Army Body Fat Assessment

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The United States Army has a weight problem. The combined military services have an average of 7.8 percent of members who are obese or overweight (Tilghman, 2016); over 2 percent lower than the Army average of 10 percent of overweight Soldiers (Phippen, 2016). Is the issue that Soldiers are exceeding the body fat standards set forth by the Army, or is the issue the method the Army uses to calculate a Soldiers body fat? The present technique used by the Army is simple but rudimentary. Even though the current Army method used to assess a Soldier's body fat uses minimal equipment and is low-cost, the Army should adopt using bioelectrical impedance because the present method does not take a person's body structure into consideration, it is inaccurate and leaves too much room for human error.

Current Army Body Fat Assessment Method

Army Regulation 600-9, The Army Body Composition Program, outlines the procedures for assessing Soldiers' body fat. This regulation dictates the maximum weight a Soldier is allowed to weigh based on their height and age. If a Soldier is over the maximum weight allowed for their height, then they undergo circumference measurements or are "taped." The regulation states a Soldier will be taped at certain landmarks on the body by a minimum of two trained individuals or "measurers"; the landmarks are different for each gender (Headquarters, Department of the Army, 2013). The Soldier's landmarks are each measured three times and then averaged.

The individuals conducting the assessment perform a calculation, that is different for males and females, which outputs a circumference value. A chart is used to determine the Soldier's body fat based on the calculated circumference value and the Soldier's height and then

compared to the allowable percentage body fat for their age and gender. The regulation does not outline specific training to certify the measurer to conduct the assessment.

Circumference Measurement for Males

The landmarks used for circumference measurement on male Soldiers are the neck and abdomen. While the Soldier is looking straight forward with shoulders not hunched, the measurer positions the tape measure on the neck just below the larynx, or Adam's apple, and perpendicular to the long axis of the neck (Headquarters, Department of the Army, 2013). The measurer will ensure the trapezius muscles are not involved in the measurement, and the tape measure is parallel to the floor (Headquarters, Department of the Army, 2013).

Next, the measurer measures the Soldier's abdomen by placing the tape measure around his stomach at the navel with the tape measure parallel to the ground while the Soldier is at a normal, relaxed exhalation and his hands are at his sides (Headquarters, Department of the Army, 2013). The measurer then conducts this sequence three times to calculate the circumference value to determine the Soldier's body fat percentage.

The circumference value is calculated by taking the abdomen measurement and subtracting the neck measurement. This value is then compared to the individual's height measurement on the percent fat estimates chart in the regulation (Headquarters, Department of the Army, 2013). The process for females is similar using different landmarks.

Circumference Measurements for Females

The landmarks used for circumference measurement on female Soldiers are the neck, waist, and hips. The procedure for conducting the neck measurement for females is the same as for males. The measurer measures the Soldier's waist at the natural waist circumference, at the narrowest point of the abdomen, halfway between the navel and the end of the sternum

(Headquarters, Department of the Army, 2013). If the measurer cannot visually determine the narrowest point of the abdomen, they will take several measurements at probable sites and record the smallest value (Headquarters, Department of the Army, 2013). The measurer takes the waist measurement with the Soldier's arms at their sides.

The measurer measures the hips by placing the tape measure around the Soldier's hips parallel to the ground, at the point of greatest protrusion of the buttocks (Headquarters, Department of the Army, 2013). The measurer must ensure they pull the tape measure tight to account for the Soldier wearing physical fitness uniform shorts but must not pull too taught as to compress the underlying soft tissue (Headquarters, Department of the Army, 2013).

The circumference value is calculated by subtracting the neck measurement from the sum of the waist and hip measurement. This value is then compared to the individual's height measurement on the percent fat estimates chart in the regulation (Headquarters, Department of the Army, 2013).

Sister Service Methods for Body Fat Assessment

Each branch of the military has regulations and standards for height, weight, and allowable body fat percentage. The Air Force, Marines, and Navy also use the circumference taping method; however, each branch varies slightly from the Army regulation.

Air Force

The Air Force uses one circumference measurement for both males and females; the abdominal circumference. The abdomen landmark used by the Air Force is directly above the right uppermost hip bone at the side of the body (Secretary of the Air Force, 2015). The measurer will ensure the tape measure is placed against the skin, parallel to the floor while the Airman stands on a flat surface with their feet no more than shoulder-width apart, looking

directly forward with the chin parallel to the floor (Secretary of the Air Force, 2015). If an Airman is not in compliance with the abdominal circumference standard of 39 inches for males and 35.5 inches for females, they will undergo a body mass index (BMI) screening. If the Airman fails the BMI screening, then they receive a Body Fat Assessment (BFA) (Secretary of the Air Force, 2015).

The Air Force BFA is the same as the Army body fat assessment. The measurer measures females at three landmarks; the neck, waist, and buttocks. The measurer measures males at two landmarks; the neck and abdomen at the navel. A Fitness Assessment Cell (FAC) Manager or FAC Augmentee must conduct the BFA.

Marine Corps

The Marine Corps' body fat assessment, called a body composition evaluation (BCE), is identical to the Army standard. The measurer measures males at the neck and abdomen and females at the neck, waist, and abdomen (Commandant of the Marine Corps, 2016). The measurer then calculates the measurements to obtain a circumference value which corresponds to the Marine's body fat percentage. Only certified force fitness instructor (FFI) and/or command physical training representative (CPTR) can conduct the BCE (Commandant of the Marine Corps, 2016).

Navy

The Navy's body fat assessment follows similar protocols as the Air Force. The measurer measures Sailors at a single point, the abdomen, for both males and females. If the Sailor exceeds the standard for the abdomen measurement, they then require a Body Composition Assessment (BCA).

The Navy BCA is the same as the Army body fat assessment. The measurer measures females at three landmarks; the neck, waist, and buttocks. The measurer measures males at two landmarks; the neck and abdomen at the navel. Only a certified Command Fitness Leader (CFL) or a trained Assistant CFL can conduct the BCA.

Inaccuracy of the Current Method

The use of the circumference method yields a higher body fat percentage compared to other methods of body fat measurement. According to a study conducted by Babcock, McCarroll, Kirby, and Devor (2003), the circumference method predicts a higher body fat percentage; therefore, the Army categorized a greater number of Soldiers as non-compliant with body composition standards. The authors suggested using caution when evaluating soldiers with the taping method due to potential misclassifications of not being within tolerance of body fat standards. The inaccuracy of the circumference method is in part due to human error but also how the regulation states find the body fat percentage is calculated.

To assess a Soldiers body fat percentage, calculations are made from the measurements taken, which corresponds to a circumference value. There is a chart in each service's regulation which lists all the possible circumference values on the left of the chart and the height measurements in inches across the top. A Soldier's body fat percentage is found by locating where the Soldiers' height and circumference value intersect on the chart. For males, the measurer calculates the circumference value by subtracting the neck measurement from the abdomen measurement (Headquarters, Department of the Army, 2013). For females, the measurer calculates the circumference value by adding the waist and hip measurement together, then subtracting the neck measurement from that total (Headquarters, Department of the Army, 2013). This method does not take into consideration the structure or build of a person's body.

When examining how the circumference value of a male is found, there is a direct correlation between neck size and abdomen size. Therefore, a male can have a large abdomen if they have a large neck; which does not necessarily mean the male Soldier is fit or has a lower body fat percentage. If a male Soldier is overweight and has a big stomach, they need only to ensure they workout their neck muscles to increase their neck size to be below their authorized body fat for their age.

For females, the current method makes it very difficult to get an accurate body fat determination with the landmarks used. Females generally have smaller necks and wider hips so when adding the waist measurement to the hip measurement, then subtracting the neck measurement to determine the circumference value, it leaves females at a disadvantage. If a female has a small neck and wide hips, it does not necessarily mean the Soldier is not fit or has a higher body fat percentage, but the current method will list the female Soldier as exceeding their authorized body fat percentage.

The Marine Corps, Navy and Air Force regulations state a certified individual or Service Member must conduct the body fat assessment. The Army, however, has no such stipulation. The Army Body Composition Program regulation only states a "designated unit fitness training [noncommissioned officer] or master fitness trainer will…train other command designated [noncommissioned officers] in proper height, weight, and body circumference methodology to assess body fat composition" (Headquarters, Department of the Army, 2013, p. 3). There is no certification process or standardized course or training an individual must attend before conducting a body fat assessment in the Army. The lack of certification and training leads to inaccuracy of measurements and varied interpretations of The Army Body Composition regulation.

Advantages of the Current Method

All branches of the military use the circumference taping method to measure a service member's body fat percentage. This method is very simple and requires few personnel, little equipment, and can be conducted in almost any location. All military regulations state a minimum of two personnel are needed to conduct the assessment and the only required equipment is a tape measure. The circumference taping method is an expedient and low-cost method that has been used for decades with few changes.

Bioelectrical Impedance

Bioelectrical Impedance Analysis, or Bioimpedance Analysis (BIA), is a method of assessing your body composition and the measurement of body fat in relation to lean body mass. BIA is a non-invasive test that involves the placement of electrodes in or on the person's hands and feet and sends an electrical current through the body (Sergi, De Rui, Stubbs, Veronese, & Manzato, 2016). The BIA device measures how the electrical current is impeded through different types of tissue. Tissues, such as blood, that contain large amounts of fluid and electrolytes have higher conductivity, but fat and bone slow the signal down the electrical signal (Sergi, De Rui, Stubbs, Veronese, & Manzato, 2016). As BIA measures the resistance of the current flow as it passes through the body, it provides estimates of body water from which body fat is calculated using selected equations (Sergi, De Rui, Stubbs, Veronese, & Manzato, 2016). According to Sergi, De Rui, Stubs, Veronese and Manzato (2016), BIA is an effective method for assessing body composition.

Several scientific tests have been conducted to validate the results of BIA testing. In 2015, Rosen et al. compared the results of BIA testing to dual energy X-ray absorptiometry (DXA). DXA is considered the "gold standard" of measuring body composition but is not a

feasible method for the military due to the high cost and repeated exposed to radiation to meet the biannual body composition requirement. Rosen et al. tested 101 male and female participants who completed a 12 hour fast, had not consumed alcohol for 24 hours, and had not exercised for 36 hours before testing. The authors determined "the eight tactile point bioelectrical impedance body composition analyzer presents a compact, portable body style that has the ability to be used on a wider variety of body types than the gold standard dual-energy x-ray absorptiometry (DXA)" (Rosen, et al., 2015, p. 237). Additionally, the authors stated the results provided validity for the BIA for to assess body fat percentage compared to DXA.

Miller, Chambers, Burns, & Godard also conducted a study comparing BIA and DXA testing in 2016. They studied 96 physically active individuals who underwent a 12 hour fast, had not conducted any physical activity for at least 12 hours, and had not consumed alcohol 24 hours before testing. The authors concluded BIA testing is cost effective, has the capability to be used on a variety of populations, and is a valid method to determine body fat percentage compared to DXA (Miller, Chambers, Burns, & Godard, 2016).

The validity of BIA testing was also compared to the Bod Pod, which uses air displacement plethysmography, for determining body composition. Johnson, Luedtke, & Romeo (2016), studied 66 university students who were tested on both the BIA and Bod Pos and refrained from exercise, eating, and drinking two hours prior to testing. The authors determined BIA testing to be an accurate method to assess body composition when compared with the Bod Pod and BIA to be more efficient when testing large numbers of individuals (Johnson, Luedtke, & Romeo, 2016).

Lastly, a study was conducted by Biaggi et al. in 1999 that compared BIA, hydrostatic weighing, and the Bod Pod. A sample consisting of 23 healthy men and 24 health women were

tested. Individuals were excluded if they had a history of heart disease, chronic obstructive pulmonary disease, or were pregnant (Biaggi, et al., 1999). All volunteers fasted, did not exercise, and consumed no alcohol for 12 hours prior. Biaggi et al. concluded the body fat percentage from the Bod Pod was not significantly different from hydrostatic or BIA and there was a significant correlation from the Bod Pod to both hydrostatic weighing and BIA. The authors stated, "there was no method-by-sex effect of the 3 methods of body-composition measurement" (Biaggi, et al., 1999, p. 900). However, there are limitations to BIA testing.

Disadvantages of BIA

According to Sergi, De Rui, Stubbs, Veronese, & Manzato "the reliability of BIA is dependent on several factors, such as the instrument itself, including electrodes, operator, subject, and environment" (2016, p. 591). The authors also indicate the physiological variations that accompany the female menstrual cycle can influence the output of BIA testing (Sergi, De Rui, Stubbs, Veronese, & Manzato, 2016). Additionally, the cost of the BIA machines is higher that the equipment used for the current method. On average, a BIA machine can cost upwards of $3,000.

Conclusion

The circumference taping method used by all branches of the military is not accurate. While the cost of a more exact device could be a hinderance, it would be more beneficial to the Soldiers. There are advantages and disadvantage to both the current method and the use of BIA; however, studies show that BIA is more accurate and compares other more expensive methods that are considered the "gold standard" of body composition testing. Even though the current system uses minimal equipment and is low-cost, the Army should adopt using bioelectrical impedance because it is more precise.

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