WEEKLY EPIDEMIOLOGICAL REPORT

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Measuring Obesity

Obesity or Body fat can be measured in several ways. Some are simple, requiring only a tape measure. Others use sophisticated equations and expensive equipment to precisely estimate fat mass, muscle mass, and bone density. Each body fat assessment method has advantages and disadvantages.

The most basic method, and the most common, is the body mass index (BMI). Doctors can easily calculate BMI from the heights and weights they gather at each checkup; BMI tables and online calculators also make it easy for individuals to determine their own BMIs. The BMI and other so-called "field methods"—among them, waist circumference, waist-to-hip ratio, skinfold thicknesses, and bioelectrical impedance—are useful in clinics and community settings, as well as in large research studies.

More sophisticated methods, such as magnetic resonance imaging or dual energy X-ray absorptiometry, are so-called "reference measurements"—techniques that are typically only used in research studies to confirm the accuracy of (or as scientists say, to "validate") body measurement techniques. Several methods can't be used in children or pregnant women, due to safety concerns or are less accurate in people who are very overweight. Here is a brief overview of some of the most popular methods for measuring body fat—from basic body measurements to high-tech body scans—along with their strengths and limitations.

Body Mass Index (BMI)

Body mass index (BMI) is the ratio of weight to height, calculated as weight (kg)/height (m^2), or weight (lb)/height (in^2) multiplied by 703.

Strengths

- Easy to measure (Standardized cutoff points for overweight and obesity: Normal weight is a BMI between 18.5 and 22.9; overweight is a BMI between 23.0 and 27.4; obesity is a BMI of 27.5 or higher)
- Inexpensive
- Strongly correlated with body fat levels, as measured by the most accurate methods
- Hundreds of studies show that a high BMI predicts higher risk of chronic disease and early death

Limitations

- Indirect and imperfect measurement—does not distinguish between body fat and lean body mass
- Not as accurate a predictor of body fat in the elderly as it is in younger and middle-aged adults
- At the same BMI, women have, on average, more body fat than men and Asians have more body fat than whites

Waist Circumference

Waist circumference is the simplest and most common way to measure "abdominal obesity"—the extra fat found around the middle that is an important factor in health, even independent of BMI. It's the circumference of the abdomen, measured at the natural waist (in between the lowest rib and the top of the hip bone), the umbilicus or at the narrowest point of the midsection.

Strengths

- Easy to measure
- For Europids, cut off value is 94 cm for males for 80 cm females [but for Americans higher values (102 cm males; 88 cm females) are being used]. Cut off points for most Asians including South Asians is 90 cm for males and 80 cm for females
- Inexpensive
- Strongly correlated with body fat in adults as measured by the most accurate methods
- Studies show waist circumference predicts development of disease and death

Limitations

- Measurement procedure has not been standardized
- Lack of good comparison standards (reference data) for waist circumference in children
- May be difficult to measure and less accurate in individuals with a BMI of 35 or higher

Waist-to-Hip Ratio

Like the waist circumference, the waist-to-hip ratio (WHR) is also used to measure abdominal obesity. It's calculated by measuring the waist and the hip (at the widest diameter of the buttocks), and then dividing the waist measurement by the hip measurement.

Strengths

- Good correlation with body fat as measured by the most accurate methods
- Inexpensive
- Studies show waist-to-hip ratio predicts development of disease and death in adults

Limitations

- More prone to measurement error because it

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requires two measurements
- More difficult to measure hip than it is to measure waist
- More complex to interpret than waist circumference, since increased waist-to-hip ratio can be caused by increased abdominal fat or decrease in lean muscle mass around the hips
- Turning the measurements into a ratio leads to a loss of information: Two people with very different BMIs could have the same WHR
- May be difficult to measure and less accurate in individuals with a BMI of 35 or higher

Skinfold Thickness

In this method, researchers use a special caliper to measure the thickness of a "pinch" of skin and the fat beneath it in specific areas of the body (the trunk, the thighs, front and back of the upper arm, and under the shoulder blade). Equations are used to predict body fat percentage based on these measurements.

Strengths
- Convenient
- Safe
- Inexpensive
- Portable
- Fast and easy (except in individuals with a BMI of 35 or higher)

Limitations
- Not as accurate or reproducible as other methods
- Very hard to measure in individuals with a BMI of 35 or higher

Bioelectric Impedance (BIA)

BIA equipment sends a small, imperceptible, safe electric current through the body, measuring the resistance. The current faces more resistance passing through body fat than it does passing through lean body mass and water. Equations are used to estimate body fat percentage and fat-free mass.

Strengths
- Convenient
- Safe
- Relatively inexpensive
- Portable
- Fast and easy

Limitations
- Hard to calibrate
- The ratio of body water to fat may change during illness, dehydration or weight loss, decreasing accuracy
- Not as accurate as other methods, especially in individuals with a BMI of 35 or higher

Underwater Weighing (Densitometry)

Individuals are weighed in air and while submerged in a tank. Researchers use formulas to estimate body volume, body density, and body fat percentage. Fat is more buoyant (less dense) than water, so someone with high body fat will have a lower body density than someone with low body fat. This method is typically used only in research settings.

Strengths
- Accurate

Limitations
- Time consuming
- Requires individuals to be submerged in water
- Generally not a good option for children, older adults, and individuals with a BMI of 40 or higher

Air-Displacement Plethysmography

This method uses a similar principle to underwater weighing but can be done in the air instead of in water. Individuals sit in a small chamber wearing a bathing suit; one commercial example is the "Bod Pod." The machine estimates body volume based on air pressure differences between the empty chamber and the occupied chamber.

Strengths
- Relatively quick and comfortable
- Accurate
- Safe
- Good choice for children, older adults, pregnant women, individuals with a BMI of 40 or higher, and other individuals who would not want to be submerged in water

Limitations
- Expensive

Dilution Method (Hydrometry)

Individuals drink isotope-labeled water and give body fluid samples. Researchers analyze these samples for isotope levels, which are then used to calculate total body water, fat-free body mass, and in turn, body fat mass.

Strengths
- Relatively low cost
- Accurate
- Safe
- Can be used in individuals with a BMI of 40 or higher, as well as in children and pregnant women

Limitations
- The ratio of body water to fat-free mass may change during illness, dehydration, or weight loss, decreasing accuracy

Dual Energy X-ray Absorptiometry (DEXA)

X-ray beams pass through different body tissues at different rates. So DEXA uses two low-level X-ray beams to develop estimates of fat-free mass, fat mass, and bone mineral density. DEXA is typically only used for this purpose in research settings.

Strengths
- Accurate

Limitations
- Equipment is expensive and cannot be moved
- Cannot accurately distinguish between different types of fat (fat under the skin, also known as "subcutaneous" fat vs. fat around the internal organs, or "visceral" fat)
- Cannot be used with pregnant women, since it requires exposure to a small dose of radiation
- Most current systems cannot accommodate individuals with a BMI of 35 or higher

Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI)

These two imaging techniques are now considered to be the most accurate methods for measuring tissue, organ, and whole-body fat mass as well as lean muscle mass and bone mass. CT and MRI scans are typically used for this purpose only in research settings.

Strengths
- Accurate
- Allows for measurement of specific body fat compartments, such as abdominal fat and subcutaneous fat

Limitations
- Equipment is extremely expensive and cannot be moved
- CT scans cannot be used with pregnant women or children, due to the high amounts of ionizing radiation used
- Some MRI and CT scanners may not be able to accommodate individuals with a BMI of 35 or high

Source

Measuring Obesity, available from *http://www.hsph.harvard.edu/obesity-prevention-source/obesity-definition/how-to-measure-body-fatness/#References*

Compiled by Dr. Madhava Gunasekera of the Epidemiology Unit

Table 1: Vaccine-preventable Diseases & AFP

29th December – 04th January 2012 (01st Week)

Disease	No. of Cases by Province									Number of cases during current week in 2013	Number of cases during same week in 2012	Total number of cases to date in 2013	Total number of cases to date in 2012	Difference between the number of cases to date in 2012& 2012
	W	C	S	N	E	NW	NC	U	Sab					
Acute Flaccid Paralysis	00	00	00	00	00	00	00	00	00	00	00	00	00	%
Diphtheria	00	00	00	00	00	00	00	00	00	-	-	-	-	-
Measles	00	00	00	00	00	01	01	00	00	02	00	02	00	%
Tetanus	00	00	00	00	00	00	00	00	00	00	00	00	00	%
Whooping Cough	01	00	01	00	00	01	00	00	01	04	00	04	00	%
Tuberculosis	21	09	31	06	13	00	07	06	25	126	364	126	364	+ 65.3 %

Table 2: Newly Introduced Notifiable Disease

29th December – 04th January 2012 (01st Week)

Disease	No. of Cases by Province									Number of cases during current week in 2013	Number of cases during same week in 2012	Total number of cases to date in 2013	Total number of cases to date in 2012	Difference between the number of cases to date in 2013 & 2012
	W	C	S	N	E	NW	NC	U	Sab					
Chickenpox	12	02	12	01	02	03	02	01	07	42	55	42	55	- 23.6 %
Meningitis	04 KL=1 GM=1 CB=2	01 ML=1	02 HB=1 MT=1	05 JF=3 MN=2	00	11 KR=10 PU=1	02 AP=1 PO=1	01 BD=1	02 RP=2	28	13	28	13	+ 115.4 %
Mumps	05	00	00	01	02	04	03	01	03	19	80	19	80	- 76.2 %
Leishmaniasis	00	00	10 HB=6 MT=4	00	00	03 KN=3	09 AP=9	00	00	22	06	22	06	+ 72.7 %

Key to Table 1 & 2

Provinces: **W**: Western, **C**: Central, **S**: Southern, **N**: North, **E**: East, **NC**: North Central, **NW**: North Western, **U**: Uva, **Sab**: Sabaragamuwa.

DPDHS Divisions: **CB**: Colombo, **GM**: Gampaha, **KL**: Kalutara, **KD**: Kandy, **ML**: Matale, **NE**: Nuwara Eliya, **GL**: Galle, **HB**: Hambantota, **MT**: Matara, **JF**: Jaffna, **KN**: Killinochchi, **MN**: Mannar, **VA**: Vavuniya, **MU**: Mullaitivu, **BT**: Batticaloa, **AM**: Ampara, **TR**: Trincomalee, **KM**: Kalmunai, **KR**: Kurunegala, **PU**: Puttalam, **AP**: Anuradhapura, **PO**: Polonnaruwa, **BD**: Badulla, **MO**: Moneragala, **RP**: Ratnapura, **KG**: Kegalle.

Data Sources:

Weekly Return of Communicable Diseases: Diphtheria, Measles, Tetanus, Whooping Cough, Chickenpox, Meningitis, Mumps.

Special Surveillance: Acute Flaccid Paralysis.

Leishmaniasis is notifiable only after the General Circular No: 02/102/2008 issued on 23 September 2008. .

Dengue Prevention and Control Health Messages

To prevent dengue, remove mosquito breeding places in and around your home, workplace or school once a week.

Table 4: Selected notifiable diseases reported by Medical Officers of Health

29th December – 04th January 2012 (01st Week)

DPDHS Division	Dengue Fever / DHF*		Dysentery		Encephalitis		Enteric Fever		Food Poisoning		Leptospirosis		Typhus Fever		Viral Hepatitis		Human Rabies		Returns Received
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	%
Colombo	127	127	0	0	0	0	1	1	0	0	6	6	1	1	3	3	0	0	**77**
Gampaha	80	80	0	0	0	0	0	0	0	0	0	0	0	0	7	7	0	0	**53**
Kalutara	37	37	1	1	0	0	1	1	0	0	10	10	1	1	0	0	0	0	**62**
Kandy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Matale	20	20	6	6	0	0	0	0	0	0	0	0	0	0	2	2	0	0	**83**
Nuwara	1	1	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	**54**
Galle	13	13	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	**89**
Hambantota	9	9	0	0	0	0	1	1	0	0	1	1	3	3	7	7	0	0	**92**
Matara	5	5	0	0	0	0	0	0	2	2	1	1	1	1	17	17	0	0	**88**
Jaffna	32	32	6	6	0	0	17	17	0	0	0	0	24	24	0	0	0	0	**75**
Kilinochchi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Mannar	10	10	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**40**
Vavuniya	4	4	4	4	0	0	0	0	1	1	0	0	0	0	0	0	0	0	**100**
Mullaitivu	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**80**
Batticaloa	6	6	5	5	0	0	0	0	0	0	0	0	0	0	2	2	0	0	**64**
Ampara	3	3	1	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	**57**
Trincomalee	1	1	2	2	0	0	0	0	0	0	3	3	0	0	0	0	0	0	**50**
Kurunegala	66	66	4	4	0	0	3	3	0	0	3	3	2	2	1	1	0	0	**77**
Puttalam	27	27	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**58**
Anuradhapu	21	21	2	2	0	0	0	0	0	0	2	2	0	0	0	0	0	0	**74**
Polonnaruw	4	4	3	3	0	0	1	1	0	0	3	3	0	0	0	0	0	0	**100**
Badulla	6	6	0	0	0	0	0	0	0	0	0	0	1	1	3	3	0	0	**71**
Monaragala	10	10	3	3	0	0	1	1	0	0	0	0	0	0	0	0	0	0	**73**
Ratnapura	19	19	10	10	8	8	0	0	2	2	4	4	0	0	3	3	0	0	**78**
Kegalle	42	42	1	1	0	0	0	0	0	0	2	2	0	0	3	3	0	0	**91**
Kalmune	5	5	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	**46**
SRI LANKA	**549**	**549**	**54**	**54**	**09**	**09**	**25**	**25**	**06**	**06**	**39**	**39**	**36**	**36**	**48**	**48**	**00**	**00**	**66**

Source: Weekly Returns of Communicable Diseases WRCD).
***Dengue Fever / DHF** refers to Dengue Fever / Dengue Haemorrhagic Fever.
****Timely** refers to returns received on or before 04th January, 2013 Total number of reporting units 329. Number of reporting units data provided for the current week: 222
A = Cases reported during the current week. **B** = Cumulative cases for the year.

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