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ANALIZA WSKAŹNIKÓW ANTROPOMETRYCZNYCH DEFOLIMPIJSKIEGO MISTRZA KARATE

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Adnotacja. Artykuł poświęcono badaniu danych antropometrycznych elitarniej zawodniczki karate – mistrzyni Igrzysk olimpijskich niesłyszących. Celem naszego badania było porównanie somatotypu elitarniej zawodniczki karate ze średnimi wartościami przedstawionymi w literaturze naukowej. W badaniu uczestniczyła dwukrotna mistrzyni Igrzysk olimpijskich niesłyszących (wiek 32 lata, masa ciała – 61 kg, długość ciała – 170 cm). Stwierdzono, że zawodniczka ma ektomorficzny somatotyp, nietypowy dla karate (0,5 – 2,1 – 4,0). Otrzymane dane uzupełniają te, które są już w źródłach naukowych i ujawniają wcześniej niezbadane cechy. Ponieważ elitarni sportowcy często znajdują się w ogonach normalnego rozkładu Gaussa, dane na ich temat są niezwykle cenne dla selekcji sportowej, modelowania i budowania procesu treningowego.

Słowa kluczowe: somatotyp, somatodiagrama, ektomorfik, mezomorfik, endomorfik, elitarny sportowiec.

ANALYSIS OF ANTHROPOMETRIC DATA OF THE DEAFLYMPIC CHAMPION IN KARATE

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Abstract. The article is devoted to the study of the anthropometric data of an elite female karateka – champion of the Olympic Games. The aim of our study was to compare the somatotype of an elite female athlete in karate with the average values presented in the scientific literature. The study involved a two-time deaflympic champion (age 32 years old, weight – 61 kg, height 170 cm). It was revealed that the female athlete has an ectomorphic somatotype atypical for karate (0.5 – 2.1 – 4.0). The data obtained complement those that already exist in scientific sources and reveal previously unexplored characteristics. Since elite athletes are often located in the tails of the Gaussian distribution, data about them is extremely valuable for sports selection, modeling, and construction of the training process.

Key words: somatotype, somatochart, ectomorph, mesomorph, endomorph, an elite athlete.

АНАЛІЗ АНТРОПОМЕТРИЧНИХ ПОКАЗНИКІВ ДЕФЛІМПІЙСЬКОЇ ЧЕМПІОНКИ З КАРАТЕ

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Анотація. Стаття присвячена вивченню антропометричних даних елітної каратистки – чемпіонки Дефлімпійських ігор. Метою нашого дослідження було порівняння соматотипу елітної спортсменки з карате із середніми значеннями, представленими в науковій літературі. У дослідженні брала участь дворазова дефлімпійська чемпіонка (вік 32 роки, маса тіла – 61 кг, довжина тіла – 170 см). Виявлено, що спортсменка має етоморфний соматотип, нетиповий для карате (0,5 – 2,1 – 4,0). Отримані дані доповнюють ті, що вже є в наукових джерелах, і виявляють раніше не вивчені характеристики. Оскільки елітні спортсмени часто знаходяться в хвостах нормального розподілу Гауса, дані про них надзвичайно цінні для спортивного відбору, моделювання та побудови тренувального процесу.

Ключові слова: соматотип, соматодіаграма, екоморф, мезоморф, ендоморф, елітна спортсменка.

Introduction. Karate is a martial art in which athletes compete in different weight categories. Athletes with certain anthropometric and physiological characteristics will have an advantage over others. According to researchers (Blerim, 2017), the morphological status of an athlete is genetically determined and the somatotype in one sport is relatively homogeneous. Thus, anthropometric characteristics can be a selection factor in karate (Sterkowicz-Przybycień, 2010). Therefore, assessing the anthropometric and physiological characteristics of elite athletes can help coaches and identify talents at different stages of athletic development (Nikookheslat, 2016, Tykhorskyi, 2018).

Several publications were devoted to the description of anthropometric characteristics (Sánchez-Puccini, 2014, Sterkowicz-Przybycień, 2010), Koropanovski, 2013), somatotype (Pieter, 2008) of karatekas of different levels, the level of development of physical qualities (Koropanovski, 2013), as well as the correlation interdependence between these indicators (Marinho, 2016). So, for example, it was revealed that in the kumite discipline there are more endomorphs and in kata there are more mesomorphs. Researchers (Koropanovski, 2013, Sterkowicz-Przybycień, 2010), note that among elite athletes, athletes with longer legs prevail compared to athletes of the average level.

High performance in sports requires the development of special physiological qualities, and qualified karatekas must have a high level of preparation for successful performances in competitions (Nikookheslat, 2016). After all, karate fighting involves high-intensity actions in a constantly changing situation, such as striking and defensive techniques, explosive lunges and retreats, which requires the development of both speed of movement and endurance (Ianchuk, Tykhorskyi, Petrenko, 2020). So, the data of scientific literary sources show that elite karatekas are “drier”, that is, they have a lower percentage of fat in comparison with karate-dischargers. For example, highly skilled male karatekas have a percentage of body fat $\approx 7,5\text{--}16,8\%$ (Nikookheslat, 2016).

According to researchers, somatotypes have been studied since the time of ancient Greece (460–377 BC). The modern classification is Sheldon’s classification (1940), which divides somatotypes into Ectomorphic, Mesomorphic and Endomorphic. On the basis of this classification, the Heath-Carter system was developed, thanks to which a person’s somatotype can be determined using special formulas. The advantage of using this technique is its ease of use, it does not require expensive equipment, as well as its prevalence and popularity, which allows us to compare the results obtained by different scientists around the world.

In literary sources, there are discussions about the decisive role of physique in successful performances of athletes, however, the fact of its influence on the result (along with the training process, nutrition, psychological preparation, etc.) remains indisputable.

In the study of anthropometric indicators in karate, athletes are often involved from beginners to international athletes. However, as far as karate is concerned, we did not find any works in which athletes – world champions or deaflympic champions would participate. Since such achievements are rare, studies of individual anthropometric data of such athletes can be useful for revealing additional aspects of sports training, and possibly refuting the previous conclusions.

Purpose of the study: to determine the anthropometric data and somatotype of an elite athlete in karate and compare them with the average values presented in the scientific literature.

Materials and methods. The study involved an elite karateka – two-time champion of the Deaflympic Games. Age – 32 years old, weight category up to 61 kg.

Body weight was measured on a Beurer BG 17 electronic balance with a measurement accuracy of up to 100 grams. Body length was measured using an RPV-2000 vertical height chart with a measurement accuracy of 1 mm. Based on

the data obtained, BMI was calculated. To determine the thickness of the subcutaneous fat folds, an electronic calliper was used with an error of no more than 0.2 mm. The circumference of the shoulder and lower leg was measured using a centimeter tape, the measurement accuracy was up to 1 mm. Joint widths were measured using a Rosscraft Campbell-type bone width calliper, with an accuracy of 1 mm.

The Heath-Carter method (Heath, Carter, 1967) was used to determine the somatotype (level of endomorphism, mesomorphism, ectomorpha) of the athlete. Ten anthropometric parameters were measured to calculate the somatotype: length and body weight, thickness of subcutaneous fat folds on the triceps, scapula, abdomen and lower leg, shoulder and lower leg circumference, and the width of the knee and elbow joints. The Heath-Carter equation (1967) was used to determine the somatotype.

Results. The data obtained in the course of this study of the two-time deaflympic champion is presented in table 1.

The results obtained indicate a low level of endomorphism – 0.5 points, a low level of mesomorphism – 2,1 points and an average level of ectomorpha – 4,0 points.

Discussion. To the best of our knowledge, there hasn't been any research done on the Olympic Games winners. The purpose of this work was to find the anthropometric characteristics of the deaflympic champion and compare them with the averaged data of literary sources that describe the contingent from beginners to highly qualified representatives of martial arts. Investigating the anthropometric characteristics of an elite karateka, a somatotype not typical for this sport in particular, and for martial arts in general, was revealed. The karateka who took part in the study is an ectomorph. In karate, the most common somatypes are meso-endomorphs, endo-mesomorphs, and ecto-mesomorphs. The athlete has a body mass index of 20,1 kg×cm², which is normal.

Analyzing the data from literary sources (Gloc, Plewa, & Nowak, 2012), a summary table was created that displays the anthropometric characteristics of karate fighters (Sánchez-Puccini, Koropanovski, 2013, Sterkowicz-Przybycień, 2010, Raković, 2015), taekwondo fighters (Pieter, 2008), aikidoka (Bernaciková, 2014), (see table 2), and also built Heath-Carter somatochart, for visual comparison of somatypes (see figure 1).

Table 1

Anthropometric indicators of the two-time deaflympic karate champion

Age, years	32
Body length, cm	174,0
Body weight, kg	61,0
BMI, kg × cm ²	20,1
Subcutaneous fat folds:	
Triceps, mm	2,0
Shoulder blade, mm	2,0
Belly, mm	3,0
Shin, mm	2,0
Shoulder circumference, cm	28,0
Shin circumference, cm	29,0
Endomorphic level, points	0,5
Mesomorphic level, points	2,1
Ectomorphy level, points	4,0

Table 2

Comparison of the studied anthropometric characteristics among representatives of martial arts

Literary source	Kind of sport	n	Level	Gender	Body height	Body mass	BMI	Endo	Meso	Ecto
[13]	Karate	19	Elite	M	167,4±9,3	65,4±12	U/N	4,0	4,2	2,1
[7]	Karate kumite	19	Veterans	M	181,0±8,0	77,6±10,9	23,5±2,1	U/N	U/N	U/N
	Karate kata	12	Veterans	M	174,1±5,5	70,5±5,0	23,2±1,8	U/N	U/N	U/N
[10]	Taekwondo	9	Elite	M	165,9±12,8	53,8 ± 13,4	U/N	2,0	3,7	2,7
		9	Elite	W	160,8 ± 10,4	50,5±10,4	U/N	3,4	2,4	2,4
[14]	Karate	14	International	M	179±0,05	86,1±8,25	U/N	3,7	5,8	1,3
	Karate	16	National	M	180±0,07	81,4±11,99	U/N	3,5	5,0	2,0
[8]	Mixed martial arts	8	Elite	M	177±5	82,1±9,6	U/N	2,9	6,4	1,9
[2]	Karatekas	50	U/N	M	173,8±5,13	67,2±8,3	22,1±2,6	3,1	4,2	2,9
	Not athletes	50	U/N					3,4	5,0	2,7
[9]	Karate	40	Elite	M	177,9±6,2	72,8±9,98	23,2±2,36	U/N	U/N	U/N
[3]	Taekwondo	32	Juniors	M	161,8±12,7	51,1±11,1	U/N	3,4	4,2	3,6
		30	Juniors	W	158,2±9,14	46,8±8,51	U/N	3,7	3,2	3,7
[15]	Athletes	250	U/N	Mix	168,8±5,63	60,4±5,53	U/N	2,9	4,7	3,9
	Not athletes	250	U/N	Mix	168,3±5,59	58,43±6,48	U/N	4,9	3,4	3,3
[1]	Aikido	33	Newbies	M	178,1±8,1	81,2±10,1	25,6±2,7	2,0	4,9	2,6
	Aikido	33	Middle level	M				4,1	5,9	1,6
	Aikido	33	High level	M				3,8	6,3	1,4
[11]	Karate	12		W	169,6±4,8	64,3±7,1	U/N	3,1	3,7	2,4

Note: U / N – Unknown

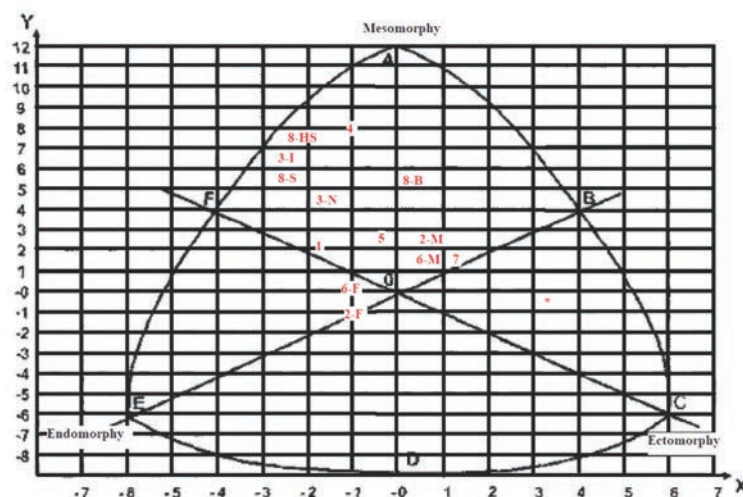


Fig. 1. Somatotype of representatives of martial arts

Note: * – The athlete who took part in our study; 1 – Elite karate athletes (Sánchez-Puccini, 2014); 2-M – Elite male taekwondo athletes (Pieter, 2008); 2-F – Elite female taekwondo athletes (Pieter, 2008); 3-N – National level karate athletes (Sterkowicz-Przybycień, 2010); 3-I – International level karate athletes (Sterkowicz-Przybycień, 2010); 4 – Highly qualified representatives of MMA (Marinho, 2016); 5 – Karate athletes (Marinho, 2016); 6-M – Junior Taekwondo athletes, men (Čular, 2013); 6-F – Junior Taekwondo athletes, women (Čular, 2013); 7 – Athletes (Sukanta, 2014); 8-B – Aikidoka beginners, men (Bernaciková, 2014); 8-S – Qualified Aikidoka, men (Bernaciková, 2014); 8-HS – Highly skilled aikidoka, men (Bernaciková, 2014).

In a study by Sánchez-Puccini, M.B et. al. (2014), in which 19 male karatekas took part, it was found that the height of the athletes was $167,4 \pm 9,3$ cm, body weight was $65,4 \pm 12$ kg, and the somatotype, according to the Heath-Carter classification it was (4,0-4,2-2,1) for the levels of endomorphism, mesomorphism and ectomorphy, respectively. Comparing these results with those obtained by us, it can be seen that the studied athlete, having a higher height, weighs less than the participants in this study do.

N. Koropanovski with colleagues investigated the differences in anthropometric characteristics and indicators of physical development of karatekas in the disciplines of kata and kumite (Koropanovski, 2013). According to the researchers, kumite karatekas with longer lower limbs have an advantage, and kata athletes have 6-7 better stretch. Kumite athletes are generally endomorphic, while kata athletes are mesomorphic. The karateka who took part in our study confirms the thesis regarding the length of the legs, and having an ectomorphic physique complements the data on kumite athletes.

Comparing the somatotypes of young karate and taekwondo women, W. Pieter came to the conclusion that karate women are more endomorphic than taekwondo women (Pieter, 2008). The data of the taekwondo athletes who took part in the study, according to the Heath-Carter classification – $2,88 \pm 0,69$ - $3,24 \pm 1,03$ - $3,41 \pm 1,01$ for the level of endomorphism, mesomorphism and ectomorpha, respectively.

According to K.L. Sterkowicz-Przybycień, karatekas who prefer punching techniques are more mesomorphic than those who prefer kicking techniques. The same is true for boxing (Vedat, 2020), where female athletes generally have a mesomorphic physique (5-5-1) for endomorphic, mesomorphic and ectomorphic components, respectively. The karateka who took part in our study prefers kicks and is an ectomorph, which confirms the data given in the study of K. L. Sterkowicz-Przybycień (2010).

It is very important for athletes in martial arts to have high speed for striking and timely application of defense techniques. It was revealed that the mesomorphic component closely correlates with the strength of the upper limbs. There is also a negative correlation between isometric trunk strength and the level of endomorphism in martial arts athletes, and the level of fat is negatively correlated with strength of the lower limbs and strength endurance (Marinho, 2016). Highly qualified karate athletes must have a high level of physical fitness for successful performances in competitions. High performance athletes require specific physical characteristics, understanding of which can help sports scientists and coaches develop training strategies (Nikookheslat, 2016).

A positive correlation was found between the explosive strength of the legs and the % of muscle mass, lean body mass by the level of ectomorphy and mesomorphism, as well as a negative correlation between the explosive strength of the legs, body weight, height and the level of endomorpha (Sukanta, 2014). Considering the fact that with an increase in sportsmanship, the level of subcutaneous fat tends to decrease, our data complement previous studies in the aspect of the training process of elite athletes.

When studying the experience of other martial arts, in particular taekwondo, it was found that elite athletes have a lower level of fat compared to middle class athletes. For successful kick techniques, athletes must have a high level of ectomorphic component, however, many successful taekwondo athletes are characterized by a mesomorphic body type. It is noted that representatives of martial arts often have a similar physique (Čular, 2013). According to

studies, taekwondo women have a balanced ectomorphic physique in 28% of cases, a central somatotype in 25% of cases and a meso-ectomorphic physique in 15% of cases.

As for athletes in aikido, according to studies (Bernaciková, 2014), the endo-mesomorphic body type is typical here. However, the authors point out that there are many factors that influence the variation in somatotypes, such as gender, age, training experience, and skill level.

Conclusions. Based on the study of these scientific sources, we came to the conclusion that the majority of martial arts representatives are at the top of the somatochart and have a high mesomorphic component. The studied karateka, being a deaflympic champion, has anthropometric characteristics that are not typical for this kind of sport, namely, she has a pronounced ectomorphic somatotype (0.5–2.1–4.0). Even in one sport, anthropometric characteristics may not be homogeneous. Studying the experience of elite athletes complements already known data and reveals previously unexplored characteristics. Since elite athletes are often found in the tails of the Gaussian distribution, data about them is extremely valuable for sports selection, modeling, and building the training process.

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