

## 2. THE IMPORTANCE OF BODY CONSTRUCTION IN SPORTS PERFORMANCE

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**Abstract:** *Starting from the morphological types established by anthropologists and sketchers artists over time based on experience of "the real" and using the measurements performed on students at the gym of UNAGE Iași, correlated with studies in the field of anthropometry, we tried to demonstrate the close connection between the construction of the body and the different sports skills that could be exploited at a given moment at a high level. This study could be used in the eventuality of some selections in schools and in institutions with a sports program.*

**Key words:** *anthropometry, morphology, sport, performance*

### 1. Introduction

From intuitive classification based on the observation of the truth from nature to measurements and the establishment of relationships between different segments of the body, the present study tries to demonstrate the fact that the assessment of anthropometric aptitude for a sports discipline is a fundamental aspect of performance in this field. There are scientific studies that tried to correlate anthropometric characteristics with a specific sports discipline, presenting complex information about the weight of adipose tissue, bone structure and diet. The present study tries to capture the essence, the evidence of the construction of the human body making an intuitive analysis of it.

### 2. Artistic perspective in anthropometry

Artists were the first specialists concerned about the proportions of the human body. Since Antiquity, the human body has been studied by Egyptian, Greek, and Roman artists. Renowned Greek sculptors, such as Lysippos (390-300 BC), Polykleitos (480-420 BC), Praxiteles (395-330BC) developed canons of proportion which have retained their validity to this day, establishing a module (proportioning segment) and finding different mathematical ratios between body segments.

Lysippos notices the defining aesthetic importance of the ratio between the head height and waist (vertex-ground distance). Taking for the first time the height of the head and the ratio waist / height of the head = 8, as module, he establishes a proportionality system that will know a wide use: the head is comprised 8 times in the waist, 3 times in the torso, 4 times in the lower limbs, 3 times in the upper ones, 2 times in the leg and shoulder width (T. Vlad, R. Minea, 2019, p. 163).

Based on the artist's need to choose his own models and to categorize them, depending on the specifics of its composition, the main morphological types were developed. They are primarily differentiated by construction, general shape, external modeling, but also by the particularities of the proportions of the body and its parts (between them and relative to the whole body). The morphological type is

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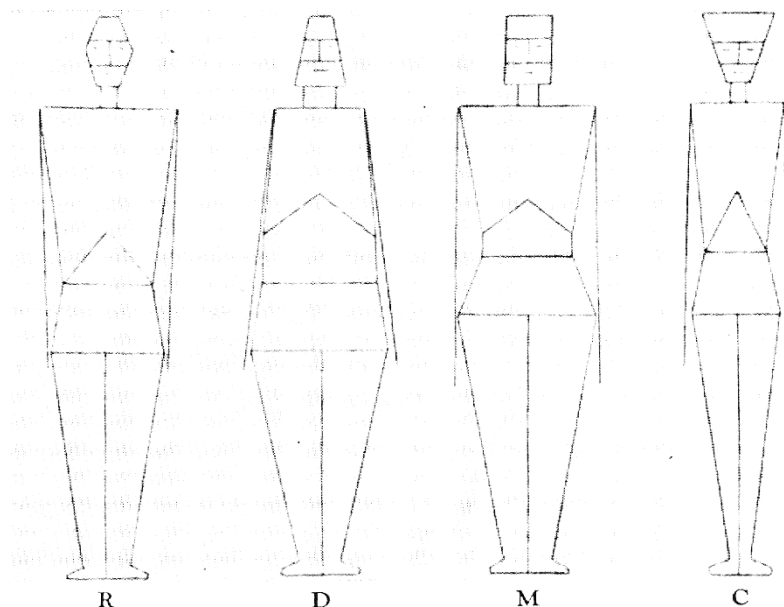
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a benchmark resulting from the comparison of a large amount of people, a reference model for some particular cases.

The essential proportionality factor is the ratio between the length of the torso and that of the lower limbs. According to this report, individuals can be classified as dolichomorphic (with high limbs), mesomorphic (balanced) and brevimorph (with short lower limbs). In all three types the constant segment is the height of the torso, differentiating itself on the basis of the variable length of the lower limbs (T. Vlad, R. Minea, 2019, 130).

The Mesomorphs have a proportionate body construction, balanced between the torso and the lower limbs. The Dolicomorphs are defined by the length of the lower limbs. They appear shorter when seated and taller when standing (orthostatism). Dolicomorphs are usually tall and thin, but they can also be medium or short. Brevimorphs are distinguished by shorter lower limbs. By this feature of construction, they appear taller when seated and shorter when standing. Brevimorphs are usually stocky when short, and stout when tall.



The morphological types presented schematically: R -respiratory type, D- digestive type, M- muscular type, C- cerebral type. (according to Claude Sigaud)

The morphological type can be defined starting from the experience of the real (the anthropological method) but it can also be glimpsed in works of art, in which we can recognize real specimens. Claude Sigaud envisages a method of defining morphological types, emphasizing the classification of constitutional categories on functional characteristics. He thus develops a typology based on the discrete predominance of one of the four great apparatuses: respiratory, digestive, muscular and cerebral (Gh. Ghițescu, 2011, p. 94).

Claude Sigaud notes the stylistic unity of the four variants in which the dominance of one apparatus does not influence the balance of the others and does not destroy the harmony of appearance. According to him, the respiratory type has a torso in the shape of an upside-down trapezium, long in relation to the lower limbs and the wide thorax dominates the other segments.

The digestive type has a long torso also, but its general shape is trapezoidal with the large base down, being dominated by the large development of the abdomen. Unlike the respiratory type, the digestive one has a high flank region and

a high umbilical-symphysis distance, an open xiphoid angle, and the shoulders pulled towards the torso. Linked to the development of the mandible, on the face, the lower floor is dominant. The contour of the head is a trapezoid with the base down.

The muscular type is characterized by balanced in proportion torso and lower limbs. In turn, the torso is rectangular and the development of the thorax and abdomen is well balanced. The face has a straight contour also, with an equal development of the three floors, and harmonious features.

The cerebral type has a high waist, dominated by the length of the lower limbs. The torso is quadrilateral, straight and thin. The long limbs lead to a relatively short torso located in the upper part, towards the ground. Because of the greater development of the forehead, the face has a trapezoidal contour with the large base upwards, which gives an aesthetic impression dominated by severity.

### **3. The scientific perspective**

There are scientific studies (Magdalena Wiacek, Ryszard Tomasiuk, Igor Z. Zubrzycki, 2022) that looked at the applicability of anthropometric measurements for a personalized selection of sports disciplines. The sports disciplines studied in this regard were wrestling, triple jump, badminton and tennis. The ratio between the height of the torso and the length of the lower limbs, the length of the arm, the ratio of height-chest circumference, height of the torso-length of the leg were taken into account. There are studies that included other ratios, such as sitting height/leg length, sitting height/arm length, sitting height/waist circumference, sitting height/chest circumference, arm/leg length, and arm length/forearm length.

Some studies (Smaruj, M.; Orkwiszewska, A.; Adam, M.; Jeżyk, D.; Kostrzewa, M.; Laskowski, R., 2019, p. 154) suggest that total adipose tissue is a factor of great importance when considering fitness for a particular sport, but a recent review of body composition by training season (Heydenreich, J.; Kayser, B.; Schutz, Y.; Melzer, K., 2017) revealed that body composition does not it is related to the sport, but is a function of diet and training. Furthermore, it is a marker of aptitude for a particular sporting discipline. Therefore, it cannot be considered a crucial factor for assigning a competitor to a certain sports discipline (Magdalena Wiacek, Ryszard Tomasiuk, Igor Z. Zubrzycki, 2022).

### **4. The morphology of development, a fundamental aspect in anthropometry**

The growth of the skeleton and the muscular system in length, width and depth alternates according to a rhythm that allows the division of the growth over periods. The morphological aspect will thus be dominated either by length, or by width and depth, each being found in the three epochs of growth: childhood, puberty and adolescence. Changes in the size, proportions and thickness of bones and skeletal complexes (pelvis, thorax, shoulders) during growth are closely related to alternating periods of growth of *full shapes* with those of *slender shapes*.

They are characterized not only by the preponderance at a given moment of the round or thin shapes but more, by the dominance of the increase in length or width and depth in the two intervals. The appearance of the body as a whole gives the impression of being stocky or slender, through the dimensional ratios of height

and transversal diameters, which are associated with the appearance of the various segments. In the physical evolution of an athlete the data provided by the way the body grows and the genetic aspect are relevant.

During prepuberty (between eleven and thirteen years old) the still soft and round shapes announce the changes of the near puberty by the accentuated increase in height. The pelvis and shoulders have minimal development compared to the waist. In boys, growth is slower, discreet and delayed, continuing upwards in the next period. The pelvis is proportionally narrower than the shoulders and slightly wider in girls. In girls, the increase in height is fast and ends almost abruptly at the end of this period and the morphological changes are faster and more pronounced. The transition from childhood to puberty is accompanied by a second change in appearance during growth. Up to and including puberty, the growth of the lower limbs dominates and starting at puberty the growth of the torso dominates (T. Vlad, R. Minea, 2019, p. 143).

During puberty (from thirteen to fifteen years old in girls and up to seventeen years old in boys) is the era when width and depth prevail again, the increase in width exceeds the one in length again. The gap between the diameter of the shoulders and the pelvis occurs in *the third period of full forms*, backwards for the two sexes. An important morphological role in these is the increase of the transversal dimensions of the pelvis and hips, causing waist emphasis.

After puberty, adolescence is characterized by a slow increase in height and a gradual completion of differences in the width of the shoulders and pelvis. The height, which has almost reached its term, ceases permanently in girls until the age of nineteen, when the sexualization of forms is completed, announcing the adult female characteristics. At the boys, it continues at a slow pace until the age of twenty-five. The growth stops as the epiphyses are ossified. The male morphological type, with wide chest and shoulders, strong muscular reliefs and rich and varied surface modeling, is gradually approaching the final appearance (T. Vlad, R. Minea, 2019, p. 145).

In the middle of all this changes of the human body is placed a highly specialized structure, called the growth cartilage. This structure has direct implications in the processes of growth, ossification and skeletal modeling in the case of vertebrate species (Marino R., 2011). During embryonic development, most of the skeleton is formed by enchondral ossification, with growth cartilage as the osteoforming source (Xie Y, Zhou S, Chen H, Du X, Chen L., 2014).

In the case of fractures that involves areas of the growth cartilage, they may compromise the metaphyseal vascularisation, with variable consequences depending of the degree of involvement of the growth cartilage. Growth cartilages ossify physiologically at the end of the puberty. In case of boys, the age corresponding to the process is 15-17 years, and in case of girls, 13-15 years (Ağirdil Y., 2020). If the fracture involves a significant portion of the cartilage, the bone may undergo angulation during osteogenesis or the osteoforming process may be completely compromised, resulting in limb length differences at the end of the growing period (Nguyen JC, Markhardt BK, Merrow AC, Dwek JR., 2017).

## 5. Conclusions

Considering the elements of morphology, body construction, but also the genetic factor and age, morphological models can be established that suit the practice of certain sports and, moreover, the achievement of certain performances by capitalizing on the abilities of the respective subjects. The results of scientific studies show that there is a clear relationship between a sports discipline and the anthropometric ratio established in athletes. Anthropometric measurements of wrestlers are the most remarkable of the disciplines studied. The presented approach allows the selection of a specific sports discipline for a young person. Moreover, anthropometric measurement can be a practical tool for the selection of athletes.

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