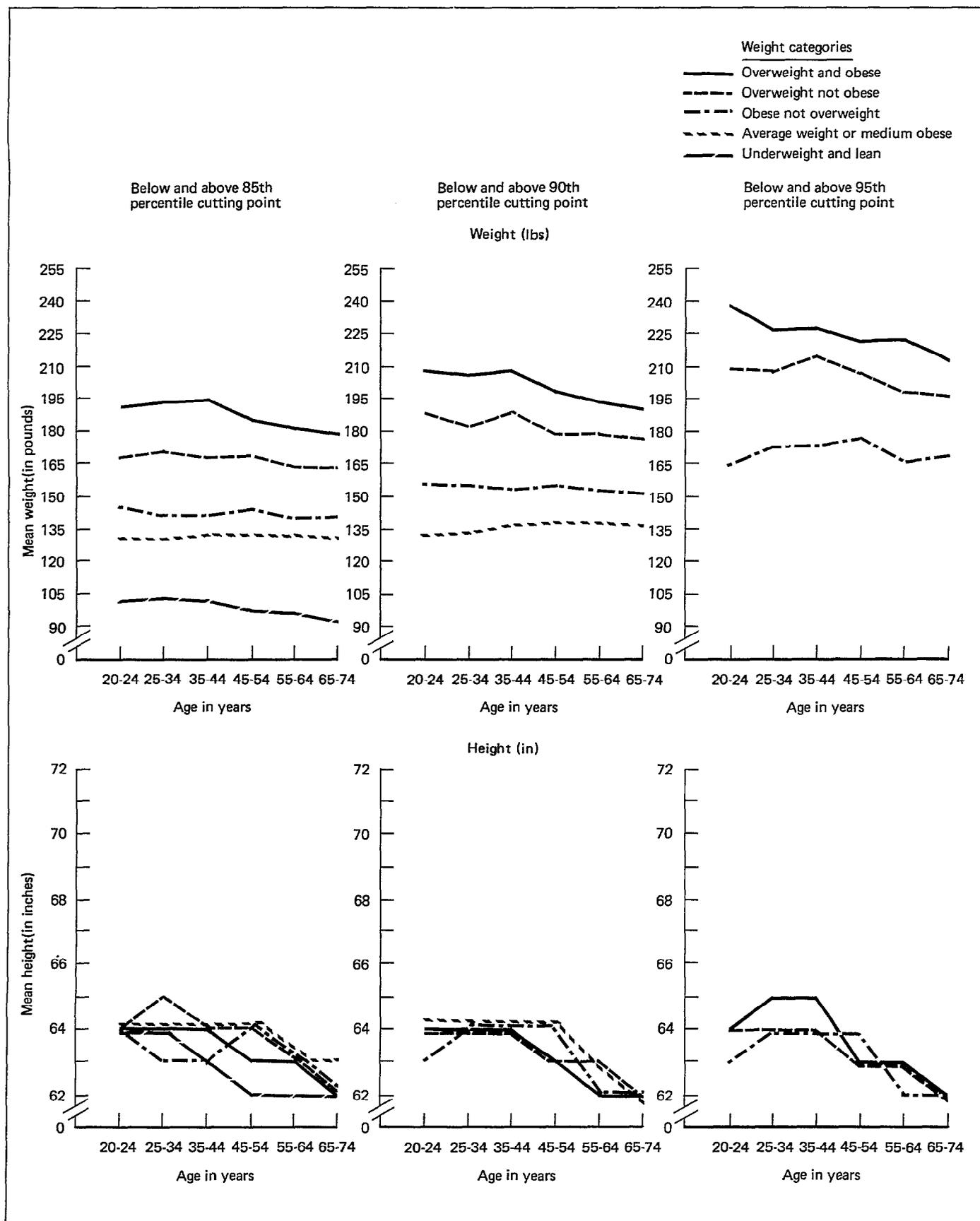
Height (in)

Figure IX. Mean weight and height of women by weight category at selected percentile cutting points based on cross-classification of triceps plus subscapular skinfold and weight-height index, by age: United States, 1971-74

Table XVI. Mean body measurements of overweight and obese men and women ages 20-74 years, by weight categories at selected percentile cutting points based on the cross-classification of triceps plus subscapular skinfold and relative desirable weight: United States, 1971-74

Weight categories at percentile cutting points	Men				Women			
	Relative desirable weight[1]	Triceps plus subscapular skinfold[2] (in milli-meters)	Arm muscle diameter (in milli-meters)	Elbow breadth (in centi-meters)	Relative desirable weight[1]	Triceps plus subscapular skinfold[2] (in milli-meters)	Arm muscle diameter (in milli-meters)	Elbow breadth (in centi-meters)
Less than the 15th percentile								
Underweight and lean	77	11	79	7.0	75	16	63	5.9
Greater than or equal to 15th — less than 85th percentile								
Average weight or medium obese	100	25	89	7.2	95	35	68	6.2
Below and above 85th percentile								
Obese not overweight	107	43	85	7.2	107	58	67	6.3
Overweight not obese	122	30	98	7.5	125	45	78	6.5
Overweight and obese	131	50	95	7.5	141	67	80	6.7
Greater than or equal to 15th — less than 90th percentile								
Average weight or medium obese	102	26	89	7.2	100	37	69	6.2
Below and above 90th percentile								
Obese not overweight	110	48	86	7.2	114	64	69	6.3
Overweight not obese	125	34	99	7.5	135	50	81	6.6
Overweight and obese	137	55	95	7.5	149	73	82	6.8
Below and above 95th percentile								
Obese not overweight	120	57	88	7.3	128	73	73	6.5
Overweight not obese	139	40	103	7.6	152	58	85	6.7
Overweight and obese	152	64	97	7.6	166	83	86	7.0

[1]Overweight—relative desirable weight is observed weight divided by desirable weight times 100, based on regression equations of weight on height for men and women ages 20-29 years.
[2]Obesity—triceps plus subscapular skinfold.

Table XVII. Mean body measurements of overweight and obese men and women ages 20-74 years, by weight categories at selected percentile cutting points based on the cross-classification of triceps plus subscapular skinfold and weight-height index: United States, 1971-74

Weight categories at percentile cutting points	Men				Women			
	Weight-height index [1]	Triceps plus subscapular skinfold[2] (in millimeters)	Arm muscle diameter (in millimeters)	Elbow breadth (in centimeters)	Weight-height index [1]	Triceps plus subscapular skinfold[2] (in millimeters)	Arm muscle diameter (in millimeters)	Elbow breadth (in centimeters)
Less than the 15th percentile								
Underweight and lean	19	11	80	7.0	22	16	63	5.9
Greater than or equal to 15th — less than 85th percentile								
Average weight or medium obese	25	25	89	7.2	29	35	68	6.2
Below and above 85th percentile								
Obese not overweight	26	43	85	7.2	32	58	67	6.3
Overweight not obese	30	31	98	7.5	37	45	78	6.5
Overweight and obese	32	50	95	7.5	42	67	79	6.7
Greater than or equal to 15th — less than 90th percentile								
Average weight or medium obese	25	27	89	7.2	30	38	69	6.2
Below and above 90th percentile								
Obese not overweight	27	48	86	7.2	34	64	70	6.4
Overweight not obese	31	34	99	7.5	40	50	82	6.6
Overweight and obese	34	55	97	7.5	44	73	82	6.8
Below and above 95th percentile								
Obese not overweight	29	57	88	7.3	38	73	74	6.5
Overweight not obese	34	40	103	7.6	46	59	87	6.8
Overweight and obese	37	64	97	7.6	49	83	87	7.0

[1]Overweight—weight-height index in kilogram/(meter^p), where p = 2 for men, and p = 1.5 for women.
[2]Obesity—triceps plus subscapular skinfold.

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