

# Anthropometry

- ◆ Measuring of outer body dimensions (body composition and somatotype)
- ◆ Evaluations of a developing, maturing or aging organism
- ◆ Helps to define a child as talented for particular sport



# Body Build, Size, and Composition

**Body build** (= somatotype) is the form or structure of the body.

- Muscularity (mesomorphy, athletic)
- Linearity (ectomorphy, asthenic)
- Fatness (endomorphy, pyknic)

**Body size** is determined by height and weight.

**Body composition** refers to the chemical composition of the body.

- Fat mass
- Fat-free mass

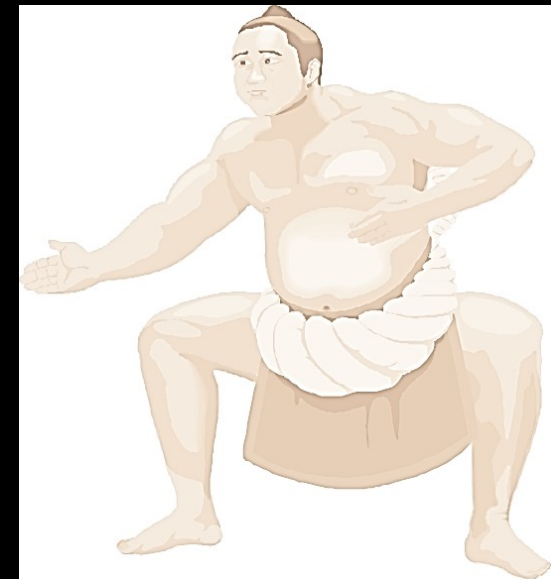


# body size. tall vs. short, overweight vs. underweight

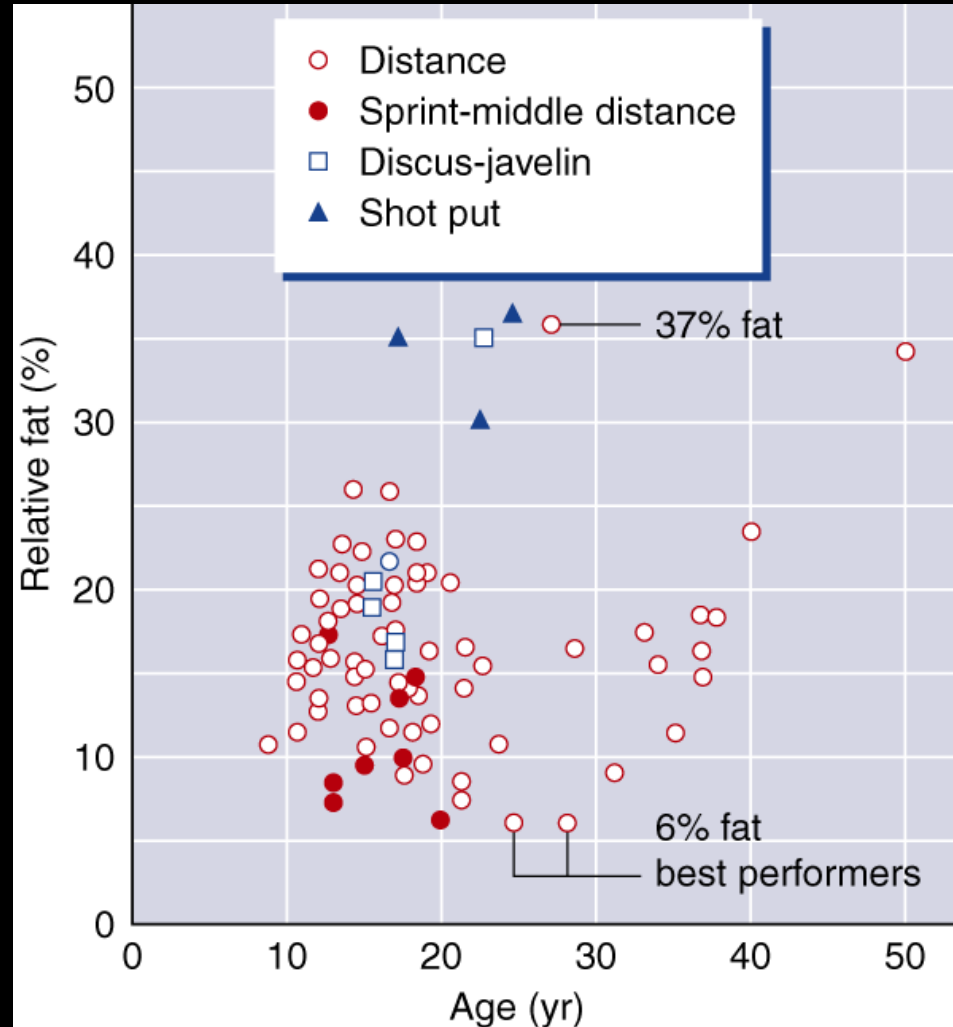
- ◇ <https://worldpopulationreview.com/country-rankings/average-height-by-country>
- ◇ [https://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_body\\_mass\\_index](https://en.wikipedia.org/wiki/List_of_countries_by_body_mass_index)

# Did You Know...?

Body composition is a better indicator of fitness than body size and weight (BMI). Being overfat (not necessarily overweight) has a negative impact on athletic performance. Standard height-weight tables do not provide accurate estimates of what an athlete should weigh because they do not take into account the composition of the weight. An athlete can be overweight according to these tables yet have very little body fat.



# RELATIVE BODY FAT IN ELITE TRACK AND FIELD ATHLETES



# Basic parameters

- ◆ Weight (bathroom scales)
- ◆ Height (anthropometer)
- ◆ Sitting height
- ◆ Upper extremity length
- ◆ Lower extremity length
  
- ◆ Body surface

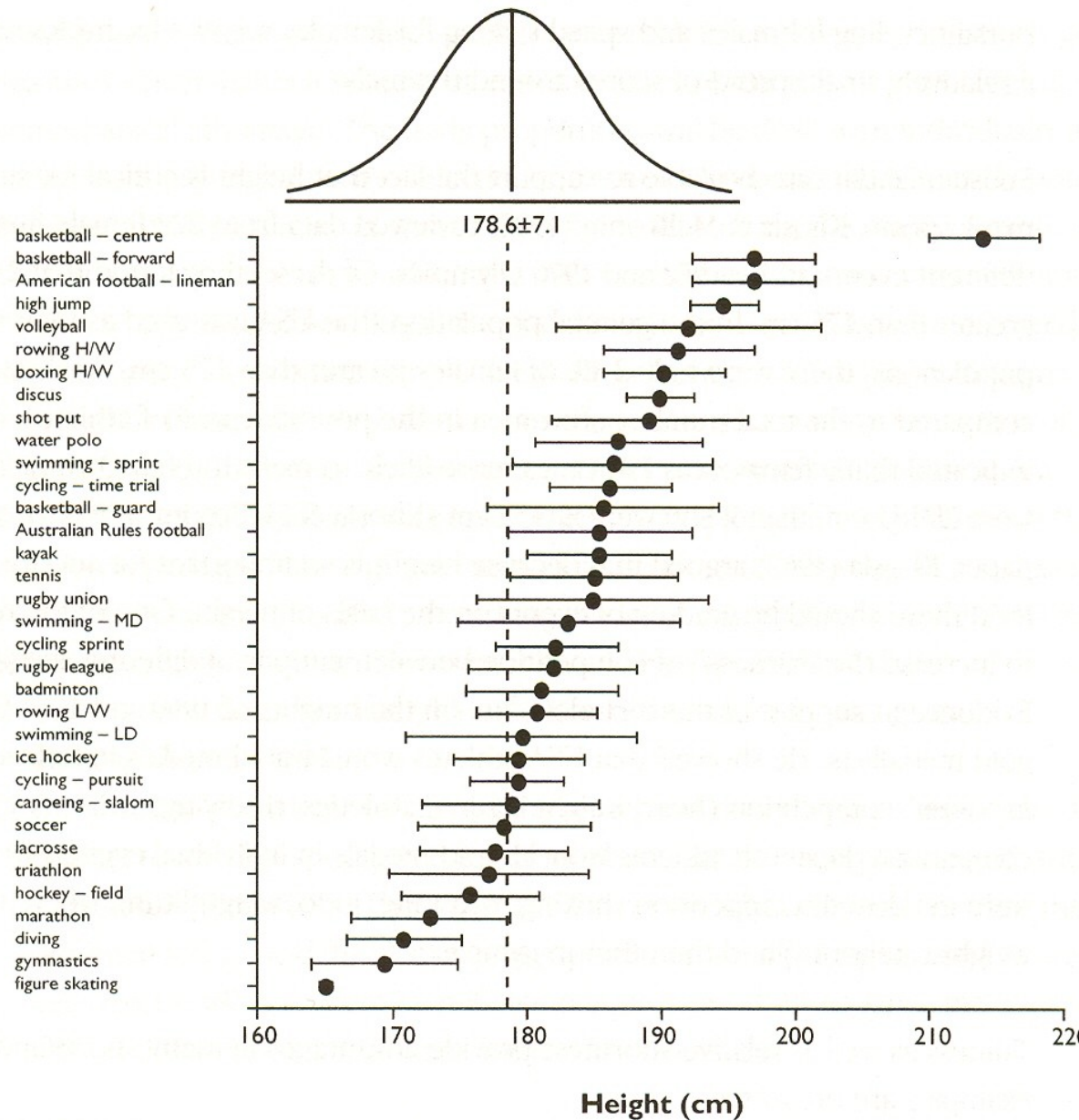


Body surface A (m<sup>2</sup>) calculation according to DuBois & DuBois:

$$A = W^{0,425} \cdot L^{0,725} \cdot 0.007184$$

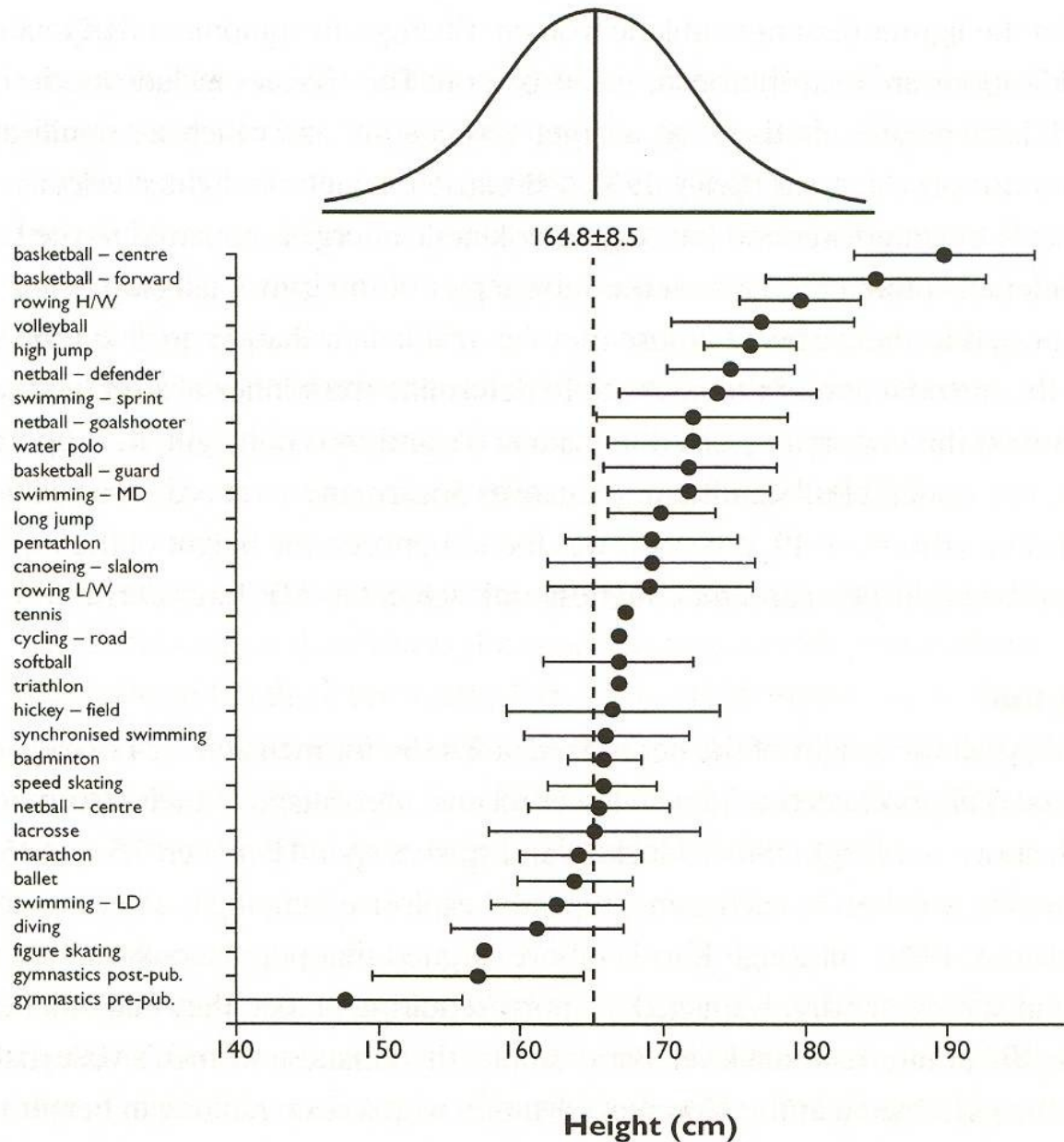
W = weight (kg); L = height (cm)

Men height average in CZ  
179 cm



**Figure 4** Plot of mean ( $\pm$  SD) heights for male athletes in different sports relative to a reference population of non-athletes.

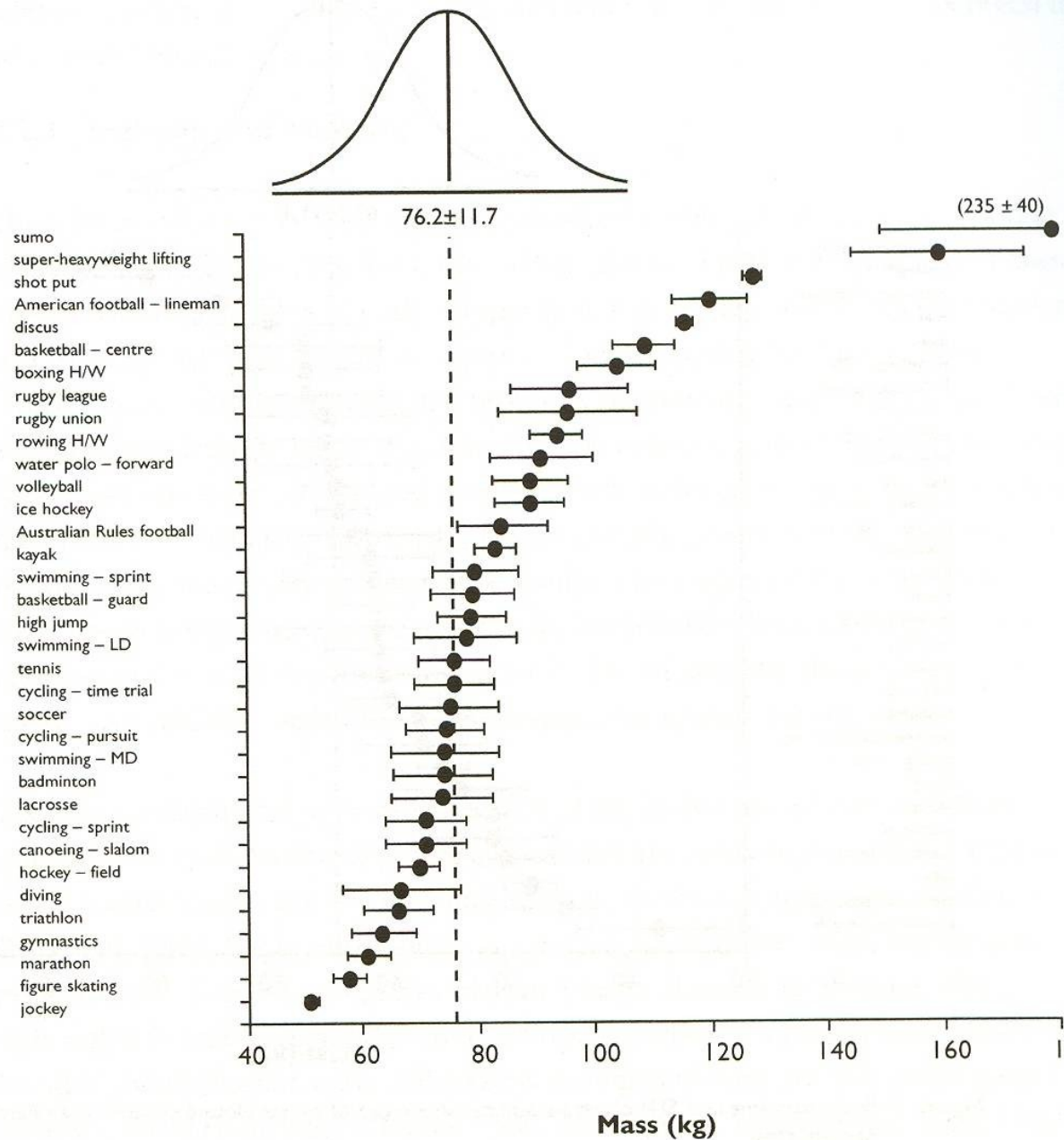
Women height average in CZ  
166 cm



**Figure 5** Plot of mean ( $\pm$  SD) heights for female athletes in different sports relative to a reference group of non-athletes.



Men weight average in CZ  
75 kg



**Figure 8** Body mass (mean ± SD) of male athletes in a range of sports plotted relative to a reference group of non-athletes.

Women weight average in CZ  
60 kg

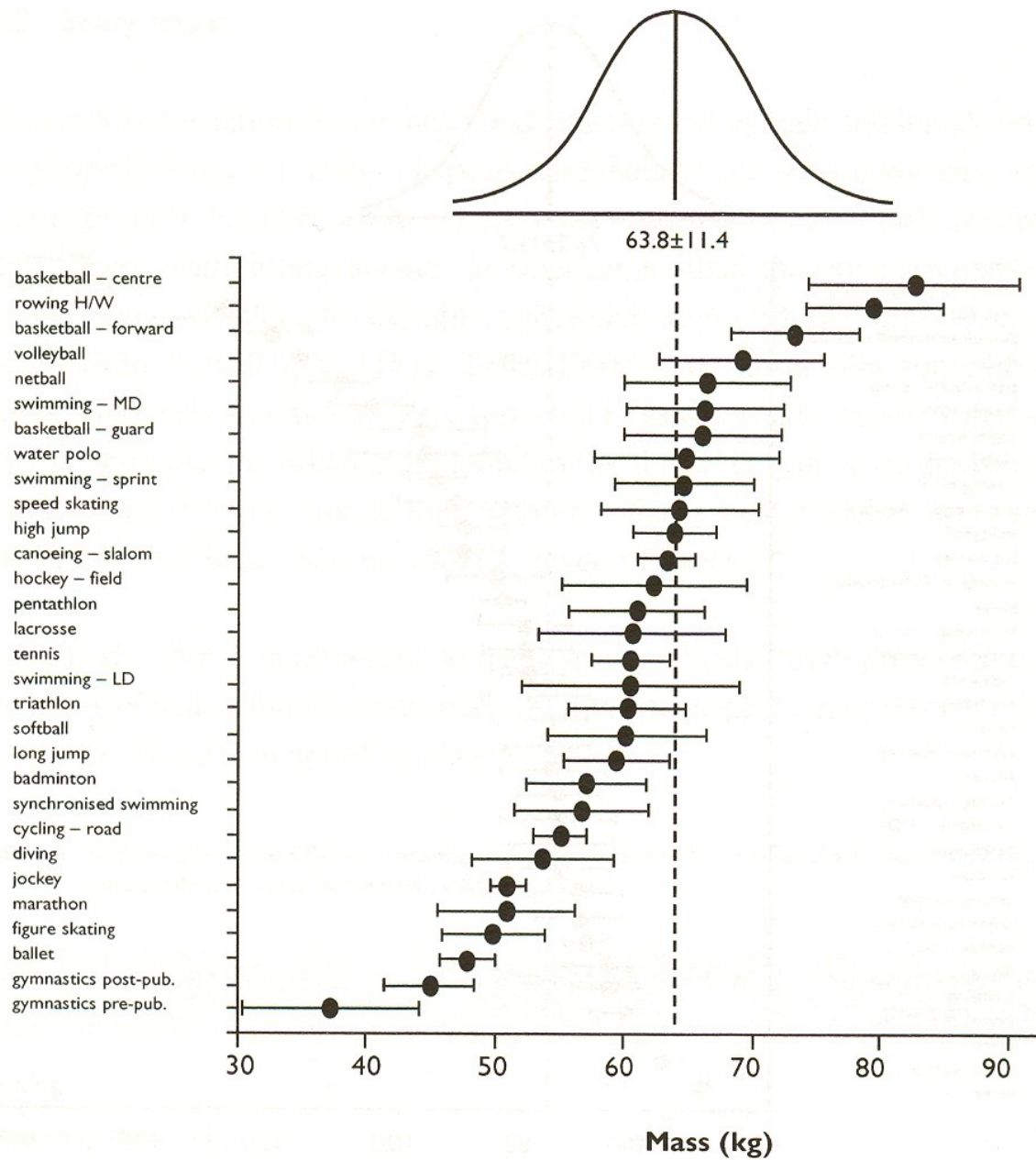
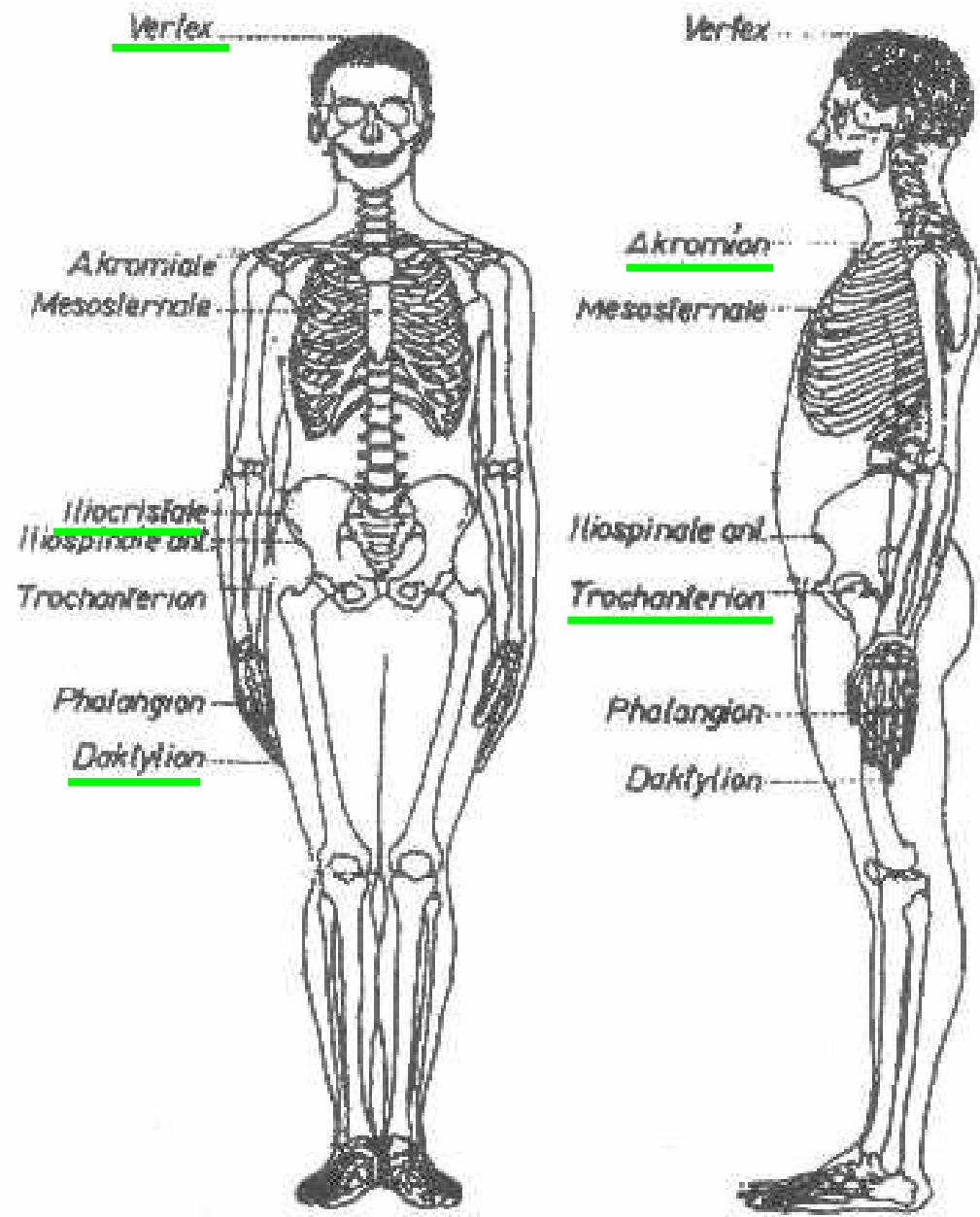


Figure 9 Body mass (mean ± SD) of female athletes in a range of sports plotted relative to a reference non-athletes.

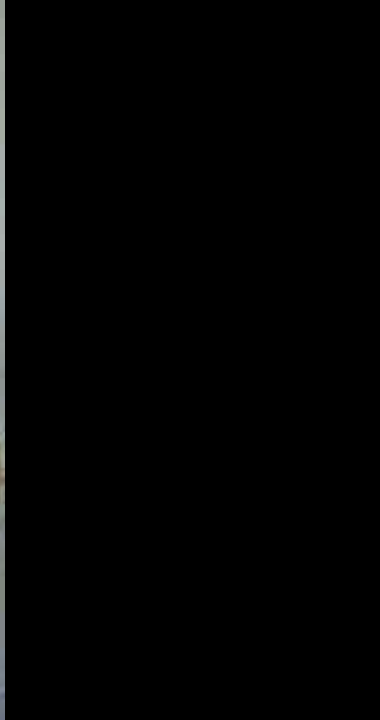
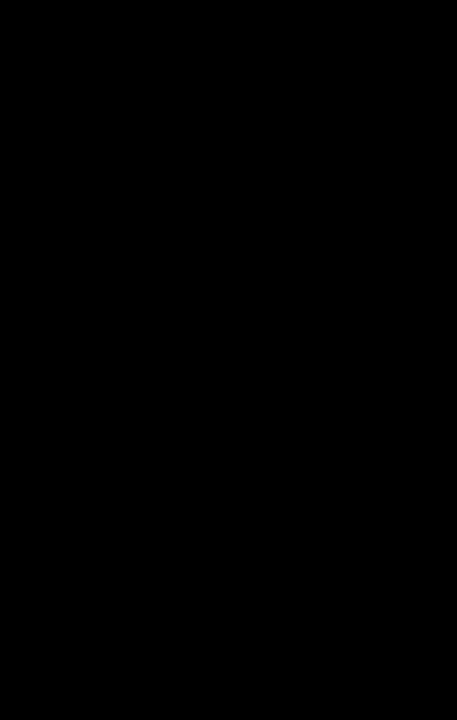
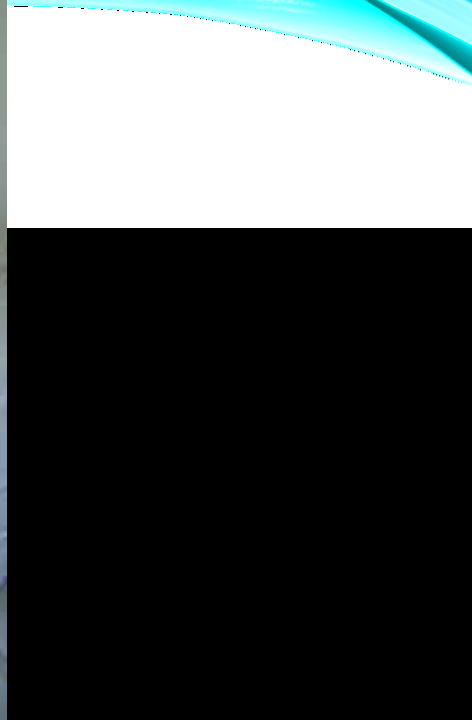
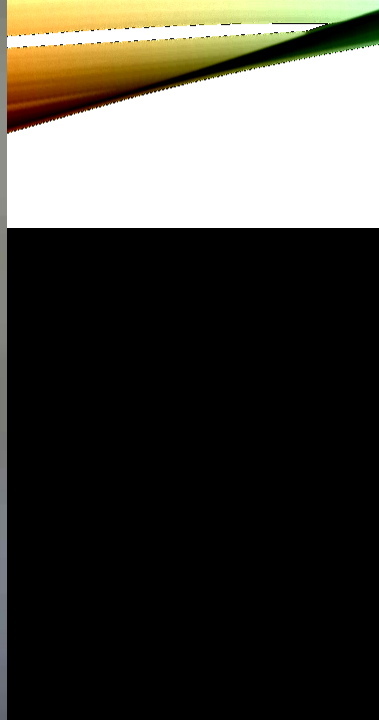


Obrázek měřených míst na těle podle R. Martina.

# Breadths

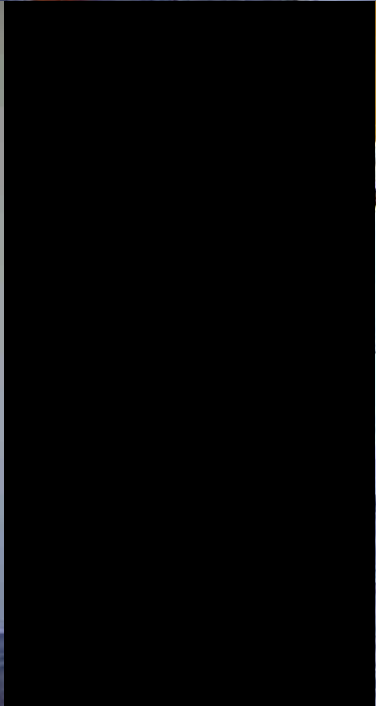
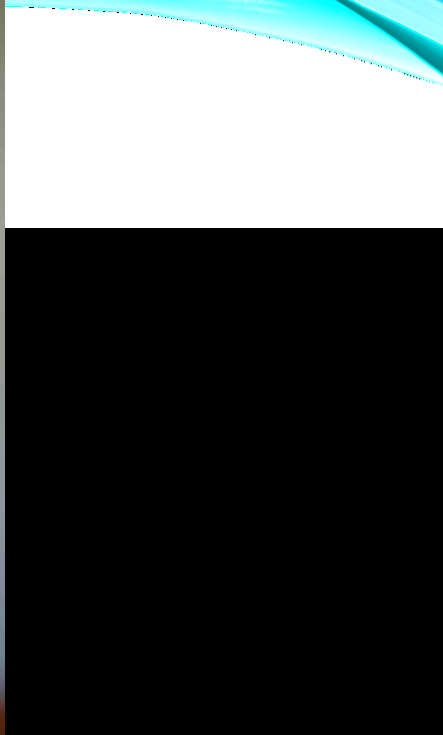
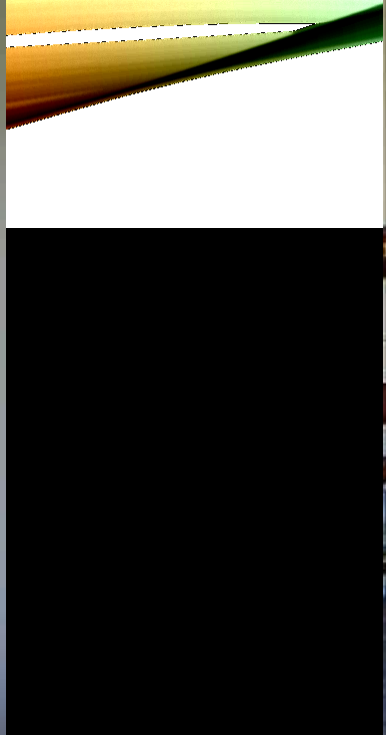
- ◇ Humeral epicondyle
- ◇ Wrist
- ◇ Femoral epicondyle
- ◇ Ankle
- ◇ Shoulders (biacromial)
- ◇ Pelvis (bicristal)

- Measuring on right side of the body by caliper



# Circumferences (girth)

- ◊ Thorax (norm., insp., exp.)
  - ◊ Arm (both loose and contracted)
  - ◊ Forearm
  - ◊ Thigh
  - ◊ Calf
- 
- Measuring on right side of the body by tape measure



# SKINFOLDS

◇ face

◇ neck

◇ thorax I

◇ arm (biceps and triceps)

◇ back

◇ abdomen

◇ thorax II

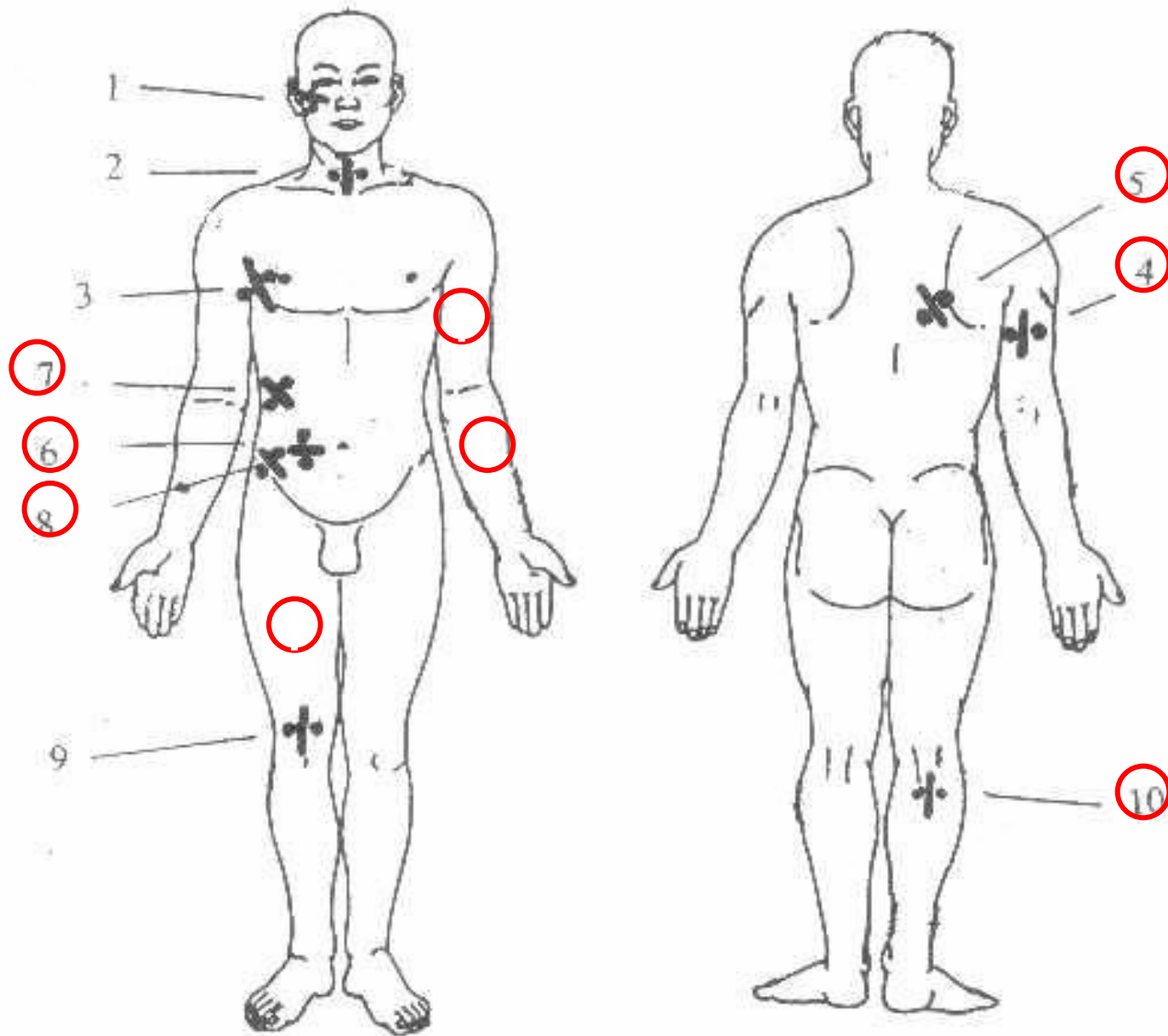
◇ hip

◇ thigh

◇ calf

- Measuring on right side of the body by caliper





Standardní místa snímání tloušťky kožních řas pro stanovení relativní hmotnosti depotní tukové tkáně kaliperem.



# Body Composition (Matiegka)

- ◇ Skeleton weight (breadths and height)
- ◇ Thickness of skin and subcutaneous tissue (skinfolds and body surface)
- ◇ Skeletal muscles weight (circumferences and subtracted skinfolds)
- ◇ Weight of the remaining matter

# Reference values

	Men	Women
Skeletal portion:	17 %	16 %
Muscular portion:	46 %	41 %
Fat portion:	14 %	22 %
Rest:	23 %	21 %



Online calculator (in Czech)

<https://publi.cz/books/159/index.html?secured=false#0>

1



# Body mass index

$m/v$  [kg/m<sup>2</sup>]

<b>Category</b>	<b>Men</b>	<b>Women</b>
underweight	< 20	< 19
normal	20–24.9	19–23.9
overweight	25–29.9	24–28.9
obesity	30–39.9	29–38.9
morbid obesity	> 40	> 39



(BI)

- ◇ Another option for assessing body composition
- ◇ Very low alternating current (5 V, 25 kHz) runs through body
- ◇ The current runs through body liquids freely
- ◇ Fat tissues evince very low electric conductivity (= bioelectric impedance)
- ◇ Evaluation is based on volume of liquid in non-fat tissues

# Tanita scale

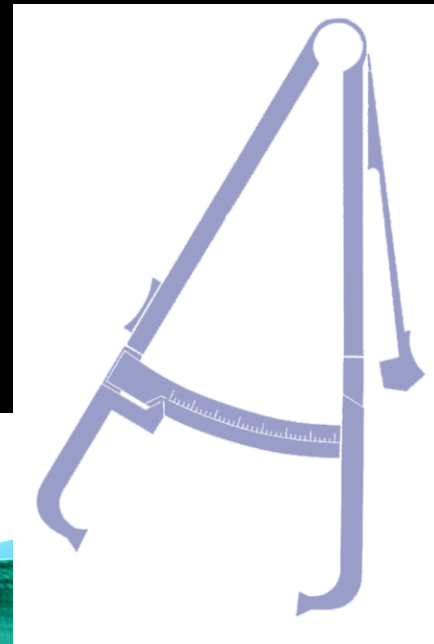
- ◆ Device for BI analysis
- ◆ height
- ◆ age
- ◆ sex
  
- ◆ percentage of body fat
- ◆ weight
  
- ◆ (assessing barefoot)



<https://osobni-vahy.heureka.cz/tanita-bc-545/#>



# SOMATOTYPE





Somatic disposition

Tall

Low, slim, low weight	Agility based performance, quick and accurate moves, synchronisation of body segments – sport gymnastics, trampoline leaps, acrobatics
Long arms, broad palms and feet	Swimming (longer and mightier strokes), rowing, paddling
Slim, low weight (astenic, ectomorph)	Endurance performance – whole body transport in bigger distance (or uphill) – road cycling, cyclocross, running (middle-distance, long-distance), walking, climbing, cross-country skiing
Developed musculature (athletic, mesomorph)	Strength performance – throwing, shot put, speed performance (sprint – running, cycling, swimming)
Balanced disposition, muscular, fat-free, size components (slim athletic, meso-ectomorph)	Most of sport performances (football, handball, baseball, downhill skiing, rowing)
Low constitution, developed musculature, robust skeleton (athletic, mesomorph)	Weight-lifting
Robust with higher weight (athletic-pyknik, meso-endomorph)	Sumo

# Somatotype

- Morphological structure of an individual based on the relative contribution of three fundamental elements (i. e. body build):
  - Muscularity (mesomorphy, athletic)
  - Linearity (ectomorphy, asthenic)
  - Endomorphy (ectomorphy, asthenic)



1) Based on the component's dominance  
(Štěpnička 1979)

Pure somatotype (ectomorph,  
mesomorph, endomorph)

1 component dominates, the  
remaining 2 are balanced

Mesomorphic endomorph  
(ectomorphic endomorph,  
endomorph mesomorph)

1 component dominates, 2<sup>nd</sup> over 3<sup>rd</sup>

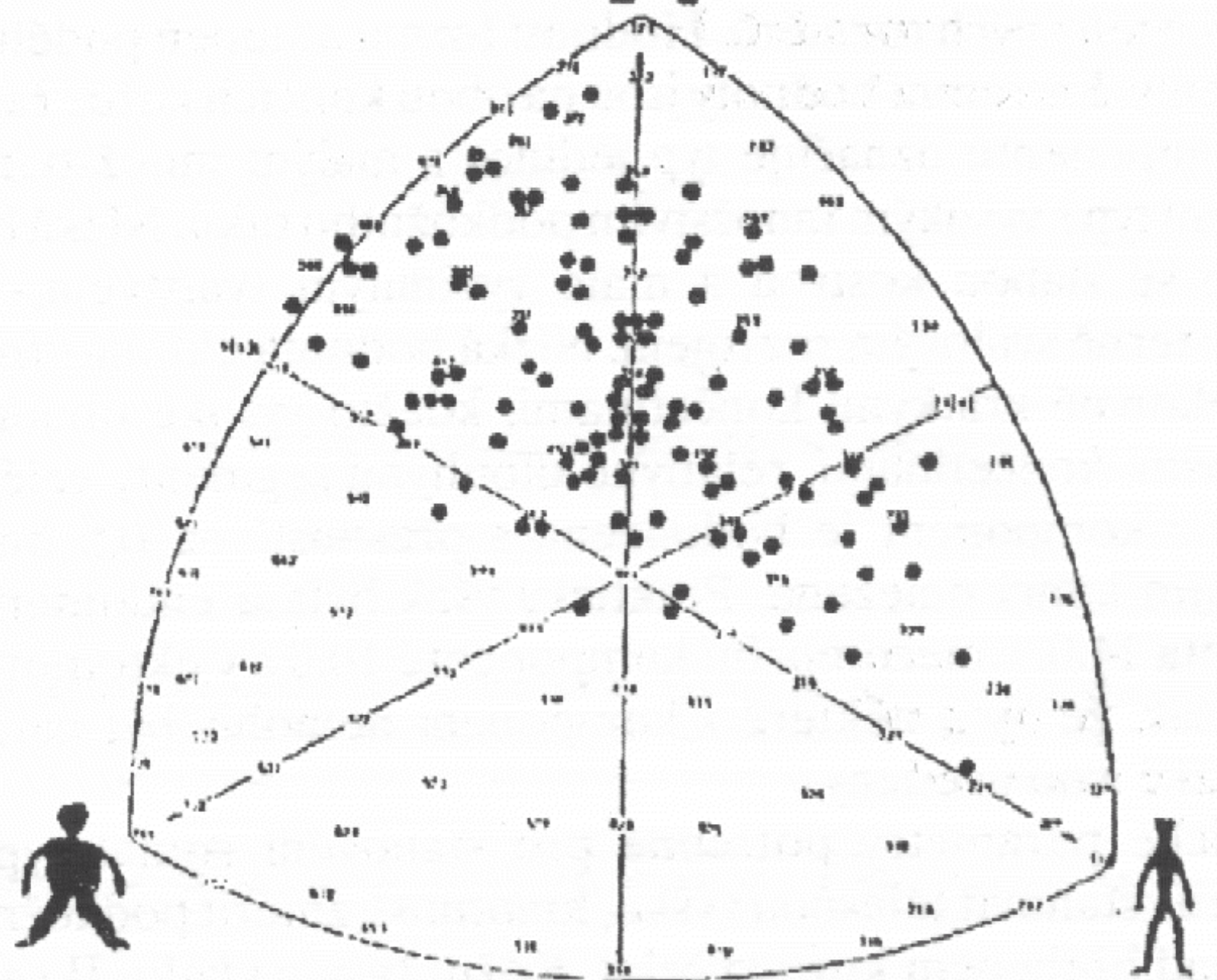
Endomorph – mesomorph  
(endomorph – ectomorph,  
ectomorph – mesomorph)

2 balanced components dominate,  
3 minor

Medium somatotype

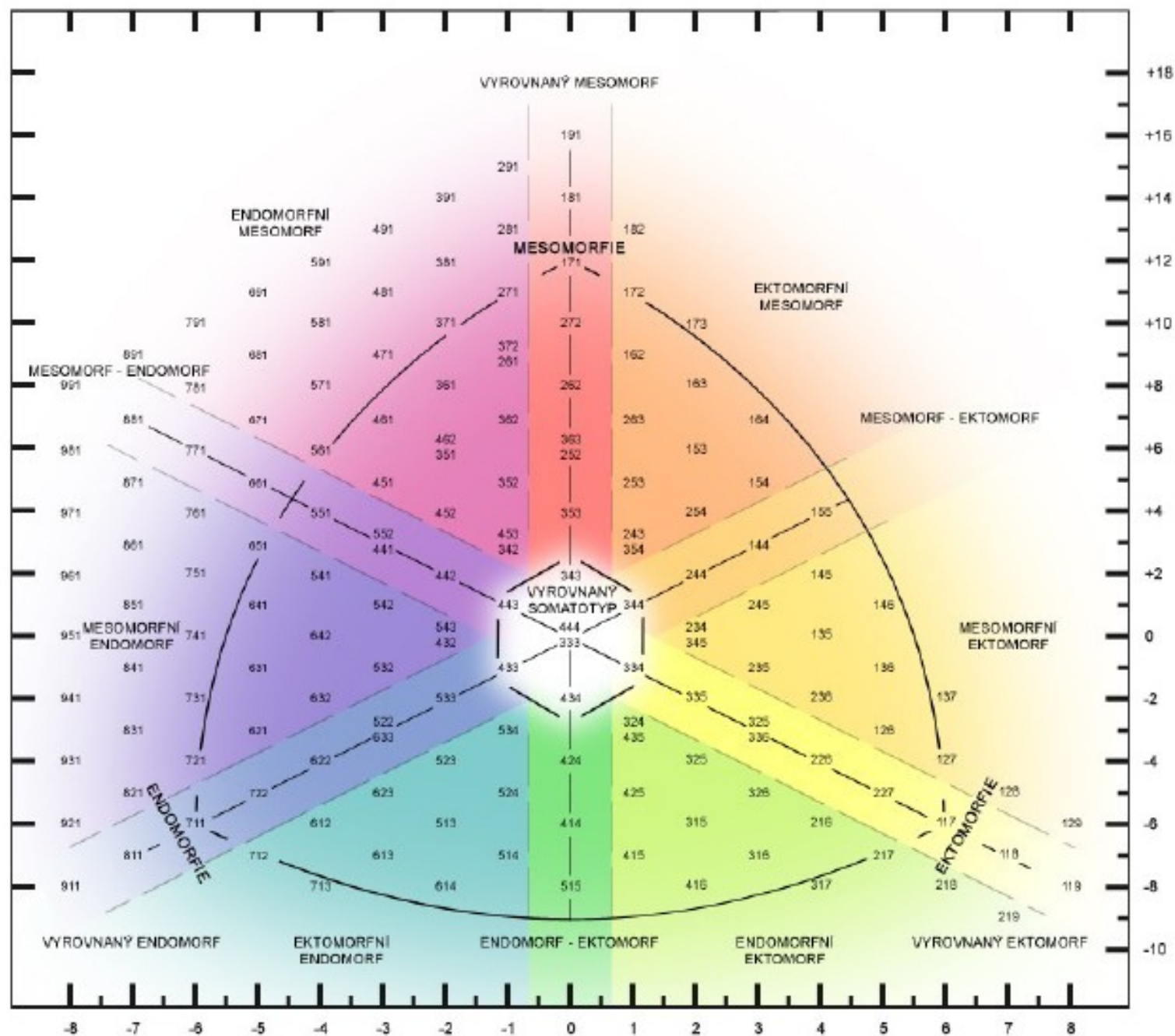
all components balanced

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X = EKTOMORFIE - ENDOMORFIE

Y = 2 x MESOMORFIE - (ENDOMORFIE + EKTOMORFIE)



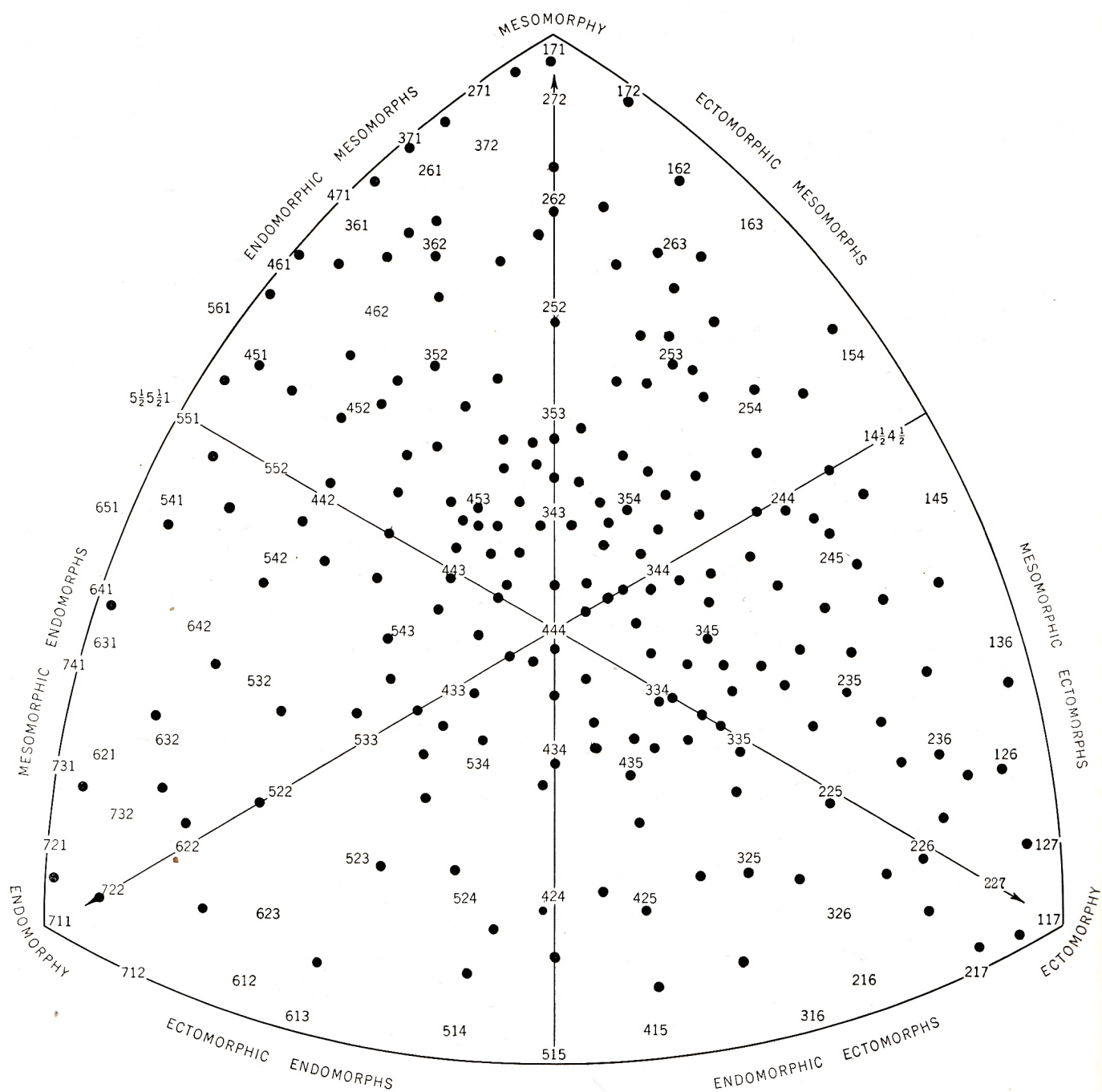


FIG. 1. The Distribution of Somatotypes for a Male College Population of 4000. Each Black Dot represents 20 Cases.



2) Based on the motion abilities  
(Chytráčková 1989):

A Category	Strength capabilities
B Category	The most versatile sport capabilities
C Category	The least sport capabilities
D Category	Endurance and agility capabilities
E Category	Low sport capabilities (general lack of muscular mass)

