

HOW TO MEASURE YOUR % BODYFAT

**AN INSTRUCTION MANUAL FOR
MEASURING % BODY FAT
USING SKINFOLD CALIPERS**

by Wallace C. Donoghue

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INTRODUCTION

Over many years, the measurement of bodyfat content has become widely used and recommended as one of the important indicators of health and fitness. By monitoring % bodyfat and weight regularly, there are many things a person can learn about their fitness and changes in fitness as time progresses.

In order to obtain the maximum benefit from bodyfat measurement, and to ensure it is done correctly, it is important to read this book carefully. The small amount of time necessary will repay you many times over in knowledge gained on health and fitness and changes over time as a result of diet and/or exercise programs.

IMPORTANCE OF % BODYFAT AND BODY COMPOSITION

A person's body is made up of many different components. Some of the major components are bone, muscle, organs and fat. The amount or percentage of the fat component is of great interest to most of us. It is what everybody is concerned about when they think about their appearance, health, fitness and longevity.

Unfortunately, people cannot tell by simply weighing themselves and looking at a height-weight chart what their % bodyfat is or if they are over fat or under fat. Height-weight charts are based on averages, and only about 50% of the population conforms to the averages on the charts. The charts make no allowances for muscle development, and most people don't really know what their frame size is. The only way to determine the amount of fat on a person's body is by actual measurement of their % bodyfat.

In addition to determining the amount of bodyfat a person has, there are many other benefits to be obtained by monitoring % bodyfat and weight. Later, I will explain how to measure % bodyfat, but first I will explain the many uses and benefits obtained by monitoring bodyfat.

Perhaps the most important information obtained from monitoring % bodyfat is determining changes in muscle tissue over time. By knowing % bodyfat, the % of muscle, bone, organs, etc., can also be determined. For example, if a person has 20% bodyfat and weighs 135 lbs., then 27 lbs. of this is fat. Everything else, which is often referred to as the "lean mass", is 80% of this weight, or 108 lbs. Of this "lean mass", the component that can change the most is muscle tissue. Therefore, if people monitor their change in bodyfat and weight, they can also determine their change in muscle tissue. Muscle tissue can increase or decrease, depending on a person's diet, activities, exercise and lifestyle.

Unfortunately, Americans as a whole don't get enough exercise in combination with a proper diet. As a result, almost all Americans gradually lose muscle tissue as they get older. A person can actually weigh the same at age 50 as they did at age 20 and have less muscle and more fat on their body at 50 than they had at 20.

A study, by Brozek and Keys, of a large group of subjects, showed the following change in % fat with age of subjects of standard weight as per height-weight charts.

FAT	20	25	30	35	40	45	50	55
% FAT	10.3	13.4	16.2	18.6	20.7	22.5	23.9	25.0

The implication of the above chart is that a person who weighs 160 lbs. at age 20 has 16 lbs. of fat and 144 lbs. of everything else (muscle, bone, organs, etc.).

But at age 55, this same person who still weighs 160 lbs. has 40 lbs. of fat and 120 lbs. of everything else. This means that from age 20 to 55, he has lost 24 lbs. of muscle and organ tissue and gained 24 lbs. of fat. Even though he weighs the same at 55 as at 20, he is "over fat". To have the correct amount of fat for his age (19%), he should now weigh 148 lbs. However, it would have been much better if he had gotten enough exercise during his life to maintain muscle mass and tone. The reason for this loss of muscle tissue is because of inactivity and diet. The example given is for a man, but exactly the same thing happens to the typical American woman.

This muscle loss and fat gain does not happen to all Americans, farmers, laborers, etc., who get lots of exercise and eat properly, do not lose this much muscle tissue or gain this much fat.

This rate of change can be modified depending upon lifestyle. It has been shown that those who exercise regularly, along with a proper diet, do not lose muscle and/or gain fat. In fact, even at age 50 and above, it is possible to build muscle tissue back up and regain the correct balance between muscle, fat and weight. All that is necessary is the proper diet and exercise program.

It is important to note that the body composition change starts early. Compared with 18 to 20, even by age 25 the typical American has already lost some muscle and replaced it with fat. And this is just for those who maintain their correct weight. For those whose weights increases, the situation is worse because almost all of the weight increase is fat. If people monitor their % bodyfat regularly, they can detect changes in fat and muscle and take corrective action early, before the changes become serious.

Another very important use of % bodyfat measurements is to monitor the effect of diet and/or exercise on muscle tissue and fat. For example, research has shown that when a person goes on a typical fad diet, with little exercise, they lose as much or more muscle tissue than fat. (Scales will not tell a person this is happening, but measuring % bodyfat regularly will.) Then, if this person goes off the diet and gains the weight back, they gain more fat back than they lost and less muscle tissue than they lost. The result is that they have more fat and less muscle than before the down-up cycle and are worse off than before the diet. Again, measuring % bodyfat will show this, whereas scales won't.

Of course, the way to reduce properly is through lots of exercise combined with a proper, well-balanced diet. In this way, it is possible to actually gain muscle tissue while losing fat. Measuring bodyfat regularly will determine the effectiveness of the exercise-diet program being used.

There are many other things measuring % bodyfat can show. For example, a person who is much too lean, particularly women, may not realize this and scales will not tell them. There are studies which indicate it is harmful for women to drop below 10 to 12% bodyfat.

Another use for % bodyfat measurements concerns a much more common situation. This is the person who has the correct weight according to a height-weight chart, or even underweight according to these charts. They may even look reasonably fit and attractive when they look in a mirror and may think they are just fine. And yet, if they measure their bodyfat, they may find they have too much fat. Their small, underdeveloped, probably little-used muscles account for their light weight and small size. Bodyfat measurements will show them they are over fat and under-muscled, and they will realize they need to go on an exercise program with adequate protein in their diet to replace fat with muscle.

And yet, another possibility is a very strong, muscular, athletic person. They may have a weight considerably above what a height-weight chart would say they should have. If they believe the chart, they may think they have to lose weight. This person might actually be very lean, and if they were to go on a diet and lose weight, almost all the loss would be muscle tissue. Measuring % bodyfat would reveal this situation and show the person they were lean and that the extra weight was muscle, and possibly even stronger bones which have a higher density. A scale cannot give this information. Only bodyfat measurements will show this.

A typical situation that exists when someone starts on a good exercise program, combined with proper nutrition, is that they find their weight is not changing much, even after several months. They may get discouraged and give it up, thinking their new regimen is not doing them any good. However, if they measured their % bodyfat regularly, they would find they were losing fat and replacing it with muscle, which weighs more. They would realize that, in fact, their new program was benefiting them greatly. Thus, rather than becoming discouraged, they would be encouraged to continue.

These are some of the uses to which bodyfat measurements can be put. As can be seen, almost everyone can benefit in some way from monitoring bodyfat on a regular basis. It is likely there are some uses not mentioned, applicable to some individuals' specific needs.

MEASURING % BODYFAT

Now that the importance of measuring % bodyfat has been explained we come to the question of how to measure it. There are various methods, each having some advantages and disadvantages. It should be noted that no method yet developed is precise for everybody. Some of the more accurate systems have the disadvantage of requiring sophisticated and very expensive equipment along with trained operators and are thus not widely used. There are two systems that are reasonable in cost and easily used and yet give good accuracy for most people. These are skinfold calipers and bio-impedance. Of these two, skinfold calipers have the advantage of being somewhat more accurate than

bio-impedance but the disadvantage of a person not being able to measure themselves. They require that another person do the measuring and the proper technique must be used. Bio-impedance devices have the advantage that a person can measure themselves but they are not as accurate as skinfold calipers for most people.

Bio-impedance devices vary widely and the instructions for each type are included with the product and no skill is required to use them. So, this book will not give instructions for their use. However, all makes of skinfold calipers are used the same way and so instructions for their use is the same. So, this book continues with detailed instructions on their use.

HOW TO USE SKINFOLD CALIPERS

NOTE: The illustrations show the Slim Guide brand of caliper. All skinfold calipers, while different in appearance, work in a similar fashion. So, the instructions that follow apply to all brands of calipers.

A Skinfold Caliper is a device which measures the thickness of a fold of skin with its underlying layer of fat. By doing this at key locations, shown by research to be representative of the total amount of fat on the body, it is possible to estimate the total % bodyfat of a person. Skinfold Calipers have springs which exert a certain pressure on the skinfold, generally 10 gm./sq.mm., and an accurate scale which measures the thickness in millimeters.

The skinfold thickness measurements are converted to % body fat using formulas and tables. There are several tables that are in use but the most widely used is based on the Durnin and Womersly data, usually abbreviated to just Durnin. Because of the locations of these areas, people cannot measure their own bodyfat. Another person must take the measurements. It is important to locate the calipers as close as possible to the areas illustrated for each measurement. Figures 1 through 3 shows how a fold of skin is pulled out from the body, folded over, and measured with the calipers. Figures 4 through 7 show the locations of key areas for measurement for the Durnin and Womersly data.

If you are right-handed, pull the fold of skin with its underlying layer of fat with your left hand. You do not have to worry about getting any muscle, as the muscle is very firm and taut and will not come out with the skin and fat. Grasp the skin and underlying layer of fat with your fingers as shown in Figure 1, pull it out and fold it over as shown in Figure 2, and hold it with the fingers of your left hand. Then holding the calipers in your right hand, place the jaws of the caliper as shown in Figure 3. The jaws should be about 1/4 inch from the fingers of your left hand which continues to hold the fold of skin. Completely release the trigger of the caliper so the entire force of the jaws is on the skinfold. This will not be

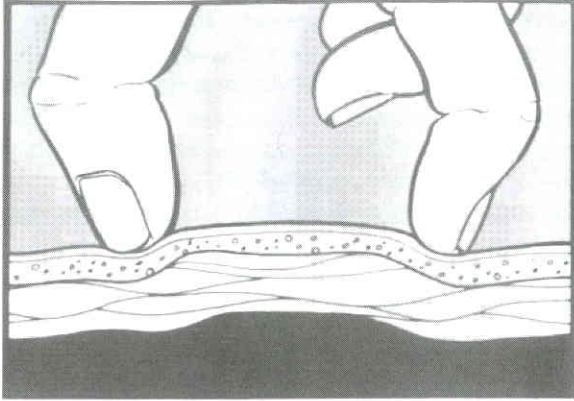


Figure 1

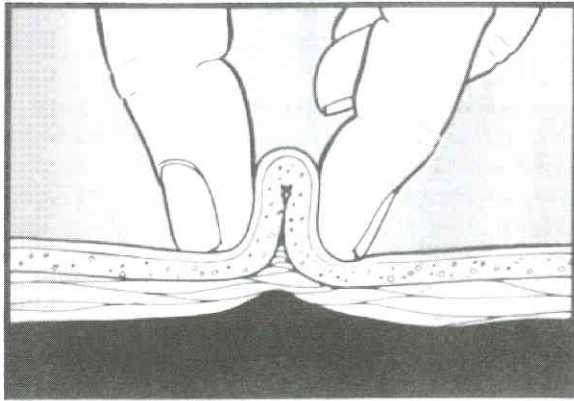


Figure 2

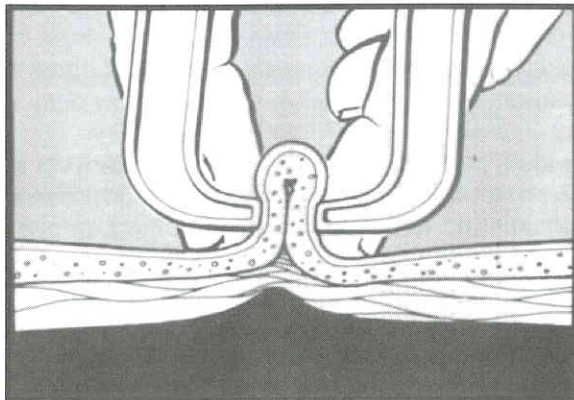


Figure 3

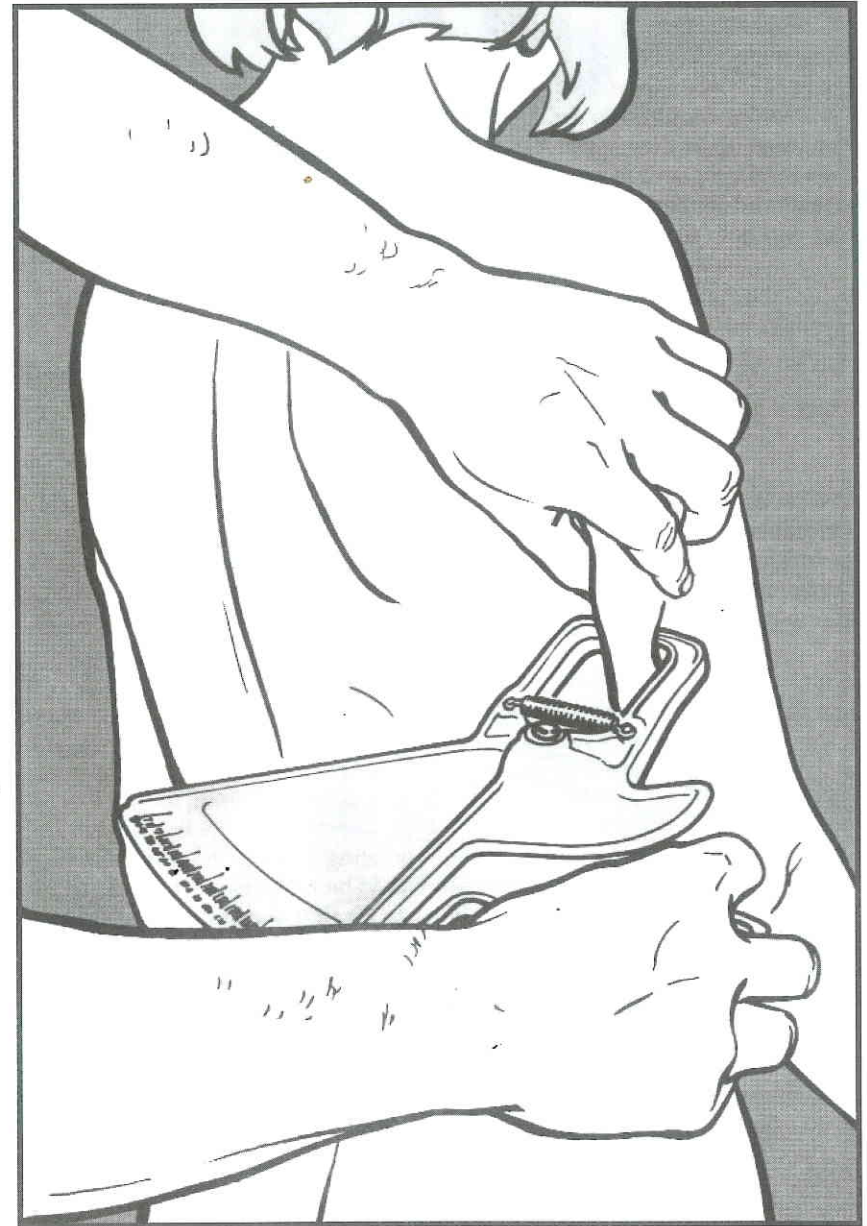


Figure 4
Taking measurements at back of upper arm.

uncomfortable to the person being measured, as the force of the jaws is not high. Do not release the fingers of the left hand while taking the readings. It is important to keep firmly holding the fold with the fingers so that the calipers are measuring just the thickness of the fold and not any of the forces required to keep it folded. The calipers will “creep” a little to a lower reading as they are first applied. After a few seconds, the creep will slow down markedly, and this is when the reading on the scale of the caliper should be read and written down. If you are left-handed, take the skin with your right hand and hold the caliper in your left hand.

Measure all four locations as shown in Figures 1 through 4 and write down the readings from the caliper scale. It makes no difference in what order the readings are taken. Then add up the four readings. The % bodyfat can then be determined from the charts starting on page 19. Men should use Chart 1 and women Chart 2.

For example, assume a 36 year old man is being measured, and the sum of the four readings is 50mm. Referring to the 30 to 39 age column on Chart 1, we would find his % bodyfat to be 21.5. Or, if a 20 year old woman were being measured, and the sum of her four measurements were 28mm, the 16 to 29 age column on Chart 2 would show her % bodyfat to be 18.6%

Note that there is not a line for every millimeter or column for every age group on the charts. To do this would make the charts too large and unwieldy. Therefore, if greater accuracy is desired, it is necessary to interpolate. For example, a woman in the 16 to 20 age group could have a sum of 29mm for the four locations. This is halfway between 28 and 30 on the chart. The % bodyfat for 28mm is 18.6% and that for 30 is 19.5%. Interpolating halfway between would give approximately 19.0%. Another example would be a 45 year old man with a sum of 42mm for the four locations. Referring to Chart 1 we find % bodyfat listings for 40 and 45mm. 42 is two-fifths of the way between 40 and 45. The bodyfat for 40mm is 21.5%, and for 45mm it is 23.1%. Two-fifths of the way from 21.5 to 23.1 is approximately 22.5%.

When interpolating for age, note that the charts are most accurate for someone whose age is in the middle of each group, so that the 30 to 39 age group will be most accurate for someone about 35 years old. For a person 29 or 30, the most accurate result will be obtained by interpolating between the two age groups. For example, a 29 year old woman with a sum of 40mm would obtain 23.4% bodyfat from the 16 to 29 chart, and 25.5% from the 30 to 39 chart. Interpolating halfway between would give a more accurate value of 24.4%.

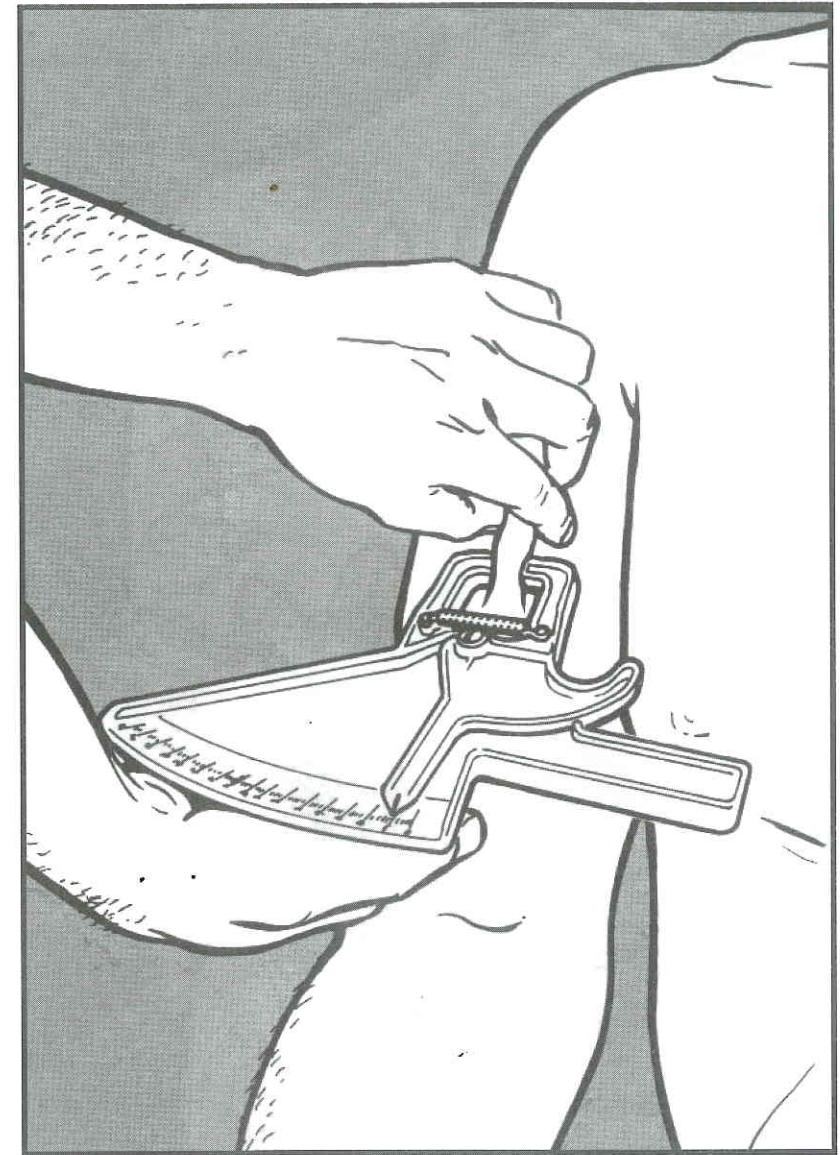


Figure 5
Taking measurement at front of upper arm.

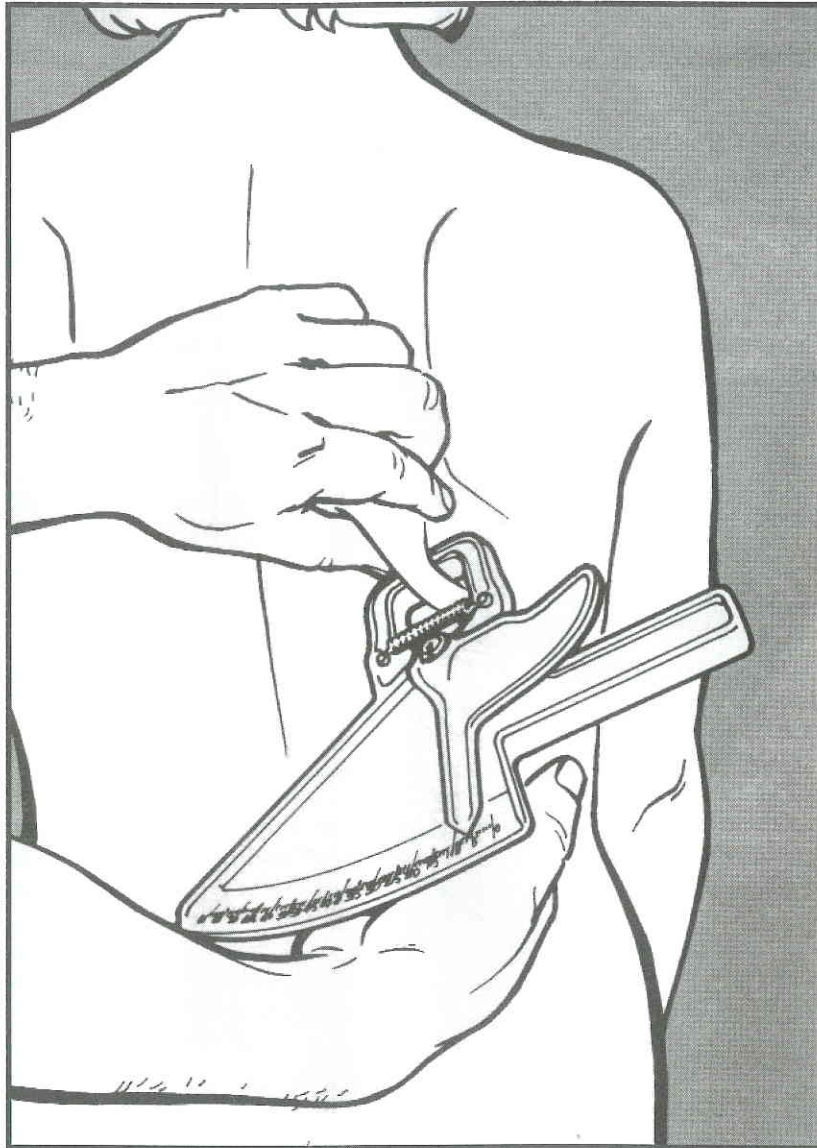


Figure 6
Taking measurement on back below shoulder blade.

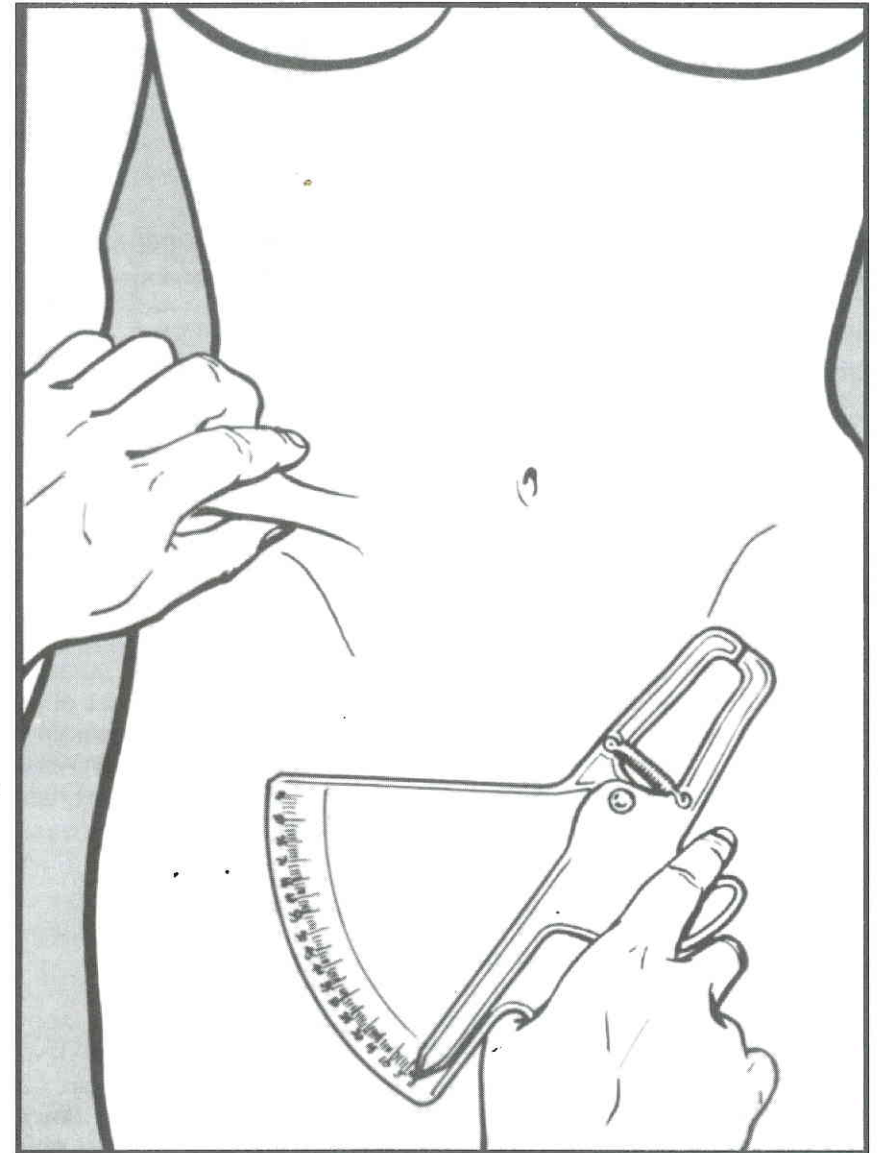


Figure 7
Taking measurement on side of waist.

A complete description of each location follows:

FIGURE 4

The back of upper arm (Triceps). This is located halfway between the shoulder and elbow joints. The fold is taken in a vertical direction directly on the center of the back of the arm.

FIGURE 5

The front of the upper arm (Biceps). This is taken exactly the same as the Triceps, Figure 1, except it is on the center of the front of the upper arm.

FIGURE 6

Back, below shoulder blade (Subscapular). This is located just below the shoulder blade. Note that the skinfold is taken at a 45° angle as shown.

FIGURE 7

Waist (Suprailiac). This is located just above the iliac crest, the protrusion of the hip bone, a little towards the front from the side of the waist. The fold is taken approximately horizontally as shown.

If time is important and a person does not want to take the time to measure all four locations, a faster but less accurate estimate of % bodyfat can be obtained by taking only one location. If only one location is used, the most accurate location is the back of the upper arm. Charts 3 and 4 show the % bodyfat obtained from measuring at one location. But it is important to remember that, while it takes more time, using all four locations is much more accurate than measuring just one.

NORMAL OR IDEAL % BODYFAT

What is the correct or ideal % bodyfat? This is perhaps the most difficult question to answer. Not all people have the same ideal % bodyfat. It varies with age, sex and heredity. One person might be better at a higher or lower bodyfat than another person of the same age and sex. And the desirable bodyfat of athletes can vary depending on the sport. For example, swimmers seem to perform better at a higher % bodyfat than runners. But, some general guidelines can be given that are applicable to most people.

For men up to about age 30, 9 to 15% is good. From age 30 to 50, 11 to 17% is a good range, and from age 50 and up, 12 to 19%. A person should try to stay at or below the upper limits given, and a person near the lower limit would be described as lean.

For women, the range up to age 30 is 14 to 21%, from 30 to 50 it is 15 to 23%, and from 50 up it is 16 to 25%. Again, it is desirable to be at or below the upper limit, and a woman near the lower limit would be lean.

The % bodyfat obtained by underwater weighing or Skinfold Calipers includes total bodyfat, not just that under the skin. In addition to fat under the skin, all people have internal fat, around organs, etc. A certain amount of fat is necessary for health and body functioning, sometimes referred to as essential fat. Many people, particularly women, try to get too lean. It is generally agreed that this is not healthy and, in many cases, can actually cause harm. Women should not try to get below the minimums given above.

It should be noted that the ranges given above are not the averages for the U.S. population, but are the desirable ranges. The actual averages for the population as a whole are much higher because of the large number of people with % bodyfat well above the upper limits of the desirable ranges.

HOW TO DETERMINE MUSCLE LOSS OR GAIN

As explained earlier, the measurement of muscle loss or gain is one of the most important uses of bodyfat measurements. It is very easy to determine and simply involves finding the weight of the "lean mass" by measuring % bodyfat and weight. Since muscle tissue is the component of the lean mass that can change the most, changes in the lean body weight are going to be caused mostly by changes in the weight of the muscles. To determine the weight of the lean mass, the person must be weighed on an accurate scale. Then the weight of the bodyfat is found by multiplying the total body weight by the % of bodyfat. This will give the total pounds of bodyfat. Subtracting this from the weight will give the weight of the lean mass. After a period of time on a diet and/or exercise program, the measurements are repeated. Any change up or down, of the weight obtained for the lean body, will represent the amount of muscle lost or gained.

For example, a man weighs 210 lbs. He measures his % bodyfat and finds it is 30%. Multiplying 210 lbs. x 30% gives 63 lbs. as the weight of this man's bodyfat. Subtracting 63 lbs. from 210 lbs shows that his lean mass weight weighs 147 lbs. After a month of regular exercise and a proper diet, his weight has dropped to 195 lbs. and his bodyfat to 25%. Multiplying 195 lbs. x 25% gives 49 lbs. as his bodyfat weight. Subtracting this from his 195 lbs body weight shows that his lean mass is 146 lbs. This shows that he has lost 1 lb. of muscle while losing 14 lbs. of fat, a very good result, and means that his diet and exercise program is working very well for him.

Reviewing the basic calculations above:

Before:	Bodyfat = 30%, 210 x .30 = 63 lbs.	Body weight = 210 lbs. 210 - 63 = 147 lbs. lean body weight
After:	Bodyfat = 25%, 195 x .25 = 49 lbs.	Body weight = 195 lbs. 195 - 49 = 146 lbs. lean body weight
Difference:	147 - 146 = 1 lb.. loss of lean body weight	

Another example could be a woman who weighs 150 lbs. and has 30% bodyfat. Multiplying her weight by her % bodyfat will show that she has 45 lbs. of bodyfat. Subtracting this from her 150 lb.. body weight shows that her lean mass is 105 lbs. After a month of a low calorie diet, she has lost 20 lbs. and is down to 130 lbs. Measuring her % bodyfat gives 27%. Again, multiplying this times her body weight of 130 lbs. and subtracting the result of 35 lbs. from her body weight shows that her lean mass has dropped to 95 lbs, a 10 lb.. loss from her previous lean mass weight of 105 lbs. Bodyfat and weight measurements, used to compute lean mass weight, have shown her that she lost as much muscle tissue as fat and that her weight-loss program is not a good one. Most likely she has not been getting enough protein in her diet.

Reviewing the basic calculations above:

Before:	Bodyfat = 30%, 150 x .30 = 45 lbs.	Body weight = 150 lbs. 150 - 45 = 105. lean body weight
After:	Bodyfat = 27%, 130 x .27 = 35 lbs.	Body weight = 130 lbs. 130 - 35 = 95 lbs. lean body weight
Difference:	105 - 95 = 10 lbs. loss of lean body weight.	

People who have lost muscle mass and replaced it with fat over the years due to inactivity can actually build this muscle back up and reduce fat at the same time. An example of this might be a 5'8" man who weighs 155 lbs. Measurement with Skinfold Calipers indicates he has 28% bodyfat. This is 43 lbs. of bodyfat and 112 lbs. of lean mass. For 4 months, on a regular basis, he does a variety of exercises including weight lifting, combined with a very sound diet with lots of protein. At the end of 4 months, he weighs 150 lbs. and his % bodyfat has

dropped to 18%. Again, multiplying his 150 lb.. body weight by his 18% bodyfat shows that his bodyfat has dropped to 27 lbs. Subtracting this from his body weight of 150 lbs. shows that his lean mass has increased to 123 lbs., a gain of 11 lbs. In other words, he has gained back 11 lbs. of the muscle he had lost over the years, and lost 16 lbs. of fat.

Reviewing the basic calculations above:

Before:	Bodyfat = 28%, 155 x .28 = 43 lbs.	Body weight = 155 lbs. 155 - 43 = 112 lbs. lean body weight
After:	Bodyfat = 18%, 150 x .18 = 27 lbs.	Body weight = 150 lbs. 150 - 27 = 123 lbs. lean body weight
Difference:	123 - 112 = 11 lbs. gain in lean weight	

HOW TO FIND A PERSON'S WEIGHT FOR A DESIRED % BODYFAT

If a person's present weight and % bodyfat are known, it is possible to determine what that person's weight should be for any desired % bodyfat. This can be done by a simple mathematical procedure. Simply subtract the present % bodyfat from 100 and divide this by 100 minus the desired % bodyfat. Multiply this by the present weight and this will give you the weight for the desired % bodyfat. For example, a 145 lb.. woman is now 32% bodyfat. She desires to be 21% and wants to know what she would weigh if she were 21 % bodyfat. Subtracting 32 from 100, she gets 68. 21 from 100 equals 79. Then, 68 divided by 79 equals 0.86. Multiply 145 lbs. x 0.86 and this will give her the desired weight of 125 lbs.

She has learned that to reduce her % bodyfat to 21%, she must lose 20 lbs. However, the above formula only works if the person reduces in such a way as to not lose muscle tissue. This can be done through adequate exercise and proper diet. If the weight is lost primarily through a low calorie diet in a short period of time, then muscle tissue will be lost, as well, and the weight for the desired % bodyfat will be correspondingly less.

Reviewing the basic calculations above:

Present % Bodyfat = 32%	Desired % Bodyfat = 21%
100 - 32 = 68	100 - 21 = 79
68 ÷ 79 = 0.86	
Desired Weight = 145 x 0.86 = 125 lbs.	

HOW TO DETERMINE FRAME SIZE

Measurements by various researchers over the past 10 to 15 years have indicated a correlation between various bone measurements and frame size; for example, wrist and ankle circumference, shoulder, elbow and knee width.

Any Skinfold Caliper with a range of 85mm or more can be used to measure the elbow width. Frame size can then be determined from the following table.

FRAME SIZE

	Small	Medium	Large
Men			
5'4" & below	less than 63mm	63-76mm	more than 76mm
5'5" to 6'1"	less than 67mm	67-8 mm	more than 81mm
6'2" & above	less than 70mm	70 - 86mm	more than 86mm
Women			
5'0" & below	less than 54mm	54 - 67mm	more than 67mm
5'1" to 5'8"	less than 56mm	56 - 70mm	more than 70mm
5'9" & above	less than 58mm	58 - 72mm	more than 72mm

The elbow width is measured by bending the elbow 45° from the straight position. This will be the position that the two round, knobby protrusions on either side of the elbow are the most prominent. Then, using the Skinfold Caliper, measure the distance across these two protrusions. This will be the elbow width. Frame size can then be determined from the above table.

It should be noted that this is not precise for 100% of the population. It is based on statistical averages of measurements taken for a very large number of people. It, therefore, will give an estimate of frame size for the majority of people.

HEIGHT / WEIGHT CHARTS

Traditionally, height/weight charts have been used to determine if a person is overweight or underweight. These have been based on frame size. One problem with these is that they make no allowance for muscle development. A secondary problem is that most people don't know which frame size they fit in. In fact, most people who are heavy in weight, according to height/weight charts, assume they have a large frame. Bodyfat measurements are far more meaning-

ful than reference to height/weight charts. However to make this book as complete as possible, a height/weight chart is included for reference.

The charts are on page 22 and are typical of traditional charts which have been used for many years. In 1943, the Metropolitan Life Insurance Company introduced their standard height/weight tables for men and women. These tables were revised in 1983 and listed as being desirable weights, to indicate persons with the lowest mortality rates. Gradually the term "ideal weight" was associated with these tables although the term was not specifically published with the tables.

USE SKINFOLD CALIPERS REGULARLY

Most people weigh themselves regularly. They are interested in their health and fitness and know that weight has an important influence. As can now be seen, however, scales tell only part of the story. Much more information can be obtained by using Skinfold Calipers in combination with a scale.

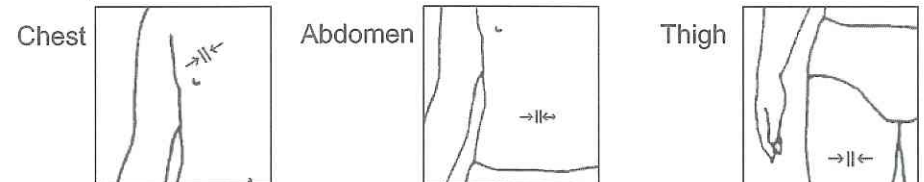
Therefore, Skinfold Calipers should be used regularly, just as scales are. By periodically checking both % bodyfat and weight, a person can monitor what is happening to their muscle and fat, and adjust their lifestyle accordingly.

NOTES ON THE FOLLOWING CHARTS

Charts 1 thru 4 on the following pages are based on the Durnin & Womersly data. This is the most widely used data and provides the most accurate results for the majority of the population.

For only relatively young, athletic people with a very low % bodyfat the Jackson Pollock data is generally considered to be a little more accurate. Men below about 12% bodyfat and women below about 15% bodyfat may prefer to use the Jackson Pollock data. The Jackson/Pollock data is found on the Creative Health Products Speed Rule Plus, a convenient slide rule device available from Creative Health Products. When using the Jackson/Pollock data the following sites should be measured and charts # 5 & 6 on page 21 used, or use the CHP Speed Rule Plus.

For Men,



For Women,

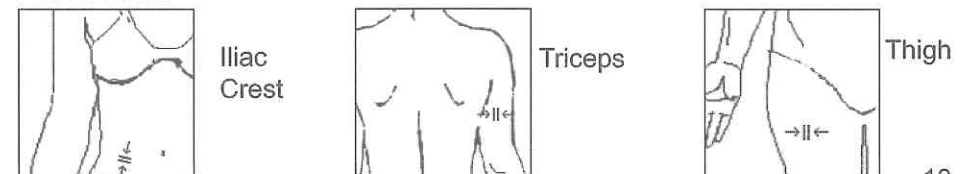


Chart # 1 - MEN
% FAT FOR MEASUREMENT AT ALL 4 LOCATIONS

SKINFOLD MEASUREMENT mm	AGE				
	16-29	30-39	40-49	50+	
16	6.7	9.3	9.5	9.7	
18	7.9	10.8	10.9	11.0	
20	8.1	12.0	12.2	12.5	
22	9.2	13.0	13.5	13.9	
24	10.2	13.9	14.6	15.1	
26	11.2	14.7	15.7	16.3	
28	12.1	15.5	16.7	17.4	
30	12.9	16.2	17.6	18.5	
35	14.7	17.8	19.7	20.8	
40	16.3	19.2	21.5	22.8	
45	17.7	20.4	23.1	24.7	
50	19.0	21.5	24.6	26.3	
55	20.2	22.5	25.9	27.8	
60	21.2	23.5	27.1	29.1	
65	22.2	24.3	28.2	30.4	
70	23.2	25.1	29.3	31.5	
75	24.0	25.9	30.2	32.6	
80	24.8	26.6	31.2	33.7	
85	25.6	27.6	32.1	34.6	
90	26.3	28.3	32.9	35.5	
95	27.0	29.0	33.8	36.5	
100	27.6	29.7	34.5	37.3	
110	28.8	30.9	35.8	38.8	
120	29.9	32.0	37.1	40.2	
130	31.0	33.0	38.2	41.5	
140	31.9	34.0	39.4	42.8	
150	32.8	34.8	40.4	45.0	
160	33.6	35.7	41.4	45.0	
170	34.4	36.5	42.3	46.0	
180	35.2	37.2	43.1	47.0	
190	35.9	37.9	43.9	47.9	
200	36.5	38.6	44.7	48.8	

These tables are based on the Durnin/Womersly data.
See figures 1 thru 4 for locations of measurements.

Chart # 2 - WOMEN
% FAT FOR MEASUREMENT AT ALL 4 LOCATIONS

SKINFOLD MEASUREMENT mm	AGE				
	16-29	30-39	40-49	50+	
14	9.4	12.7	15.6	17.0	
16	11.2	14.3	17.2	18.6	
18	12.7	15.7	18.5	20.1	
20	14.1	17.0	19.8	21.4	
22	15.4	18.1	20.9	22.6	
24	16.5	19.2	22.0	23.7	
26	17.6	20.1	22.9	24.8	
28	18.6	21.1	23.8	25.7	
30	19.5	21.9	24.6	26.6	
35	21.6	23.8	27.2	28.6	
40	23.4	25.5	28.1	30.3	
45	25.0	27.0	29.6	31.9	
50	26.5	28.3	30.9	33.2	
55	27.8	29.5	32.1	34.6	
60	29.1	30.6	33.2	35.7	
65	30.2	31.6	34.2	36.7	
70	31.2	32.6	35.1	37.7	
75	32.2	33.5	36.3	38.6	
80	33.1	34.3	37.5	39.5	
85	34.0	35.2	38.4	40.4	
90	34.8	36.0	39.1	41.1	
95	35.6	36.7	39.9	41.9	
100	36.3	38.4	40.6	42.6	
110	37.7	38.7	41.8	43.9	
120	39.0	39.9	43.0	45.1	
130	40.2	41.1	44.1	46.2	
140	41.3	42.1	45.1	47.3	
150	42.3	43.1	46.0	48.2	
160	43.2	44.0	46.9	49.1	
170	44.6	45.1	47.8	50.0	
180	45.0	45.6	48.5	50.8	
190	45.8	46.4	49.3	51.6	
200	46.6	47.1	50.0	52.3	

Chart # 3 - MEN
% FAT FOR MEASUREMENT ON BACK OF UPPER ARM

SKINFOLD MEASUREMENT mm	AGE				
	16-29	30-49	50+		
3			12.1		
4		14.4	15.7		
5		16.6	18.6		
6	10.8	18.6	20.9		
7	12.5	20.2	22.9		
8	13.9	21.5	24.6		
9	15.2	22.6	26.2		
10	16.4	23.6	27.6		
11	17.4	24.5	28.8		
12	18.4	25.3	30.0		
13	19.3	26.1	31.1		
14	20.1	26.8	32.1		
15	20.9	27.5	33.0		
16	21.6	28.1	33.9		
17	22.3	28.7	34.7		
18	22.9	29.2	35.5		
19	23.5	29.8	36.2		
20	24.1	30.3	36.9		
22	25.2	31.2	38.2		
24	26.2	32.1	39.5		
26	27.1	32.9	40.6		
28	28.0	33.6	41.6		
30	28.8	34.3	42.6		
32	29.5	34.9	43.5		
34	30.3	35.5	44.3		
36	30.9	36.1	45.2		
38	31.6	36.7	45.9		
40	32.2	37.2	46.7		
45	33.6	38.4	48.4		
50	34.8	39.4	49.9		
55	35.9	40.4	51.3		
60	37.0	41.3	52.5		
65	37.9	42.1	53.7		
70	38.8	42.9	54.8		
75	39.7	43.6	55.8		
80	40.5	44.3	56.8		

These tables are based on the Durnin/Womersly data.
See figure 1 for location of measurement.

Chart #4 - WOMEN
% FAT FOR MEASUREMENT ON BACK OF UPPER ARM

SKINFOLD MEASUREMENT mm	AGE				
	16-29	30-49	50+		
4		11.2	12.6		
5	10.8	14.0	15.8		
6	13.3	16.4	18.4		
7	15.3	18.5	20.7		
8	17.2	20.2	22.7		
9	18.8	21.8	24.5		
10	20.2	23.2	26.1		
11	21.5	24.5	27.5		
12	22.8	25.7	28.8		
13	23.9	26.8	30.1		
14	24.9	27.8	31.2		
15	25.9	28.8	32.3		
16	26.8	29.7	33.3		
17	27.7	30.5	34.2		
18	28.5	31.3	35.1		
19	29.3	32.1	36.0		
20	30.0	32.8	36.8		
22	31.4	34.1	38.3		
24	32.6	35.4	39.7		
26	33.8	36.5	41.1		
28	34.9	37.6	42.2		
30	35.9	38.6	43.3		
32	36.9	39.5	44.4		
34	37.8	40.4	45.3		
36	38.6	41.2	46.3		
38	39.4	42.0	47.2		
40	40.2	42.8	48.0		
45	42.0	44.5	50.0		
50	43.6	46.1	51.8		
55	45.0	47.5	53.4		
60	46.3	48.8	54.8		
65	47.6	50.0	56.2		
70	48.7	51.1	57.5		
75	49.8	52.2	58.7		
80	50.8	53.1	59.8		

**Chart # 5 - MEN
% FAT FOR MEASUREMENT AT 3 LOCATIONS**

SKINFOLD MEASUREMENT mm	% FAT FOR MEASUREMENT AT 3 LOCATIONS			
	AGE to-27	28- 37	38-47	48- 57
9	1.6	2.7	3.7	4.8
12	2.7	3.6	4.7	5.8
15	3.5	4.6	5.7	6.8
18	4.5	5.6	6.7	7.7
21	5.5	6.6	7.6	8.7
24	6.4	7.5	8.6	9.7
27	7.4	8.5	9.6	10.7
30	8.3	9.4	10.4	11.6
33	9.2	10.3	11.4	12.6
36	10.2	11.3	12.4	13.5
39	11.1	12.2	13.3	14.4
42	12.0	13.1	14.2	15.3
45	12.9	14.0	15.1	16.2
48	13.7	14.9	16.0	17.1
51	14.6	15.7	16.9	18.0
54	15.5	16.6	17.7	18.9
57	16.3	17.5	18.6	19.8
60	17.2	18.3	19.5	20.6
63	18.0	19.2	20.3	21.5
66	18.8	20.0	21.7	22.3
69	19.7	20.8	22.0	23.1
72	20.5	21.6	23.8	23.9
75	21.3	22.4	23.6	24.7
78	22.0	23.2	24.4	25.5
81	22.8	24.0	25.2	26.3
84	23.6	24.7	25.9	26.1
87	24.3	25.5	26.7	27.9
90	25.1	26.3	27.4	28.6
93	25.8	27.0	28.2	29.4
96	26.5	27.7	28.9	30.1
99	27.2	28.4	29.7	30.8
102	27.9	29.7	30.3	31.5
105	28.6	29.8	31.0	32.2
108	29.3	30.5	31.7	32.9

**Chart # 6 - WOMEN
% FAT FOR MEASUREMENT AT 3 LOCATIONS**

SKINFOLD MEASUREMENT mm	% FAT FOR MEASUREMENT AT 3 LOCATIONS			
	AGE to-27	28- 37	38-47	48- 57
24	12.1	12.6	13.3	13.9
27	12.1	12.7	13.2	13.9
30	13.3	13.9	14.5	15.1
33	14.4	15.0	15.6	16.2
36	15.5	16.1	16.7	17.3
39	16.5	17.1	17.8	18.4
42	17.6	18.2	18.8	19.5
45	18.7	19.3	19.9	20.5
48	19.7	20.3	20.9	21.6
51	20.7	21.3	22.0	22.6
54	21.7	22.4	23.0	23.6
57	22.7	23.4	24.0	24.6
60	23.7	24.3	25.0	25.6
63	24.7	25.3	26.0	26.6
66	25.6	26.3	26.9	27.6
69	26.6	27.2	27.9	28.5
72	27.5	28.1	28.8	29.4
75	28.4	29.0	29.7	30.3
78	29.3	29.9	30.6	31.2
81	30.2	30.7	31.5	32.1
84	31.0	31.7	32.3	33.0
87	31.9	32.5	33.2	33.8
90	32.7	33.4	34.0	34.7
93	33.5	34.2	34.8	35.5
96	34.3	35.0	35.6	36.3
99	35.1	35.7	36.4	37.1
102	35.8	36.5	37.2	37.8
105	36.6	37.2	37.9	38.6
108	37.3	38.0	38.6	39.3
111	38.0	38.7	39.3	40.0
114	38.7	39.4	40.0	40.7
117	39.4	40.0	40.7	41.4
120	40.0	40.7	41.4	42.0

These tables are based on the Jackson/Pollock data.
See page 18 for locations of measurements.

Chart # 7 Height & Weight Table For Men

Height Feet-Inches	Small Frame	Medium Frame	Large Frame
5' 2"	128-134	131-141	138-150
5' 3"	130-136	133-143	140-153
5' 4"	132-138	135-145	142-156
5' 5"	134-140	137-148	144-160
5' 6"	136-142	139-151	146-164
5' 7"	138-145	142-154	149-168
5' 8"	140-148	145-157	152-172
5' 9"	142-151	148-160	155-176
5' 10"	144-154	151-163	158-180
5' 11"	146-157	154-166	161-184
6'	149-160	157-170	164-188
6' 1"	152-164	160-174	168-192
6' 2"	155-168	164-178	172-197
6' 3"	158-172	167-182	176-202
6' 4"	162-176	171-187	181-207

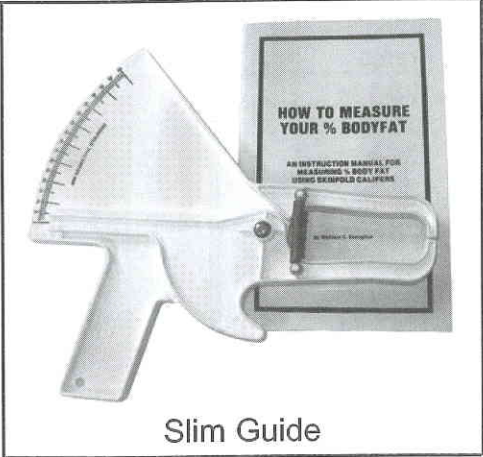
Weights at ages 25-59 based on lowest mortality. Weight in pounds according to frame (in indoor clothing weighing 5 pounds, shoes with 1" heels.)

Chart # 8 Height & Weight Table For Women

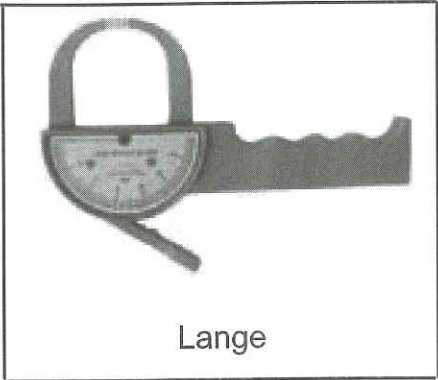
Height Feet-Inches	Small Frame	Medium Frame	Large Frame
4' 10"	102-111	109-121	118-131
4' 11"	103-113	111-123	120-134
5'	104-115	113-126	122-137
5' 1"	106-118	115-129	125-140
5' 2"	108-121	118-132	128-143
5' 3"	111-124	121-135	131-147
5' 4"	114-127	124-138	134-151
5' 5"	117-130	127-141	137-155
5' 6"	120-133	130-144	140-159
5' 7"	123-136	133-147	143-163
5' 8"	126-139	136-150	146-167
5' 9"	129-142	139-153	149-170
5' 10"	132-145	142-156	152-173
5' 11"	135-148	145-159	155-176
6'	138-151	148-162	158-179

Weights at ages 25-59 based on lowest mortality. Weight in pounds according to frame (in indoor clothing weighing 3 pounds, shoes with 1" heels.)

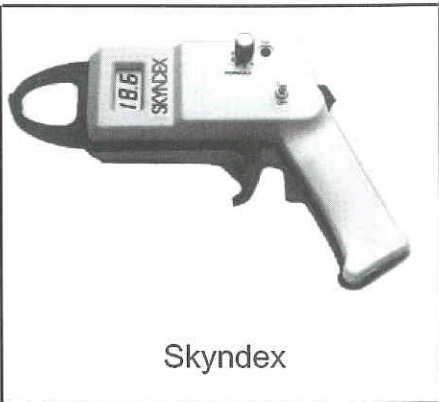
Examples of Skinfold Calipers



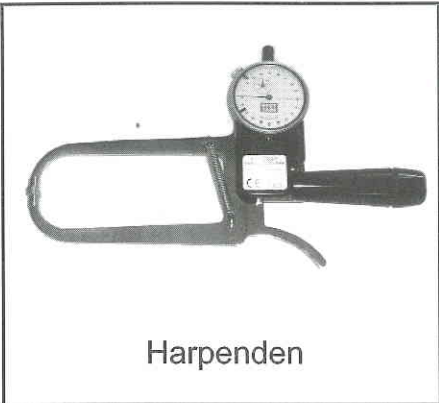
Slim Guide



Lange



Skyndex



Harpenden