

# Anthropometric predispositions for kumite specialization in traditional karate

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

Paweł Piepiora <sup>1ABCDE</sup>, Magdalena Superson <sup>1BCD</sup>, Justyna Bagińska <sup>1CDE</sup>,  
Małgorzata Zając <sup>1ABC</sup>, Daniela Stackeová <sup>2BDE</sup>, Kazimierz Witkowski <sup>1ABC</sup>

<sup>1</sup> Faculty of Physical Education and Sports, Wrocław University of Health and Sport Sciences, Wrocław, Poland

<sup>2</sup> College of Physical Education and Sports PALESTRA Ltd., Prague, Czech Republic

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## Abstract

### Background and Study Aim:

In traditional karate, the kumite competition is dominated by hand techniques. Due to the specific nature of this competition, most probably a hypothesis is true that kumite athletes will have an athletic body build with a predominance of upper limbs. The aim of this study was to verify this hypothesis and the knowledge on the anthropometric predispositions of traditional karate competitors specializing in kumite.

### Material and Methods:

Subjects (n = 30) are randomly selected, active Polish traditional karate competitors competing in kumite – senior female karatekas (n = 15) and senior male karatekas (n = 15), with dan master degrees, dan a professional experience (national and international) of 4 years or more. The anthropometric method was used. The Rohrer Index of the subjects was calculated. Based on the data obtained, the Ape Index classification for karate players. Then the Ape Index of the tested persons was compared to the number of ranking points they obtained during the Poland season of 2021/2022. Basic descriptive statistics and Spearman's rank correlation were performed, assuming a significance level  $\alpha$  of 0.05.

### Results:

Senior female karatekas are characterized by a leptosomic build type and symmetrical range of limbs. Senior male karatekas are characterized by a pyknic type of build with a positive Ape Index. In senior female karatekas, a correlation was observed between the Ape Index and the number of ranking points. Among the senior male karatekas, no correlation was observed between the Ape Index and the number of ranking points.

### Conclusions:

The hypothesis regarding the athletic built of athletes practicing traditional karate turned out to be false in relation to the researched sample. In the studied population of traditional karatekas, senior females have a predisposition to kata and kumite competition in the semi-contact formula. On the other hand, the studied senior males have a predisposition to kumite in the knockdown formula.

### Keywords:

Ape Index • combat sports • semi-contact • shobu ippon • sports selection

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### Conflict of interest:

Authors have declared that no competing interest exists

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### Author's address:

Paweł Piepiora, Wrocław University of Health and Sport Sciences, I. J. Paderewskiego 35 street, P-2 room 247, 51-612 Wrocław, Poland; e-mail: pawel.piepiora@awf.wroc.pl

**Kata** – a formal arrangement of related sequences of movements, attack and defense techniques in specific positions and breathing patterns [47].

**Kumite** – fight understood as sport competition according to specific rules or training sparring match [46].

**Semi-contact** – limited-contact points-based formula [49].

**Shobu ippon** – fight to 1 point: 1 ippon or 2 wazari. Scoring the ippon results in a win before the end of the regulation time of the fight [50].

**International Traditional Karate Federation** – the first traditional karate organization in history. It was founded by Hidetaka Nishiyama, who was its long-time leader. He passed away on November 7, 2008 [51].

**Anthropometric points** are precisely defined locations on the human skeleton or on the human body. The distances between them or between them and the ground (base) are called anthropometric measurements [20].

**Vertex (v)** – anthropometric point: in the median sagittal plane at the highest point on the head when positioned in the Frankfurt plane (odd) - used to measure body height [20].

**Basis (B)** – anthropometric point: the lowest point of the body located on the sole of the foot in the horizontal plane on which the subject is standing (odd) - used to measure body height [20].

**Dan (dan'i)** – a term used to denote one's technical level or grade [52].

## INTRODUCTION

Traditional karate was established in 1972 as a result of an organizational split of the World Union of Karate Organizations (WUKO) due to the modifications introduced in the judging of kata and kumite competitions [1], which deviated from the Budo tradition [2]. In 1974, the traditionalists established the International Amateur Karate Federation (IAKF) [3]. In 1986, the IAKF officially changed its name to the International Traditional Karate Federation (ITKF) to emphasize the traditional values of karate [4]. In sports competitions, traditional karate is performed in kata and kumite competitions with a gender and age division for the competitors. Unlike sports karate, kumite competitions do not have weight category divisions. They are decided in the semi-contact system in the *shobu ippon* scoring system [5]. It should be noted that in traditional karate, unlike kyokushin karate [6], the emphasis in kumite is on hand techniques [7].

An important aspect in directing karate students to kata or kumite specializations are anthropometric indicators. During sports selection, coaches direct short karatekas with comparable limb lengths to the kata specialization. In contrast, tall karatekas with long limbs are directed by coaches to kumite specialization [8]. The rationale for this division stems from the fact that the performance of kata by short karatekas is perceived by the judges as more dynamic, while the kumite competition performed by karatekas with long limbs allows them to manoeuvre the fight over a long distance and use their full technical-tactical potential [9, 10].

In coaching, the most common anthropometric indicator for sports selection is the Ape Index [11]. This is the ratio of one's arm span to one's height. It is believed that the arm span of most people corresponds to their height, which means that most people have a neutral Ape Index, that is, in such cases, the Ape Index equals 1 [12]. This indicator is important in combat sports [13], individual sports [14], and team sports [15], where having long arms is considered an advantage for a given height. Noteworthy, this indicator is universal: there is no gender and race division here.

Due to the specific nature of this competition, most probably a hypothesis is true that kumite athletes will have an athletic body build with

a predominance of upper limbs. Therefore, the aim of this study was to verify this hypothesis and the knowledge on the anthropometric predispositions of traditional karate competitors specializing in kumite.

## MATERIAL AND METHODS

### Research subjects

The research subjects ( $n = 30$ ) were randomly selected active Polish traditional karate competitors competing in kumite – senior females ( $n = 15$ ) and senior males ( $n = 15$ ). All subjects hold dan master degrees. Their professional experience was 4 years or more (Table 1). The subjects undertook competition on the national and international arena in the ITKF. Their respective places won during the 2021/2022 season were ranked. In this study, the ranking points scored in Poland by individual kumite athletes were taken into account. The 2021/2022 season was carried out in the sanitary regime due to the COVID-19 pandemic [16-18]. The range of points scored by the subjects was 0 to 86.

### Method

The anthropometric method was used in the present study. The TM-915 TECH-MED personal scale was used to measure the weight of the subjects. A CHARDER HM 200P PORTSTAD designed by CHARDER was used to measure the height of subjects. For limb measurements, the Gulick's BASELINE anthropometric tape was used. First, the Rohrer index of the examined persons was calculated:  $\text{body weight [g]} / \text{height [B-v]} [\text{cm}^3] \times 100$  [19].

The results were interpreted according to Kowalewska's classification [20]: for women: <1.23 leptosomic type; 1.23-1.43 athletic type; >1.43 pyknic type; and for men: <1.14 leptosomic type; 1.14-1.34 athletic type; >1.34 pyknic type.

Based on basic descriptive statistics and the mean value of Rohrer's Indices, an Ape Index classification was proposed for karate athletes because there is no such index for this discipline. The following classification was adopted for the present study: <1 karatekas with predominantly longer lower limbs – predisposition to kumite; 1 karatekas of a symmetrical limb range – predisposition to kata; >1 karatekas with predominantly long upper limbs – predisposition to kumite.

**Table 1.** Descriptive statistics of the studied karatekas: female n = 15; male n = 15.

Variable [indicator]	Statistical indicators	Females	Males
age [years]	Mean	19.2	22.8
	Standard deviation	1.6	4.748
	Min	18	18
	Max	23	32
weight [kg]	Mean	49.466	72.733
	Standard deviation	11.383	13.877
	Min	26	48
	Max	78	95
height [cm]	Mean	159.8	173.6
	Standard deviation	11.383	13.877
	Min	137	158
	Max	174	195
arm span [cm]	Mean	160.133	171.333
	Standard deviation	12.815	13.533
	Min	132	142
	Max	178	198

### Research procedure

The study was carried out by the Combat Sports Research Team in the Department of Sports Didactics at the Wrocław University of Health and Sport Sciences between February and June 2022. The subjects took anthropometry in their underwear. First, the Rohrer Index and the Ape Index of the subjects were calculated. Then the Ape Index of the subjects was related to the ranking points they obtained in Poland in the 2021/2022 season.

The project received a positive opinion of the Ethics Committee for Scientific Research at Wrocław University of Health and Sport Sciences number 7/2021.

### Statistical analysis

Statistical analyses were performed using Excel and Libre Office Calc. Basic descriptive statistics and Spearman rank correlation were performed assuming a significance level  $\alpha$  of 0.05.

## RESULTS

Analysis of the mean Rohrer Index data showed that female seniors can be assigned to the leptosomic type, while male seniors to the pyknic

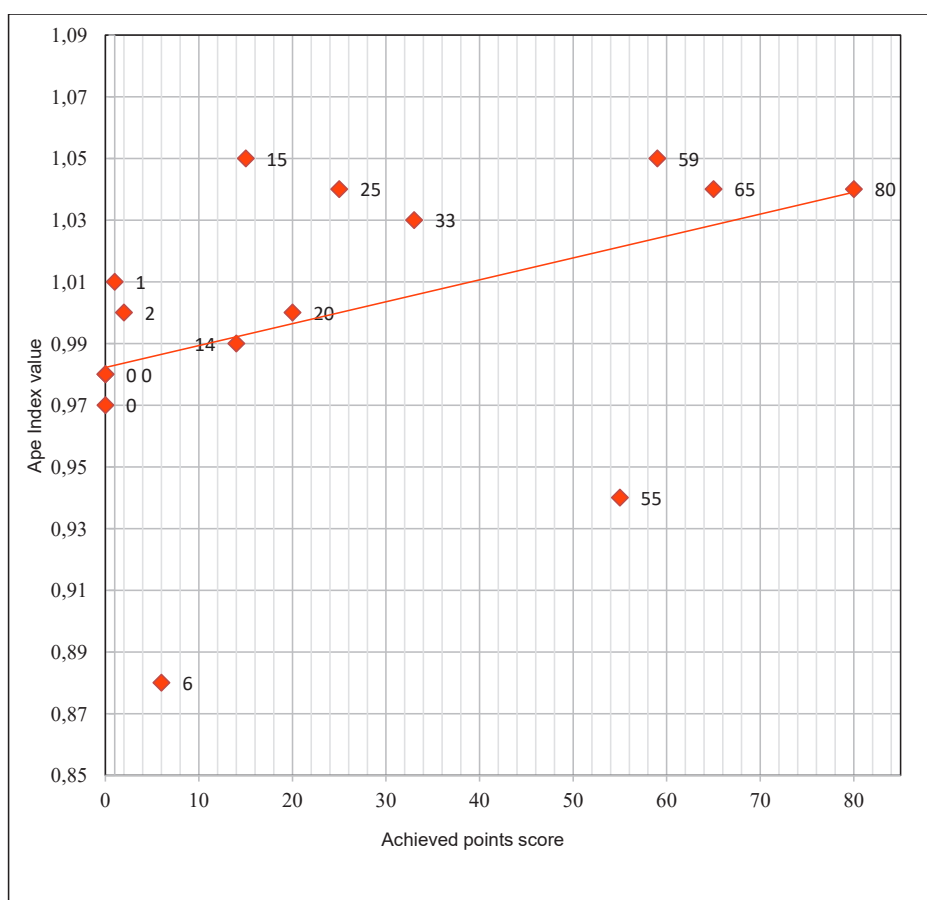
type. Furthermore, the analysis of the mean Ape Index data showed that senior females can be assigned to karatekas with symmetric reach, while senior males to karatekas with a positive Ape Index (Table 2).

A breakdown of the data from the senior female Ape Index with the points they scored in the 2021/2022 season noted the Spearman rank correlation coefficient of 0.575, the significance level is 0.574, with degrees of freedom of 13. The result of the significance test of the correlation coefficient is 3.1, for the critical value it is 2.2. The result is therefore statistically significant (Figure 1).

A parallel breakdown of the data from the senior male Ape Index with the points they scored in the 2021/2022 season noted the Spearman rank correlation coefficient of 0.128, with degrees of freedom of 13. The result of the significance test of the correlation coefficient is 1.691, for the critical value it is 2.2. Therefore, the result is statistically insignificant. In the regression equation, a tendency to a decrease in the value of the independent variables was observed with an increase in the value of the dependent variables (Figure 2).

**Table 2.** Comparison of the average Rohrer Index and Ape Index of the surveyed karatekas

Variable [indicator]	Statistical indicators	Females (n = 15)	Males (n = 15)
Rohrer Index	Mean	1.194	1.38
	Standard deviation	0.12	0.16
	Min	0.97	1.11
	Max	1.48	1.71
Ape Index	Mean	1.00	1.015
	Standard deviation	0.05	0.04
	Min	0.88	0.98
	Max	1.05	1.11

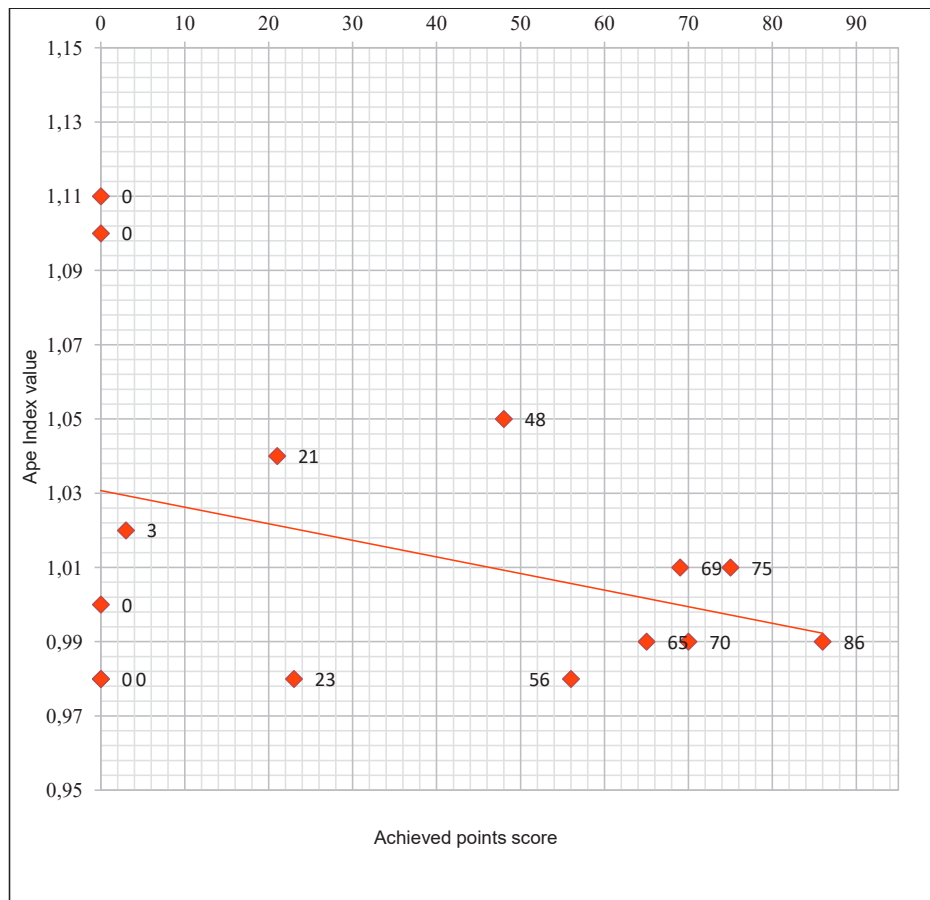


**Figure 1.** The Ape Index of the senior female karatekas (n = 15) and the number of points scored.

## DISCUSSION

The hypothesis adopted proved to be false in relation to the sample studied sample from the population of athletes practicing traditional karate, with respect to their athletic body build. Therefore, the results of the observations of

15 female and 15 male Polish karatekas should be regarded as a pilot study. The hypothesis that kumite athletes will have an athletic body build with a predominance of upper limbs is thus open to secondary verification.



**Figure 2.** The Ape Index of the senior male karatekas (n = 15) and the number of points scored.

Meanwhile, in the studied population of traditional karate, female seniors are characterized by a leptosomic type of build and symmetrical range of limbs. Therefore, it can be assumed that kumite competitors in traditional karate are characterized by a petite physique and poorly defined muscles. They have a slender body, thin bones, insignificant adipose tissue, and limbs proportionately equal [21]. According to the proposed Ape Index classification, female seniors are predisposed to kata. But leptosomic type of build may have a chance of success in kata and kumite specialization [22], yet only in the semi-contact formula [23]. The prospect of limited contact means that the leptosomic type may have as good a chance of success in semi-contact kumite competition as the athletic type, as evidenced by the positive correlation in female seniors between the Ape Index and the ranking points.

Male seniors, on the other hand, are characterized by a pyknic build type with a positive Ape Index. On this basis, it can be assumed that kumite

competitors in traditional karate are characterized by round shapes and a tendency to accumulate body fat. Their well-developed muscles are barely visible. The pyknic type is characterized by severe fat accumulation throughout the body, which is very difficult to reduce due to slow metabolism [24]. The chest, shoulders and hips are moderately broad, and there is a lack of pronounced indentation and prominence throughout the figure, and the face is also full. It should be noted that the pyknic is not weak. This type performs well in endurance and power exercises [25]. But these abilities decline rapidly with age. This is associated with increased fat in people who do not diet or participate in any physical activity [26].

The above indicates that kumite athletes are not typical athletes (athletic type) and traditional karate is not suitable for their predisposition. The pyknic type can successfully pursue an athletic career, but not in traditional karate due to the nature of semi-contact competition. This type will perform well in combat sports such as judo [27],

sumo [28], and wrestling [29]. Furthermore, among the studied kumite athletes, only a trend towards a correlation between a negative Ape Index and the number of points in sport competition was noted. This has not been linked to the dominance of foot attack techniques in fighting tactics, as in taekwondo [30], but rather to the specificity of long-distance fighting manoeuvres – shortening the distance by rapid access in long positions to the opponent [31].

In general, the pyknic type in traditional karate is a major sporting challenge due to its tendency to put on weight [32]. If athletes of this build are trained, they must constantly maintain a slight energy deficit [33]. Furthermore, plenty aerobic exercise, cardio, and interval training are recommended, as this promotes a faster burning of excess body fat [34]. In view of the above, it was concluded that the male seniors studied have a predisposition to kumite in the knockdown formula [35], a characteristic of kyokushin karate [36].

At this point, it should be noted that the sporting environment is very rich in different disciplines. Therefore, people with different physiques perform better in disciplines in which they can utilize their predispositions [37, 38]. The correct determination of one's physique allows sporting [39] and

nutritional [40] preferences to be tailored. This is important because what works for the athletic type may have the opposite effect for the pyknic or leptosomic type. This is why individualization of training methods, forms and measures during the specialization stages is so important [41].

It is worth mentioning that the proposed Ape Index classification for karate athletes is a cognitive novelty in the sport sciences (more precisely: in the science of martial arts [42, 43]). Taking into account the knowledge of kumite systems, somatotypes, and Ape Index of karate athletes, it is possible to accurately adjust for them the specialization in kata or kumite in Olympic [44], sport (style) [45], and traditional [46] karate.

## CONCLUSIONS

The hypothesis proved to be false in relation to the study sample from the population of athletes practicing traditional karate, in terms of their athletic physique. In the studied population of traditional karate athletes, female seniors have a predisposition to kata and kumite competition in the semi-contact formula, while the studied male seniors have a predisposition to kumite in the knockdown formula.

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