



Injury Prevention: Just the Facts

Body Mass Index (BMI)

FACT SHEET 12-014-0418

What is Body Mass Index (BMI)?

Body mass index (BMI) is an easy way to estimate the relative percentage of a person's body fat (BF).¹ It is based on body mass (weight) divided by height squared and can be determined using either metric (kilograms/ meters²) or non-metric measurements (pounds/ inches² x a conversion factor of 703).¹

Although not drawn from a direct measure of body fat, BMI calculations result in fairly reliable and consistent estimates^{1,2} that are moderately to strongly correlated to more direct body fat measures, such as waist or other body circumference "tape testing", skinfolds (caliper) measures, air-displacement plethysmography ("BOD Pod"), water displacement, or "gold-standard" dual-energy x-ray absorptiometry (DEXA)).^{2,3}

What are the benefits of using BMI?

The BMI is a quick, inexpensive, and scientifically-accepted screening measurement used to assess BF among large populations.^{1,4} For example, BMI is used by the National Institutes of Health (NIH) and World Health Organization (WHO) which group BMI into four evidence-based obesity classifications¹:

- Underweight (BMI<18.5)
- Normal or 'healthy' BMI (BMI ≥18.5-24.9)
- Overweight (≥25-29.9)
- Obese (BMI≥30)

These classifications (Figure 1) apply to both men and women >20 years old and correspond to risks of developing various diseases (e.g., type-2 diabetes, heart disease, high blood pressure (hypertension), and some cancers).

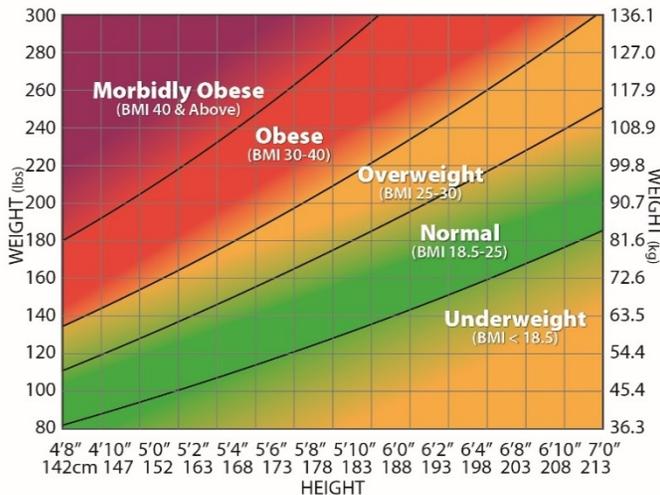


Figure 1. WHO/NIH BMI Chart for Adults

Medical and occupational communities often use BMI as an initial screening tool to identify potential at-risk individuals. Public health organizations (e.g., Centers for Disease Control and Prevention (CDC) and WHO) use BMI to evaluate obesity trends and to predict long term health impacts and death rates for the general population.¹ For example, recent U.S. epidemiological data show over two-thirds of adults are "overweight" and of these one-third are "obese."^{1,4}

What concerns are there with using BMI?

BMI is a scientifically valid means to screen individuals for potential health concerns. However, as with any screening tool it doesn't provide detailed information that might be relevant to a person's true risk.^{1,3} For example, BMI does not reflect how fat is distributed,^{1,3} so it can't be used to identify those with most fat in their waists who are at greater risk.

In addition, BMI does not account for "lean body mass (LBM)," which is the portion of a person's weight from body components other than fat, like muscles and bone. Only time-consuming and very expensive measures of BF (e.g., DEXA) can provide a measure of LBM.⁴ This may be important to some athletes.³ Since muscle weighs more than fat, a very fit muscular person and a less fit non-muscular person of the same weight and height will have same BMI. Therefore, a healthy, muscular person could have a BMI that is slightly above the "normal" range (e.g., BMI= 27.5) and not be truly "overweight".^{3,4,7} But studies have shown such athletes are a very small percentage of the overall population, and that they only slightly exceed acceptable or normal BMI standards.³ Persons with BMIs in highly overweight or obese ranges are appropriately portrayed as having a BF% that puts them at greater health risk.

How does the Army use BMI?

To reduce risk of injury, attrition, and the associated costs, the Department of Defense (DoD) requires all U.S. Service members to maintain aerobic capacity, muscular strength, muscular endurance, and optimal body composition (i.e., body fat levels).⁵ Each Service maintains procedures and standards to identify high risk persons during entry (accession) and to regularly monitor Service members to ensure compliance.

The U.S. Army standards are based on past assessments of Active Duty Soldiers.⁷ The Army uses weight-for-height standards^{6,7} (converted to the maximum BMIs in Table 1) for initial screening when determining a recruit's suitability to join, and then to routinely monitor Soldiers' fitness every 6 months.⁶ Army standards are slightly different from the WHO/NIH BMI classifications for civilians (Figure 1). For example, Army standards include a small portion of men who would be in the NIH/WHO "overweight" range (i.e., 27-27.5 BMI). This helps address the potential greater muscle mass of some Soldiers.^{3,4,7}

The Army's weight-for-height (BMI) screening standards (Table 1) are more conservative than the Army's maximum % BF standards (Table 2). The maximum %BF allows for a slightly greater amount of BF, especially for women and older ages. Age adjustments reflect evidence that %BF slightly increases with age for both sexes.^{1,7,8} Sex adjustments reflect evidence that women have more BF (10-15%) than men for the same BMI.^{1,7} Higher allowable %BF standards for women help reduce excessive weight-loss efforts among female Soldiers which might increase risk of injury and other health problems.⁷

Table 1. Army Max BMI (kg/m ²) ^{6,7}		Age	Table 2. Army Max % BF ^{6,7}	
Men	Women		Men	Women
25.9	25.0	<21	20	30
26.5	25.3	21-27	22	32
27.2	25.6	28-39	24	34
27.5	26.0	≥40	26	36

What if a Soldier exceeds the BMI standard?

The use of the Army %BF height-weight (BMI) standard is over 80% accurate for identifying excessive fatness among Soldiers.² This is extremely useful as a screening tool, but there are limitations. Therefore, if a Soldier exceeds his/her standard, a “tape test” of sex-specific site circumference measurements (men: neck and waist; women: neck, waist and hip) is obtained to determine how their fat is distributed. Only an estimated 3% of those classified as “overweight” by the Army BMI standards pass the tape test.² The vast majority of those exceeding the Army BMI standard will also exceed the tape-test measures. These Soldiers are overweight, and have excessive body fat that increases their risk of injury and illness. They are ‘flagged’ and entered into the Army Body Composition Program (ABCP). The ABCP goal is a monthly loss of 3 to 8 pounds or 1%BF, until the Soldier is within the Army BF% standards.⁶

What is the BMI status of the Active Army?

Despite mandatory fitness requirements, excessive fat (high BF%) continues to be a problem among Soldiers.^{4,8} Although the Active Duty population is generally considered more fit than the civilian population, DoD obesity trends actually parallel those within the general population.^{4,8,10,12} More than half of the Active Duty has a BMI >25 and would be classified as overweight or obese using the WHO/NIH classifications.^{4,8,10,12-13} In a recent analysis (2017 Health of the Force Report), 17% of Active Army Soldiers were classified as obese, with rates ranging from 8% to 26% at different installations.

Excessive fat results in lost work days, increased medical costs associated with illness or injury, earlier departure from service (attrition), and poor physical performance based on Army Physical Fitness Test (APFT) results.^{4,7-9} Overweight Soldiers present logistical problems when clothing and protective gear do not fit.¹⁰ Also, while only a small portion of the population, those below minimum weight standards with *very low BMI* (i.e., BMI<19) are at higher risk of injury and/or attrition than fit Soldiers with normal or moderately high BMI.¹¹ Leaders should be aware of both the high and low BMI risk groups to monitor Soldiers and enhance readiness through appropriate nutrition and exercise programs.

Should the Army care about civilian BMI?

High obesity rates in the civilian population directly impact the military’s available recruitment pool. Over one-third of young adult military applicants do not meet the Army’s body composition standards for enlistment.^{4,14} The inability to meet these standards is a leading reason applicants are determined to be non-suitable to enter any of the US military services.⁴ Also of concern, military veterans now have rates of obesity and related diseases comparable to that of the general population.¹³ Increases in weight (and thus BMI) among veterans occurs within a few years of discharge or retirement.¹³ The annual cost for treating medical conditions associated with obesity in this population has been estimated to be over a billion dollars.⁴

Key Information Sources

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How can you improve your BMI?

BMI can be a useful measure to monitor as part of a weight management or exercise plan. However, it is important not to misinterpret your BMI, especially when comparing to national civilian classification (Figure 1). Consider the following recommendations if you have:

- ▶ **BMI ≥30:** You are considered “obese,” exceed Army standards, and have high risk of disease, injury, and poor physical performance. Reduce BMI with diet and exercise.^a
- ▶ **BMI >25–30 and have failed Army standards and tape testing:** You are overweight and should improve your diet and aerobic and muscle fitness to reduce your %BF.^a
- ▶ **BMI >25–27.5 and are within Army standards and/or have passed Army tape-testing:** You are most likely at a healthy weight; maintain your fitness and LBM (muscle).^{a-d}
- ▶ **BMI <19:** You are below Army minimum weight standards and considered “underweight”. This is not generally considered healthy and is associated with higher risk of injury. Aim to increase your weight and muscle mass through proper diet and strength training.^{a,b}

^a Weight management plans should be tailored to individuals with advice from trained professionals – Army Wellness Centers (AWCs), located at various installations, provide Active Duty personnel and Army civilians free body fat assessments (using “BOD POD” technology), and professional consults for nutrition, weight management, and exercise programs

^b An athletic person with a very muscular build could have the same BMI as an overweight person with little muscle

^c Women typically carry more fat than men due to their anatomy and are expected to have greater %BF at the same BMI as men

^d Losing “fat” while on a diet and exercise program is often accompanied by an increase in muscle mass. Muscle is healthier than fat, but weighs more. It is possible to increase fitness and lose fat but end up with a higher weight/BMI. Other measures of %BF should be examined before further attempts to lose weight.

Determine your own BMI and Body Fat:

- ▶ NIH BMI calculator and civilian risk categories: https://www.nhlbi.nih.gov/health/educational/lose_wt/BM/bmicalc.htm
- ▶ Army max weight calculator: <http://www.goarmy.com/soldier-life/fitness-and-nutrition/components-of-fitness/body-composition.html>
- ▶ Army body fat calculator (*need circumference of neck, waist, hip*): <http://www.armyprt.com/apft/online-apft-and-body-fat-calculator.shtml>
- ▶ Army Wellness Centers (AWCs): <https://phc.amedd.army.mil/topics/healthyliving/al/Pages/ArmyWellnessCenters.aspx>