

IMPORTANCE OF MORPHOLOGICAL CHARACTERISTICS FOR SUCCESS IN JUDO

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ABSTRACT

The aim of this review paper is to determine the significance of morphological space for success in judo, through the analysis of previous results of various scientific papers. The research included 739 respondents of both sexes, aged 13 to 24 years. The analysis of the obtained results revealed that there are statistically significant differences in morphological characteristics between the sexes at all ages, and that these differences are mainly in height, weight, circumference, and limb length, which are all greater in men, as well as subcutaneous tissue and body fat percentage, which are both greater in females. Subcutaneous adipose tissue has been found to be a complicating factor during judo performance. The obtained results generally indicated that morphology did not have a crucial impact on judo performance, which was shown for almost all ages, especially for the ages of 13 to 16 years. The judoist somatotype mainly showed that judoists belong most often to the mesomorphic somatotype, then to the endomorphic and a combination of the mesomorphic and endomorphic, while the ectomorphic type is rarely present among judoists. In regard to differences in morphology between high and lower-ranked judoists of both sexes, there are negligible differences.

KEYWORDS: judo, morphology, anthropometric characteristics, analysis.

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1. INTRODUCTION

Judo belongs to the category of martial arts that originated in Japan. In addition to being a martial art, judo is a competitive sport that became an official Olympic sport for men in 1972 and for women in 1992 [1]. Success in judo depends not only on the technical and tactical readiness of the athlete, but also on the level of development and mutual correlation of different segments of anthropological status. Judo requires strength, speed, flexibility, agility, explosive power, anaerobic strength, and endurance [2]. In addition to the mentioned segments, in judo, the psychological readiness, competitive experience, technical and tactical ability to apply a wide range of fighting techniques at a high level are certainly important. In judo, it often happens that competitors, despite their extraordinary psychophysical preparation, and high rating on the ranking list of the World Judo Federation (IJF), finish their performance in the competition in the first fight. Additionally, it is not uncommon for lower-ranked fighters to win the most important world competitions. These findings indicate that the outcome of a judo match is not easy to predict, which makes judo more interesting, both for the audience and science [3]. The role of morphological characteristics and body constitution in sport activities is substantial. For specific types

of kinesiological activity, a specific morphology type is necessary for above-average and top result achievement. Additionally, for above average and top result achievement, long-term training procedures are necessary, with regards to previous selection, genetic basis and social surroundings [4].

Morphological characteristics appear to be of great importance for orientation and selection in most sports disciplines. Given that morphological characteristics are present in the specification equation of every sport, morphological characteristics play a major role. For a large number of sports disciplines, the morphological structure that affects sports efficiency the most is already known, although the coefficients of participation of individual morphological dimensions in the specification equation undoubtedly change due to the development of technique and tactics, and modern achievements in a particular sport [5]. An important factor in success in judo is morphological (anthropometric) characteristics. Body weight, which belongs to the morphological space of a person, dictates in which weight category the judokas will compete. The significance and connection of morphological space with judo achievements have been analyzed in previous researches [1-11]. The research, related to the morphological space of the respondents, most often addresses the analysis of the body

composition of judoists or definition of the morphological (anthropometric) profile of judoists, followed by determining the differences between the sexes, weight categories and levels of judo performance. Very few studies have analyzed the significance and influence of morphological space on the performance of specific techniques of fighting, gripping, position, etc. which would be of great importance in terms of adapting the technical training of judoists to their morphological predispositions. The aim of this review paper is to determine the significance of morphological space for success in judo, through the analysis of previous results of various scientific papers.

2. Materials and Methods

2.1. Literature research

To collect relevant research works from 2005 to 2020, the electronic search engines PubMed, MEDLINE, Google Scholar, ScienceDirect, and ERIC were used. The search was conducted based on the following keywords: judo, morphology, anthropometric characteristics, and analysis. The search strategy was modified for each electronic database, where possible, to increase sensitivity. All titles and abstracts were reviewed for papers with the potential to be included in the systematic review. Additionally, lists of references from previous reviews and original research were reviewed. Literature research was performed by one author.

2.2. Data extraction

The PICO (Participants, Intervention, Comparison or Control Group, Outcomes) format was used to extract data: respondents, sample size, group comparisons, and results were obtained. Data extraction was performed according to the Cochrane Consumers and Communication Review Group's data extraction protocol. The selection and verification of the accuracy and completeness entered data were performed by one author. All included papers were reviewed in full to enter the necessary data. The search identified 579 potentially relevant studies, and another 21 were identified by reviewing references. After removing the duplicates and reviewing the titles and abstracts, 75 papers remained. After reviewing the entire text according to the inclusion criteria, 13 papers remained (Figure I).

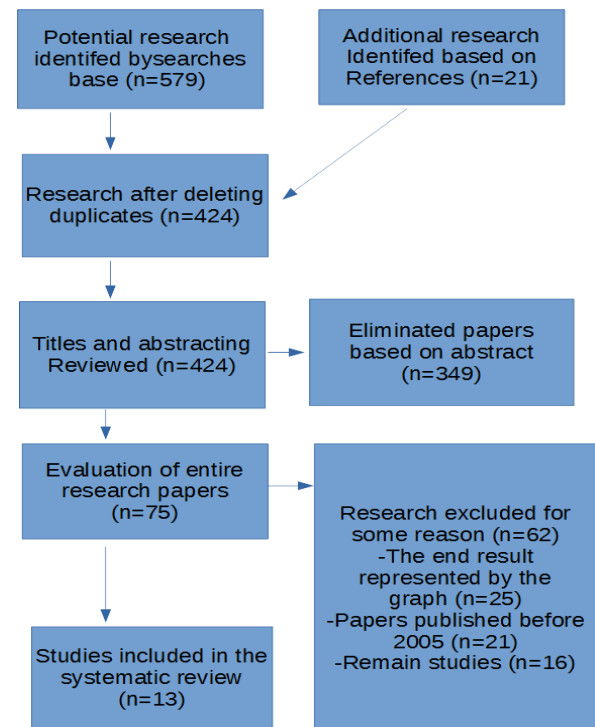


Figure I. Flow Diagram

3. Results and Discussion

In the 13 scientific papers analysed, a total of 739 subjects were analysed, of which 458 were male and 281 were female. The age of the respondents ranged from 13 to 24 years. The studies analysed, most often aimed at determining differences in morphological characteristics between judoists of different sexes, ages and weight categories, as well as to determine differences between judoists of different type of judo performances. Additionally, part of the research analysed the importance of morphological characteristics on the efficiency of performing specific-motor judo tests, as well as to determine the somatotype of judokas and compare them with those of athletes of different martial arts. Determining differences in absolute and relative morphological characteristics, Nikolova and Dimitrova found that men have higher morphological variables such as body height, arm span, leg length, and forearm and upper arm circumferences [1]. There were no differences in the dimensions of the lower extremities. Additionally, judokas had higher values for all measured skin folds, as well as the percentage of body fat. The same study found that better-ranked judo cadets were taller and had a larger arm span than their less successful peers, and had a lower percentage of fat and more lean body mass. Statistically significant differences between more successful and less successful female judokas were found in almost all analysed variables.

In studies by Shariat *et al.* and Burdukiewicz *et al.* [12, 13], differences in morphological characteristics between judokas and

athletes from other martial arts disciplines were determined. Shairat *et al.* [12] found that judokas had significantly higher weight, subcutaneous adipose tissue, body fat percentage, and lower nonfat mass than karate and taekwondo athletes. Furthermore, the research found that judokas with an average of 21.7 years showed a significantly higher prevalence of endomorphic somatotype than karate and taekwondo athletes. The researchers noted that athletes did not differ in body height, which is related to the positive effects of body height on athlete performance that were found in similar studies [13, 14] found that female judo athletes competing in universities aged 21.2 years had a statistically significant difference in body weight compared to their karate and fencing peers. The ratio of body height, sitting height, and length of the upper and lower extremities did not differ significantly between athletes, which is broadly in line with the results of the above study [12], although it was a study that analysed sex differences in martial arts athletes. Female judoists showed higher upper body circumferences compared to other athletes. No statistically significant differences were found in the percentage of body fat however, the authors indicated that judo and jiu-jitsu athletes showed higher levels of body fat than the competitors in karate, taekwondo and fencing. The highest degree of mesomorphic somatotype and low level of endomorphic somatotype were found in female judoists, while the ectomorphic somatotype had the lowest prevalence among female judokas.

Franchini *et al.* [11] conducted a study aimed at identifying and comparing morphological characteristics between judoists of different sexes in categories of cadets, juniors and seniors. Researchers have found that male judoists have higher weights, are taller and have a lower body fat, and higher percentage of muscle mass than female judoists. Male judoists had fewer endomorphs and more mesomorphic components compared to female judoists. Ali *et al.* [15] found high levels of body fat in female judoists with an average age of 22.5 years and a negative correlation of body fat with aerobic power. Also, Gurses *et al.* [16] found in a sample of subjects of both sexes, within a sample of subjects of both sexes, with an average age of 14.8 years, that the test sample had a higher percentage of body fat than the samples from other studies, which directly reflected the negative impact on judo performance, especially on anaerobic performance. In male judoists, as in other athletes, body weight and body fat percentage have a negative effect on the values of maximum oxygen consumption. A lower percentage of adipose tissue allows top judokas to have better metabolic adaptation to different technical and tactical requirements during the match [17].

Determining differences in anthropometric characteristics and neuromuscular function by age, sex, and weight category, Torres-Luque *et al.* [6] found that there was a statistically significant and large difference in the percentage of body fat between individuals of different sexes aged 14 to 17 years. The percentage of body fat in male judoists was 12.7%, while in female judokas the percentage of body fat was 24.6%. The authors also found that body fat percentage and body mass index (BMI) increased from the lower to the heavier categories of competitors in both sexes. The authors found that female judoists competing in the heavier categories had a very high body fat percentage and suggested that lower body fat percentages could contribute to improved neuromuscular function and therefore the dynamics of judo combat. Katralli, Goudar [18], comparing differences in anthropometric characteristics and judo performance tested by the Special Judo Fitness Test (SJFT), found that there were no statistically significant differences in anthropometric characteristics (except in body height) between seniors training judo for more or less than 5 years. Additionally, similar to the previously analysed results, in this study, a negative effect of body fat on performance in SJFT was found.

Based on the obtained results, the authors are of the opinion that physical components are not discriminatory for success in judo, i.e., long-term judo training has a minimal effect on anthropometry when in regard to top judokas aged 18-25 years. Djapic *et al.* (2013) determined the latent structure of morphological simplicity on a sample of judokas aged 13-15 years, with at least 3 years of judo practice. According to the results, the morphological space is defined by 4 factors, namely: longitudinal dimensionality, subcutaneous adipose tissue, transverse dimensionality and the factors of body volume and mass [19]. After identifying the latent variables of morphological and motor space, regression analysis revealed a high level of joint influence of morphology and motor skills on the judoist's situational performance. However, individually isolated morphological factors did not significantly influence the prediction of success in judo. The authors concluded that judo success within the analysed sample was determined by the development of a range of basic motor skills, primarily explosive power, coordination, and psychomotor speed.

Krstulovic *et al.* [9] also defined latent morphological space on a sample of judoists with an average age of 15.6 years, based on 14 manifested morphological variables. Based on the results obtained, the authors defined the longitudinal dimensionality factor, absolute volumetric factor, and transferral dimensionality

factor. The authors classified the judoists into four groups according to their judo performance rank, and the results of the study did not reveal differences in anthropometric latent space between groups. Accordingly, Krstulović *et al.* [9] concluded that the morphological structure does not contribute to success in judo in respondents aged 15-16 years. As one of the reasons for the aforementioned conclusion, the authors point out that in judo the weight category limits the variation in the results, i.e., the morphological statuses of judokas are quite uniform due to weight restrictions. Sertić, Segedi (2014) defined the latent structure of morphological space on the basis of 18 anthropometric variables in a sample of students from the Faculty of Kinesiology, aged 19 to 21: body volume and mass factor, subcutaneous adipose tissue factor, and longitudinal and transverse dimensionality factor [7]. The authors found a very low influence of morphological space on performance in judo. The authors explain the obtained results with an extremely large number of judo throwing techniques, in which athletes have the opportunity to choose the appropriate techniques that will be most effective in accordance with their morphological characteristics.

Elipkhanov and Nemtsev (2013) analysed differences in anthropometric characteristics among female judoists on different ranks. Additionally, compared to lower-ranked candidates (Candidates for Master of Sports of Russia), better-ranked female competitors had shorter lower limbs, longer arms and more developed forearm muscles, as well as greater chest volume during inspiration and expiration [10]. Socha *et al.* [20], in a sample of 25 female judoists of the Polish National Team with an average age of 20.2 years, showed that functional dominance, defined as the preferred (dominant) side of attack during the execution of basic judo techniques in right-handed women, eliminates the established morphological asymmetry of most circumferences and skin folds, as well as the dynamic asymmetry of hand grip strength. The authors of the research noted the similarity of the results obtained with the results of some previous studies, which state that the probability of success in judo may not be related to the standard classification of judoists in regard to

right-handed and left-handed but that success is more related to the type of technique used.

4. CONCLUSION

By analysing 13 scientific studies that focused primarily on the analysis of the morphological space in judo athletes, it is possible to report different conclusions. A high percentage of body fat in judokas is a factor that complicates judo performance. The increased percentage of body fat is mainly present in female judokas, while body fat is significantly lower in male judokas. Body height, length and arm span can be characterized as advantages in judo wrestling.

The obtained results mainly indicated that morphology does not have a crucial influence on judo performance, which was shown at almost all ages. The classification of judoists into weight categories contributes significantly to the reduced differences between judoists in regard to morphology. A wide range of judo techniques allow judoists to successfully apply those techniques that best suit their morphological predispositions. The somatotype of a judoist generally indicates that judoists exhibit a mesomorphic somatotype, followed by an endomorphic somatotype and a combination of these two somatotypes, whereas the ectomorphic type is generally rarely represented in the judoist body composition.

In regard to the difference in morphology between higher and lower ranked judoists in both sexes, there are almost negligible differences. The most common differences between male judoists of different levels of success in regard to seniority are usually in the amount of subcutaneous fat, body height and arm length. The lack of research on the morphological space in judo athletes is reflected in the insufficient analysis and correlation of the morphological space with the techniques of judo, which would be necessary to assess in future research. Certainly, the different lengths of the extremities due to the lengths of the levers does not positively influence the performance of all techniques in judo, so it may be useful to direct future research into that direction.

Conflict of interests

The authors state that there are no conflicts of interests.

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