Erasmus+

Development of innovative training solutions in the field of functional evaluation aimed at updating of the curricula of health sciences schools

TEACH

MODULE BIOMECHANICS: FOUNDATIONS OF BIOMECHANICS APPLIED TO THE LOCOMOTOR SYSTEM

Didactic Unit E: TECHNIQUES FOR THE INSTRUMENTAL ANALYSIS OF PHYSIOLOGICAL SIGNS AND ANTHROPOMETRIC AND MORPHOMETRIC PARAMETERS?

E.4. What are the applications of the analysis of anthropometric and morphometric parameters?

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1. Objectives

- To learn what are the applications fields of the analysis of anthropometric and morphometric parameters.
- To know what are the known standard measures and indicators obtained from the analysis of anthropometric parameters.
- To be able to determine the selected measures and indicators as a result of the analysis of anthropometric data.

2. Application of anthropological analysis in prevention of diseases, developmental disorders and improvement of health of people.

Anthropological researches and analysis are used in the prevention of diseases, developmental disorders and improvement of health of people, especially children and adolescents

Systematic monitoring of growth allows for early detection of abnormalities and counteracts permanent health impairments.

Determining the correct dimensions for age and gender, body proportions ensuring good health and well-being motivate to change eating habits and lifestyle.

Systematic carrying out of professional analysis of body structure and nutritional status allows to monitor the effects of weight loss or weight increase therapy

Anthropological parameters monitoring and analysis for prevention and obesity therapy for children and young people.

Anthropometric measurements are a series of quantitative measurements of the muscle, bone, and adipose tissue used to assess the composition of the body. The core elements of anthropometry are height, weight, body mass index (BMI)

Body mass index (BMI) is a measure of body fat based on height and weight that applies to adult men and women.

$$BMI = \frac{\text{Weight (Kg)}}{(\text{Height in metres})^2}$$

OR

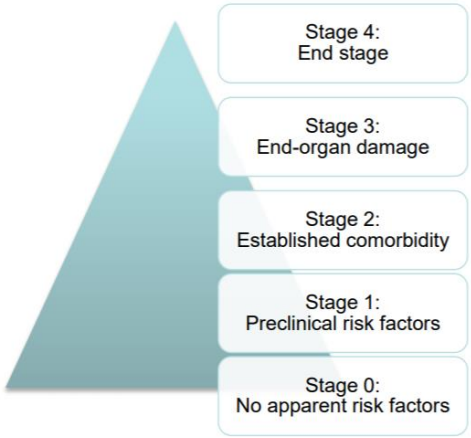
$$BMI = \frac{703 \times \text{Weight (lb)}}{(\text{Height in inches})^2}$$

Body mass index (BMI) is a value derived from the mass (weight) and height of a person. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m2, resulting from mass in kilograms and height in metres.

BMI standards for adults

BMI	kg/m^2
Underweight	≤ 18.5
Normal weight	18.6–24.9
Overweight	25.0–29.0
Obesity class I	30.0–34.90
Obesity class II	35.0–39.9
Obesity class III	≥ 40

Edmonton standardized obesity staging system (EOSS), indicating level of health risc.



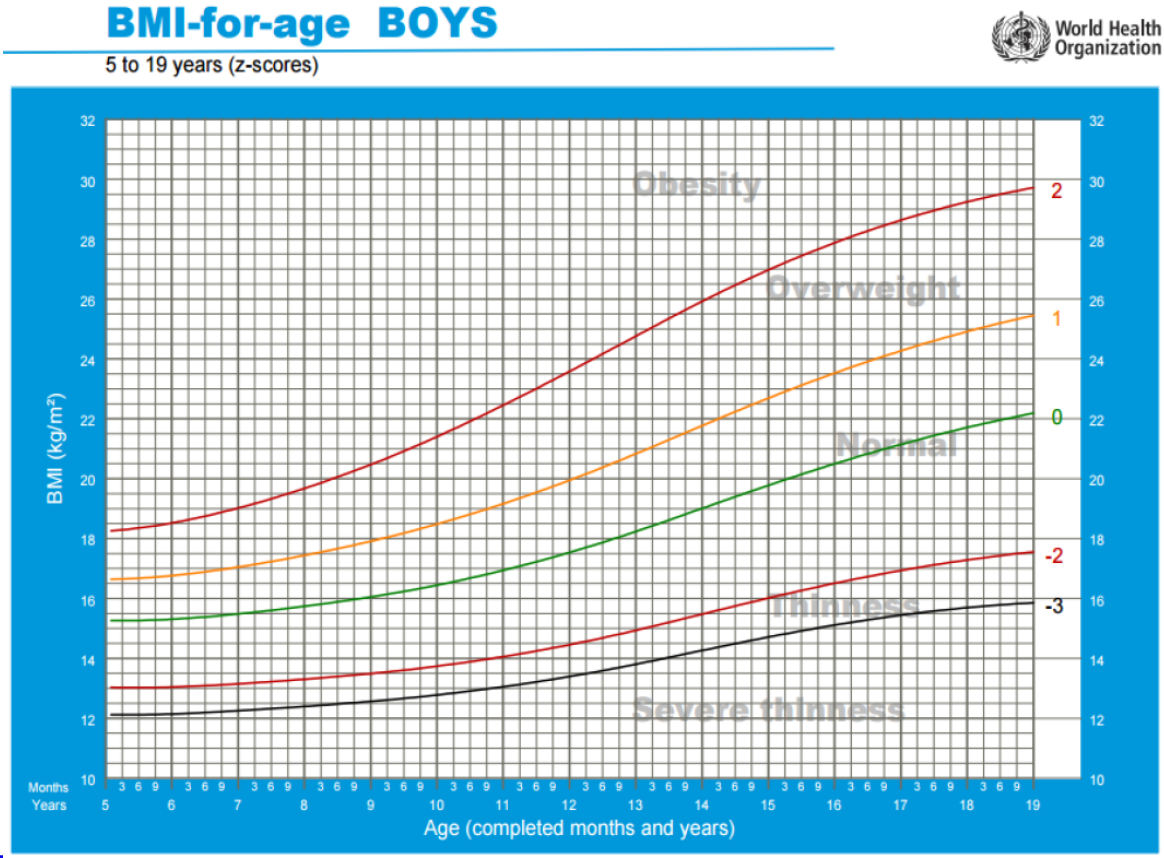
BMI scales for children

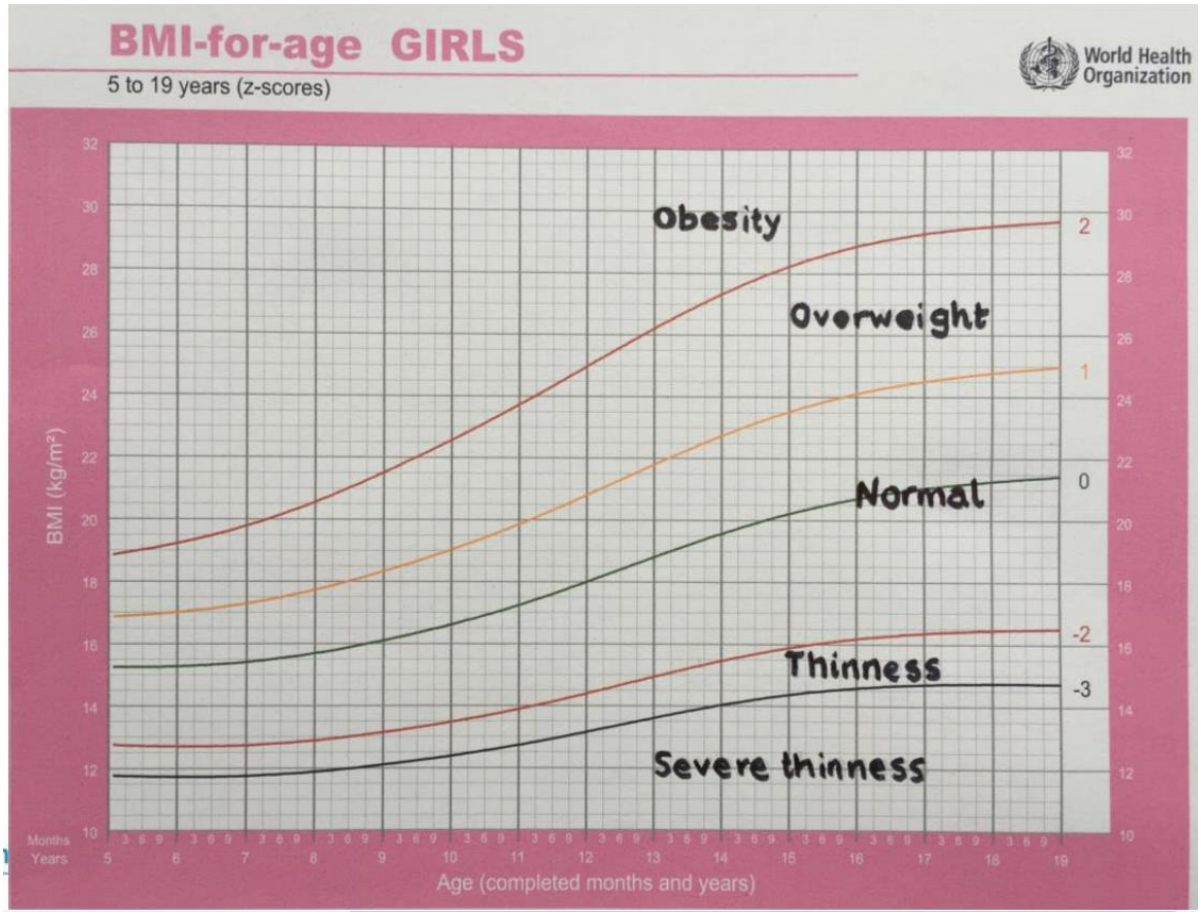
DO NOT use adult BMI reference ranges for children.

Child reference ranges vary constantly, according to age, sex and pubertal growth spurt.

BMI percentile takes account of this variation and so allows comparison at different ages.

Z-score uses standard deviation from the mean.





Waist circumference can be used to assess adult cardiovascular risk

Male risk ranges :

Normal < 94 cm

Increased risk 94–102 cm

High risk > 102 cm

Female risk ranges

Normal < 80 cm

Increased risk 80–88 cm

High risk > 88 cm

	Body mass index	Obesity class	Disease risk (relative to normal weight and waist circumference)	
			Men < 102 cm Women < 88 cm	Men >102 cm Women >88 cm
Underweight	<18.5			
Normal	18.5–24.9			
Overweight	25.0–29.9		Increased	High
Obesity	30.0–34.9 35.0–39.9	I II	High Very high	Very high Very high
Extreme obesity	>40.0	III	Extremely high	Extremely high

Source: NHLBI Obesity Education Initiative (2000)

Anthropometric and morphometric parameters application in sport, fitness and healthy life style.

Anthropometry is the method of measuring the human body or the individual body parts, which involves the quantitative definition of the morphological traits, and insight into an objective image of the state of growth of the person tested

Morphological characteristics appear to be great importance for orientation and selection in the most of sport disciplines, given that they are present in the specification equation of almost every sport, morphological dimensions occupy one of the major positions.

For a large number of sports disciplines, the morphological structure that affects the sports efficiency the most is already known, although the coefficients of participation of individual morphological dimensions in the specification equation indubitably change due to the development of technique and tactics, and modern achievements in a particular sport.

Role of morphological characteristics or body constitution in sport activities, on one side for specific kinesilogical activity type, specific morphology type is necessary for above-average and top result achievement, and on the other side long-term training process, with regards of previous selection, genetical basis and social surroundings.

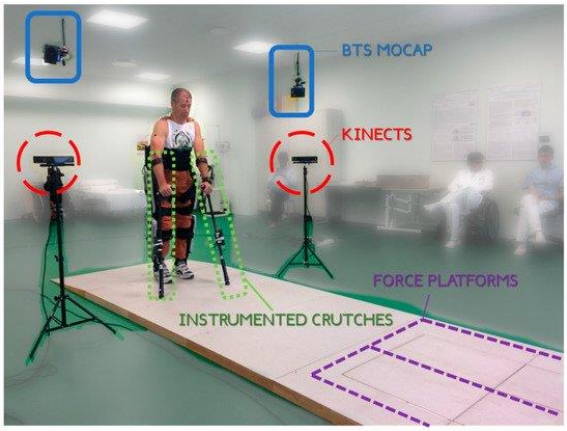
In regards of sport-specific or postion-specific morphological profiling of athletes, study conducted in last years can be used by coaches for improving process of designing training program to maximize the fitness development.

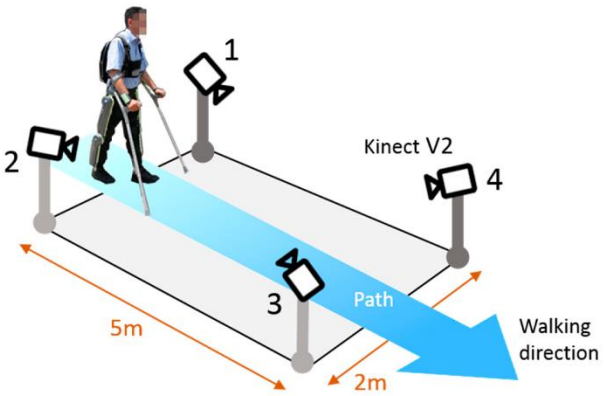
Motion Capture systems applications for anthropometric parameters monitoring during normal activity, sport or physiotherapy: Marker based or Marker-less technology

Modern Complex Motion Capture System with IT system can integrate, synchronize & manage multimodal information in real time coming from:

- Electromyography monitor,
- Sensorized force feet platforms
- External cameras (mainly IR),
- Additional channels for the integration and synchronization of signals acquired from other, external devices.

Marker less systems (e.g. kinect) as an alternative for marker based (e.g. BTS IR cameras) systems can be used to body position and body motion capture to computer based system for further analysis.

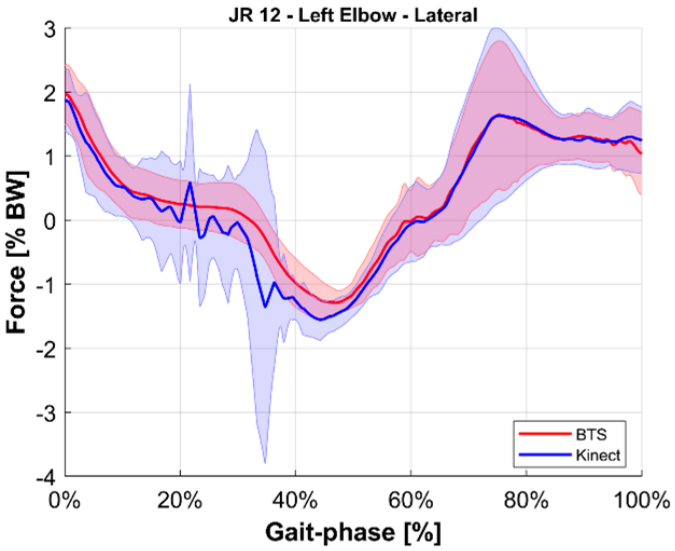




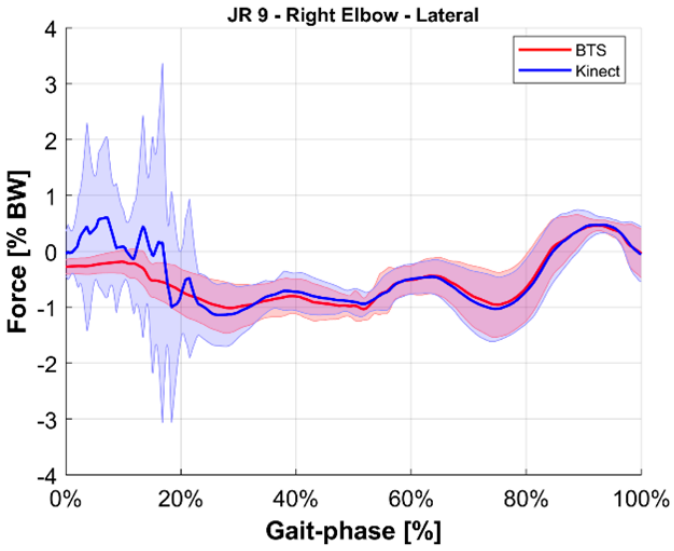
Comparison of BTS system (gold std.) with IR cameras with Kinect system integrated with force sensitive feet platforms.

Below examples of force trajectories recorded from gold standard: BTS system and marker less - Kinekt System from left (a) and right (b) elbow (lateral), during gait are presented.

All recorded signals in digital form are gathered in local or share computer systems for further analysis.


JR 12 - Left Elbow - Lateral
Force [% BW]
Gait-phase [%]
BTS
Kinect

(a)


JR 9 - Right Elbow - Lateral
Force [% BW]
Gait-phase [%]
BTS
Kinect

(b)

3. Key ideas

- Anthropometric and morphometric parameters fulfill an important role in the assessment of overall human health and development from birth to adulthood as well as in specialised examinations among others posture and gait.

- The dynamic development of biosensors, electronic and information technologies is the reason for significant progress in measurement systems supporting the classical approach and allowing for the monitoring of these parameters also at home and in the field.

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