

Importance of Anthropometric Measurement

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Introduction

- Anthropometric measurements are **noninvasive** quantitative measurements of the body, provides a **valuable assessment** of **nutritional status** in children and adults.

- In pediatric populations, it is an essential tool to detect **Metabolic and Developmental abnormalities**

- In adults can be used to diagnose the **severity of illnesses such as Obesity and Cognitive impairments**

- Body measurements can help assess health and dietary status and future **Disease risk** in adults.

- These measurements can also determine **adult body composition to** help determine underlying **Nutritional status** and diagnose obesity.

- The core elements of anthropometry are:
- **Height**,
- **Weight**,
- **Head circumference**,
- **body mass index** (BMI),
- **Body circumferences** to assess for adiposity (Waist, Hip, and Limbs),
- and **Skinfold thickness**.

Anthropometric measurements can also assess body composition in Athletes;

also used to assess the Nutritional status of pregnant women and to assess patients with Obesity.

Indications

Anthropometric measurements are recommended at each visit to determine nutritional status and risk of future disease

Contraindications

*Anthropometric measurements are **Noninvasive** and, as such, do not have any contraindications for their use.*

Obesity

- *Obesity is one of the most serious health problems in most countries .*

- *Obesity and adiposity increase the risk of serious and common diseases, such as cancer, HTN, sleep apnea, DM, metabolic abnormalities, and CVD, and can lead to disability and premature death .*

- *Therefore , obesity is a matter of health and serious diseases worldwide*

Indicators or Indices of Obesity

There are two methods :

1:Anthropometric indices, such as body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR), and waist-to hip ratio (WHR), can be determined by simple measurements

2:Body composition indices, such as body fat mass and lean mass, percent fat mas, and trunk fat mass (TFM), can be determined by dual X-ray absorptiometry (DXA), MRI , and bioelectrical impedance (BIA).

BMI

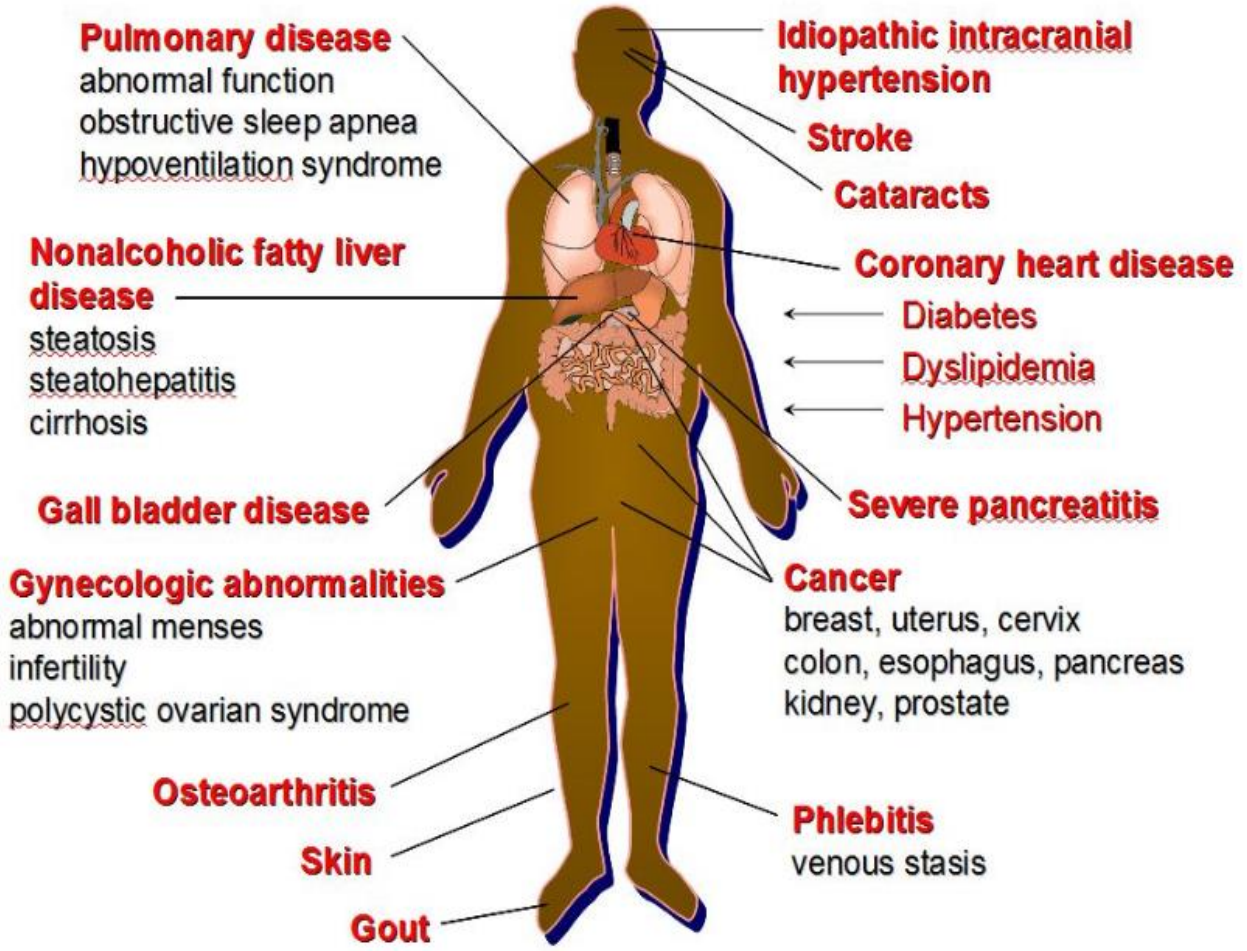
- BMI = weight in kilograms / [height in meters x height in meters]
- In adults, BMI is used to diagnose obesity as it correlates with body fat.

- However, it **does not directly measure body fat** and has limitations when used in isolation.

Categories Ranges Of BMI

- For adults with 20 years of age and older, BMI categories ranges are
- underweight (BMI<18.5 kg/m2),
- normal weight (18.5 to <24 kg/m2) ,
- overweight (24 to < 28 kg/m2),
- and obesity (≥28 kg/m2)

Medical Complications of Obesity



BMI Importance In Metabolic Syn.

Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD),Affecting 30% of the global population resulting complex interactions with various **cardiometabolic** and **environmental** Risk factors.

Hepatic steatosis with at least one cardiometabolic RF, the presence of steatohepatitis is now termed (MASH)

MASLD/ MASH is rapidly increasing and contributes to **liver** and **Cardiovascular** complication , approximately 30% of patients with MASLD have MASH

Limitations of BMI

- *BMI doesn't differentiate between **lean body mass** (the weight of everything in your body except fat) and **fat mass**.*
- *The same BMI chart is used for **males** and **females** even though adult females typically have more body fat than adult males.*
- ***Not adjusted for increasing average adult height over the years***

BMI less than 18.5 (underweight)

Higher risk for developing the following conditions:

- **Malnutrition**
- **Anemia**
- **Weakened immune system,**
- **Osteoporosis**
- **Infertility**

Percent body fat

*Percent body fat **varies** with **age, gender, and ethnicity**.*

PBF increases with age even if the weight stays the same, making it a less accurate measure of obesity in adults.

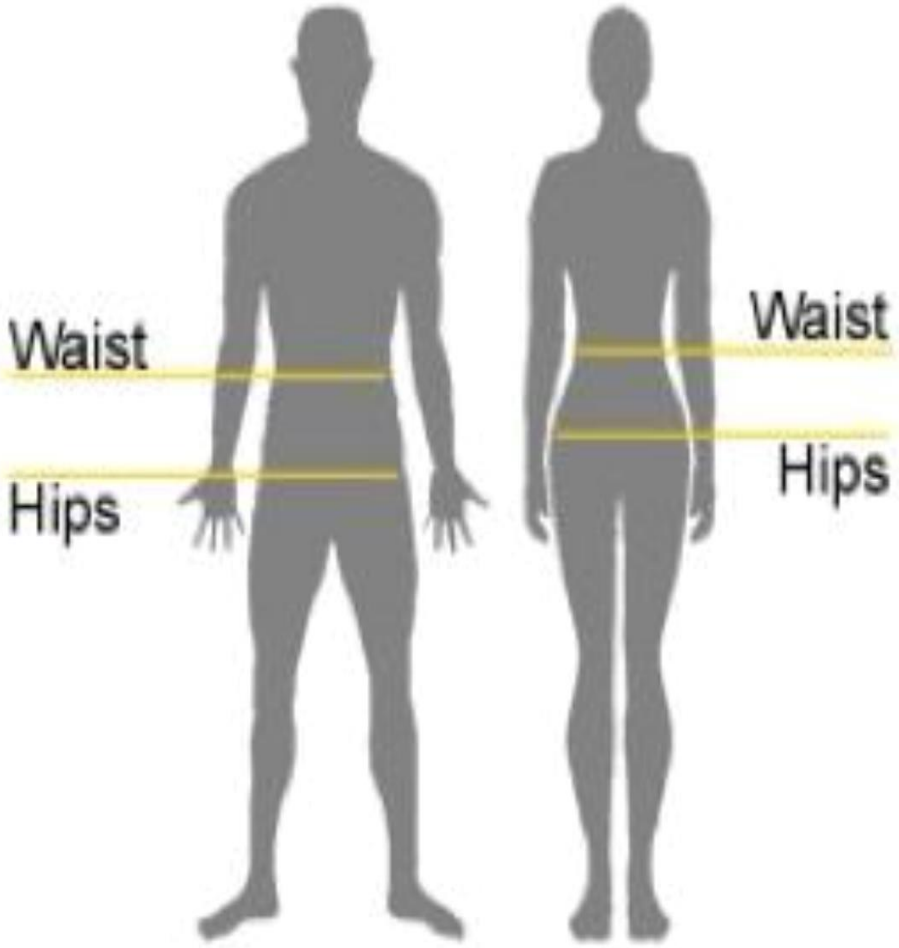
*Also, in **Athletes,** increased muscle mass for a given height and age increases their BMI, even though they have a low percentage of Total body fat.*

Waist Circumference

*The measuring tape should be placed snugly around the **lateral aspect** of each **ilium** at the **mid-axillary line**.*

*It is an essential measure of anthropometry in adults and children as it directly measures **Central Adiposity***

Measuring Waist Circumference



Measure the narrowest section of the torso, or at the mid point between the top of the hipbones and below the lowest palpable rib.

A Waist Measurement of
>102cm for males
>88 cm women

Is associated with an increased risk of Type 2 Diabetes and Cardiovascular Disease.



Waist-to-Height Ratio

(WSR: waist-to-stature ratio)

Is a measure of the **distribution of Body Fat.**

Higher values of WHtR indicate higher risk of obesity-related **Cardiovascular Diseases**, which are correlated with **abdominal obesity**.

A waist size less than half the height helps to stave off serious health problems.

*According to **World Health Organization** guidance, the waist circumference is usually measured **midway** between the **lower rib** and the **iliac crest**.*

Waist-to-Height Ratio

*"it is a proxy for harmful **central adiposity**"; it predicts obesity-related CVD .*

*A boundary value of 0.5 was proposed to indicate increased risk . A WHtR of over **0.5** is critical and signifies an increased risk.*

*WHtR may be **advantageous** because **it avoids** the need for age-, sex- and ethnic-specific boundary values".*

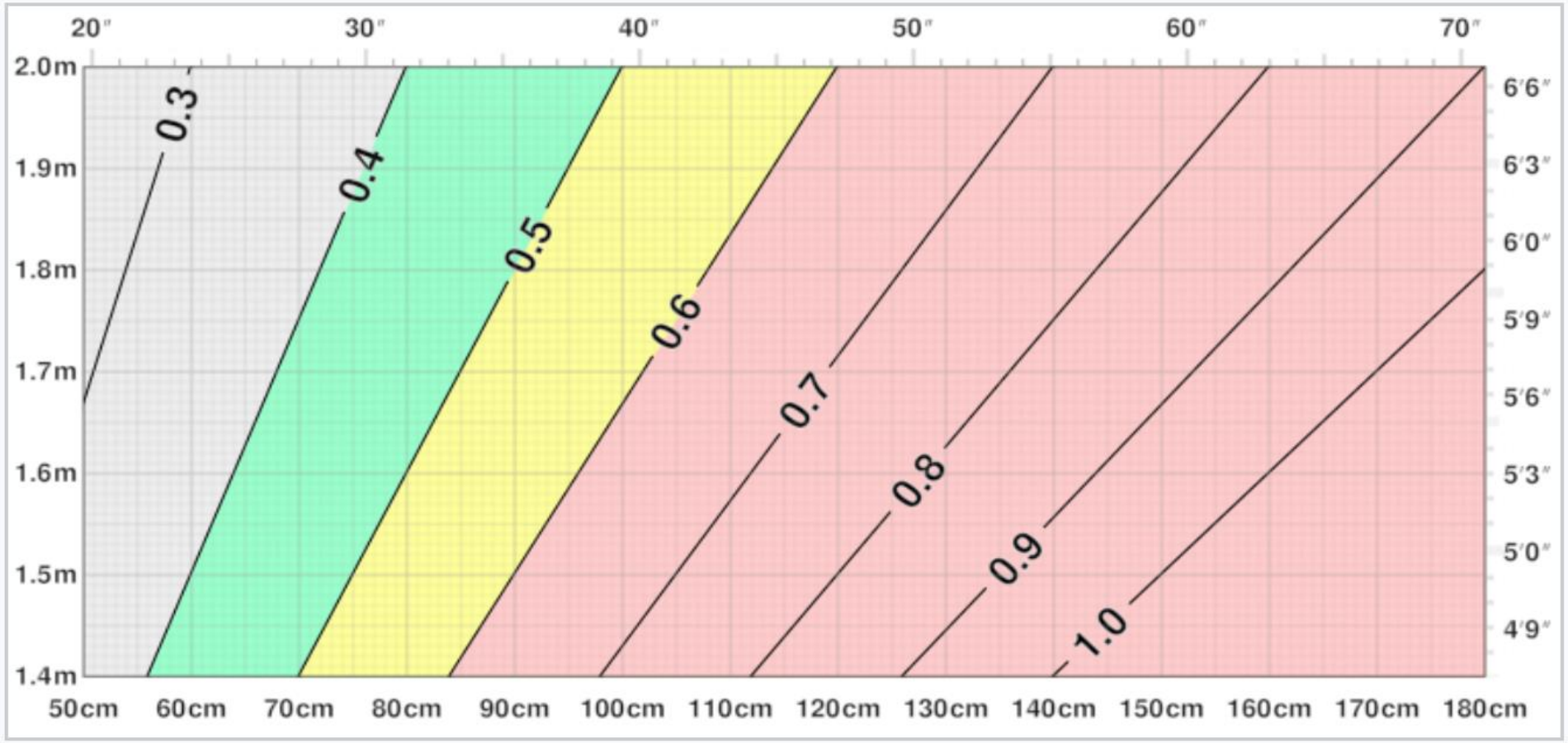
Calculation [edit]

$$\mathrm{WHtR} = \frac{\text{waist circumference}}{\text{height}}$$

e.g. 1: $\frac{72\ \text{cm}}{160\ \text{cm}} = 0.45$

e.g. 2: $\frac{28\ \text{in}}{5\ \text{ft}\ 3\ \text{in}} = \frac{28\ \text{in}}{63\ \text{in}} = 0.44$

WHtR	central adiposity	health risks	action?
0.6 or more	high	further increased	Take Action
0.5 to 0.59	increased	increased	Take Care
0.4 to 0.49	healthy	not increased	no, OK



vertical axis: height

horizontal axis: waist circumference

colours: NICE risk level

lines: Waist-to-height-ratio

Although numerous studies have been performed to examine the association of obesity and adiposity with CVD and metabolic RF in public health , few studies have compared anthropometric and body composition indices to identify CVD and metabolic RF

Kiel Obesity Prevention Study

For example, Bosy-Westphal et al. compared the value of percent **body fat mass, BMI, WC** , and **WHtR** in predicting metabolic RF based on data from 355 adults from the Kiel Obesity Prevention Study.

Kiel Obesity Prevention Study

They argued that **Body Fat Mass** has **No Benefits** in identifying **Metabolic RF** compared with BMI and WC because the magnitude of the association of WHtR and WC with risk factors was slightly higher than or equal to that of percent body fat mass and BMI.

Kiel Obesity Prevention Study

They also found that **WHtR** showed the **best value** on receiver operating characteristic curve analysis in identifying the **prevalence of 2≥component** traits among the triglyceride, blood pressure, and glucose levels

Other Indices Of Anthropometric Measurements

Skinfold Measurements

- Common sites for skinfold measurements include the biceps, triceps, iliac crest, thigh, calf, subscapular, abdomen, and chest.

- The exact technique can vary, but we discuss one method using the triceps as an example.

- For the triceps skinfold, grab the **Skin 2 cm Above The Midpoint** of the **Right Upper Arm** with the **thumb** and **index finger** to create a **skinfold.**
- Then, place the calipers at midpoint to obtain measurement.
- Similarly, skinfold measurement is obtained at other sites 2 cm away from the measuring site.

Despite standard measuring techniques, skinfold testing has **high variability** and has **limited use** in the **clinical setting.**

The Lengths of Extremities

The lengths of extremities are related to chronic diseases as well.

A literature review shows that those with a ***shorter upper leg length (ULL)*** *have a higher prevalence of* ***metabolic syndrome****.*

Similarly, ***shorter upper arm length*** *has an association with a higher prevalence* ***of diabetes*** *in Japanese Americans.*

- Although anthropometric data in the adult population **helps define obesity**, it is also used extensively in the **pediatric** population to determine **nutritional status**.

- By measuring the height for **age**, weight for **age**, and weight for height over time, anthropometric measurements can help identify inadequate growth patterns warrant further evaluation.

Take Home Message

- Anthropometric measurements are noninvasive and easily obtained, and they have a wide range of utility in pediatric and adult populations.

- In pediatric populations, it is an essential tool to detect metabolic and developmental abnormalities early on so that they may be addressed efficiently.

In the adult population, they can be used to diagnose the **severity of illnesses such as obesity and cognitive impairments** and help follow patients over time to assess for improvement after treatment.

