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Somatotype components in judoists

Katarzyna Sterkowicz-Przybycień[1], Wiesław Błach[2], Ryszard Żarów[3]

[1] Institute of Sport, University School of Physical Education in Kraków, Poland
[2] University School of Physical Education in Wrocław, Poland
[3] Department of Anthropology, University School of Physical Education in Kraków, Poland

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Summary

Introduction. There is a lack of high-quality international evidence concerning somatotypes in judo, which are becoming more and more important in selection of talented individuals. This study is aimed to summarize contemporary scientific output in the field of somatotypes and judo. The analysis was based on the data recorded in databases of Academic Search Complete, Elsevier, Sportdiscus, Medline. Searching and reviewing relevant references and review articles helped identify 21 studies involving 574 male judoists in total. In all the studies, a methodology of somatotype identification by somatochart developed by Carter and Heath [6] was used. At the next stage of the analysis, 5 publications were excluded because they failed to present SDs. Somatotype components were analyzed using an analysis of means (ANOM method). Furthermore, several studies concerning age and gender were also reviewed.

Somatotypes of male judoists. Mean somatotypes of 21 international samples were presented in a somatochart. The grand mean amounted to 2.7-6.3-1.6. The review of the results obtained for judoists revealed that the mean somatotype in 16 groups of contestants is endomorphic mesomorph, whereas five other studies have demonstrated balanced mesomorph.

Somatotypes of female judoists. Typical somatotype in females was endomorphic mesomorph (4 samples) or mesomorph-endomorph (1 sample). The sexual dimorphism in body build in judoists was lesser than in untrained subjects.

Concluding remarks. A typical somatotype among judo contestants is endomorphic mesomorph, with dominant mesomorphy and endomorphy greater than ectomorphy. It can be concluded that many years of training and selection schemes contribute to the development of the somatotypes typical of judo contestants. The analyses of the somatotypes in relation to the factor of age, gender, weight categories and technique preferred are less frequently presented in the relevant literature and need further investigations. The information collected may be useful for judo coaches when making supplementary professional decisions.

Introduction

Sport theoreticians and practitioners predominantly agree that the choice of a particular sport by a candidate should be based on their individual aptitudes (physical, psychological, somatic) [1,2]. It is emphasized that the athletes with potential for success in sport should be found through "careful elimination" in direct "back-up" groups in national teams [3]. Body height can be estimated according to regression equations [4]. The body composition, width and circumference dimensions can be improved through sport training and competitions [5,6], but there is a lack of high-quality updated international evidence concerning somatotypes, which are becoming more and more important in selection of talented individuals in judo. This analysis aimed to review the contemporary scientific output in the field of somatotypes and judo.

The analysis encompassed the data contained in the databases of Academic Search Complete, Elsevier, Sportdiscus, Medline. Searching and reviewing relevant references and review articles helped identify 21 studies involving 574 male judoists in total. In all the studies, the methodology of somatotype identification by Carter and Heath [6] was used and mean somatotypes were presented. The mean somatotypes were presented in a somatochart. At the next stage of the analysis, 5 publications were excluded because they failed to present standard deviation values, which are necessary for comparative analysis of means (ANOM). Somatotype components (endomorphy, mesomorphy, ectomorphy) were analyzed using analysis of means (ANOM method) (16 samples involving 311 seniors). The chart allowed for the determination of the grand mean and upper (UDL) and lower (LDL) decision limit, useful for interpretation of statistical significance of the differences between the means from each study group and the grand mean [7]. Differences were confirmed by the analysis of variance ANOVA and Bonferroni's multiple comparison test. In addition five samples of female judoists were analysed.

Somatotypes of male judoists

The review of the results obtained for judoists revealed that in 16 groups of contestants, the mean somatotype is endomorphic mesomorph, whereas five other studies demonstrated balanced mesomorph. The results obtained in the most recent studies [8,#1] are consistent with previous reports from other studies which investigated the morphological characteristics of Polish elite athletes who practice the sport at a competitive level [11,#5;13,#7]. The profile of Polish National Judo Team (#1) is much similar to the grand mean, which amounts to 2.7-6.3-1.6. The biggest somatotype attitudinal distance (2.4 units) was found in the Japanese National Team [18,#14]

Mean values of the components of endomorphy, mesomorphy and ectomorphy which characterize judo contestants in different studies were analyzed using the ANOM graphical method (Fig. 2 ABC).

Two points outside the decision lines can be observed in the graph which illustrates the level of endomorphy (Fig. 2A), which means that the value of endomorphy in Koreans (#9) is significantly higher than the mean for the whole study material. The National French Team (#15) is distinguished by a substantially lower share of this component compared to the grand mean. Fourteen among the sixteen group characteristics of endomorphy are contained between the lines marked by decision limits (ANOVA F=3.19, p<0.001).

In the ANOM chart which represents the level of mesomorphy, three points are located above the UDL, whereas 2 points can be found below LDL. The teams from Brazil, Japan and France are characterized by statistically significantly higher value of mesomorphy compared to the grand mean calculated for all the data (CL – center line). Polish National Team ((# 5) and Belgian National Team (#10) shows lower values than the grand mean. The analysis of variance confirmed the significant differentiation of the means (F=6.08; p<0.001). The characteristics of the Polish Team exhibit statistically significant differences compared to the mean obtained by Japanese judoists, being a group uniform with other teams (Fig. 2B).

The ANOM chart shows that the level of the component of ectomorphy (Fig.2C) in Belgian team (#10) is significantly higher than the grand mean (CL) and significantly lower in Cuban team (#18). The means compared in ANOVA confirmed the differences (F=3.29; p<0.001). However, they do not concern Polish representation, which is a group uniform with previous studies (Bonferroni multiple comparison test).

The results obtained by [26] demonstrated that the somatotype typical of judoists can be found even in younger contestants (Fig. 3). The typical judo somatotype, endomorph-mesomorph, was found in Polish juniors (3.0-5.5-2.1), representative of Polish senior national team (2.6-6.4-1.8) and the participants of world championships from 37 countries (3.0-6.8-

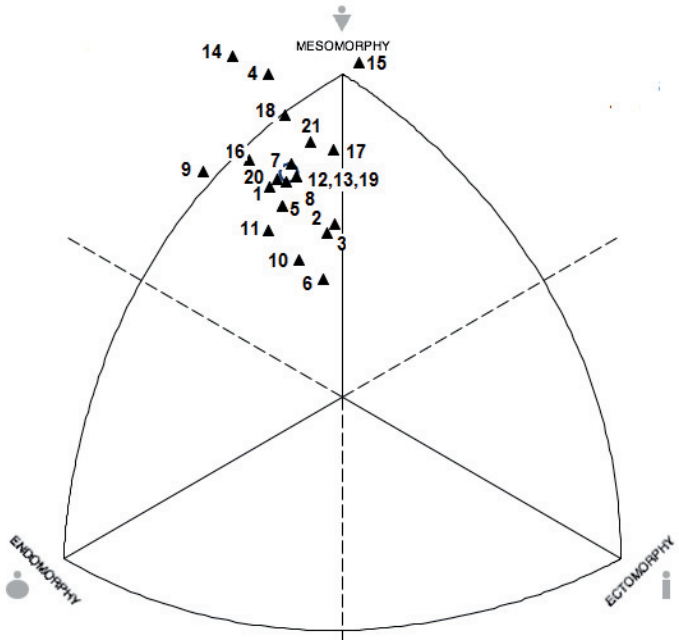

Fig. 1. Somatotypes of judo contestants: 1 – Poland 2003, [8] → endomorphic mesomorph; 2 – Slovakia 2000, [9] → balanced mesomorph; 3 – Slovenia 2000, [9]→ balanced mesomorph; 4 – Brazil 1999, [10] → endomorphic mesomorph ; 5 – Poland 1993 – 95 [11] → endomorphic mesomorph; 6 – Poland 1990, [12] → balanced mesomorph; 7 – POL86 [13] → endomorphic mesomorph; 8 – POL86 [13], juniors → endomorphic mesomorph; 9 – Korea, Dong A University, [14] → endomorphic mesomorph; 10 – Belgium, [15] → endomorphic mesomorph; 11 – POL83 [13], sub – elite subjects → endomorphic mesomorph; 12 – World Championships 1981, [16] → endomorphic mesomorph; 13 – Bolivar Games 1981, [17] → endomorphic mesomorph; 14 – Japan, [18] → endomorphic mesomorph; 15 – France, [18] → balanced mesomorph; 16 – Hungary, [19] → endomorphic mesomorph; 17 – Czechoslovakia Republic 1977, [20] → balanced mesomorph; 18 – Cuba 1976 – 1980,[21] → endomorphic mesomorph; 19 – Pan American Games, 1979, [22] → endomorphic mesomorph; 20 – Brazil, [23] → endomorphic mesomorph; 21 – Olympic Games Montreal 1976, [24, 25] → endomorphic mesomorph.

1.6). Balanced mesomorph somatotype (mesomorphy is dominant, endomorphy and ectomorphy are less or equal or do not differ by more than one-half unit) was found in the youngest Polish judoists (3.2-4.4-3.4) and cadets (2.8-4.9-2.8).

The somatotypes in Fig. 3 illustrate the phenomenon of intensification of the component of mesomorphy with age and sport skill level in judo contestants. Several differences have been recently found among age categories, with cadets

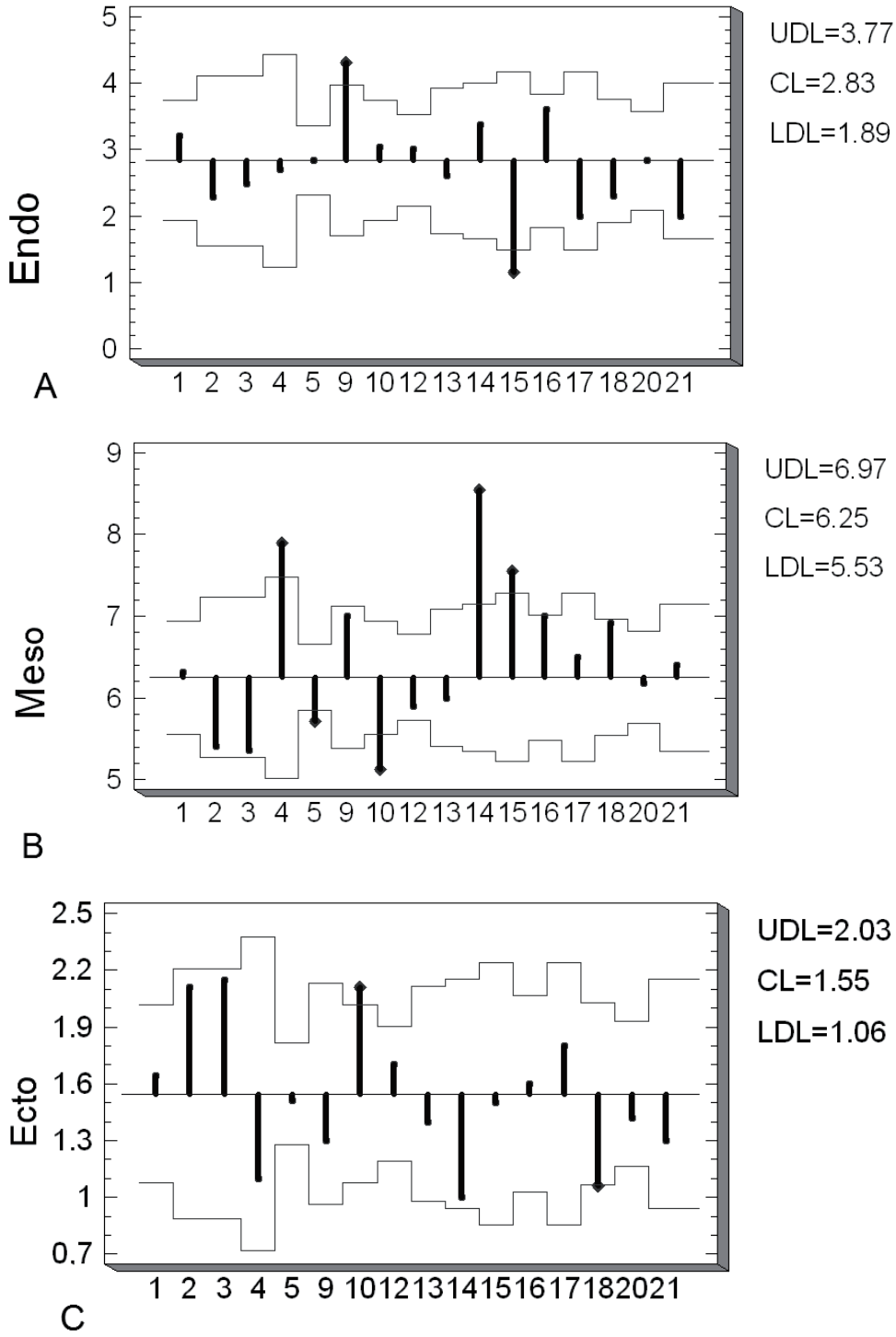

Fig. 2ABC. Analysis of mean components of the somatotype of judo contestants: 1 – Poland 2003, [8]; 2 – Slovakia 2000, [9]; 3 – Slovenia 2000, [9]; 4 – Brazil 1999, 10]; 5 – Poland 1993 – 95 [11]; 9 – Korea, Dong A University, [14]; 10 – Belgium, [15]; 12 – World Championships 1981,[16]; 13 – Bolivar Games 1981, [17]; 14 – Japan, [18]; 15 – France, [18]; 16 – Hungary, [19]; 17 – Czechoslovakia Republic 1977, [20]; 18 – Cuba 1976 – 1980,[21]; 20 – Brazil, [23]; 21 – Olympic Games Montreal 1976, [24,25]

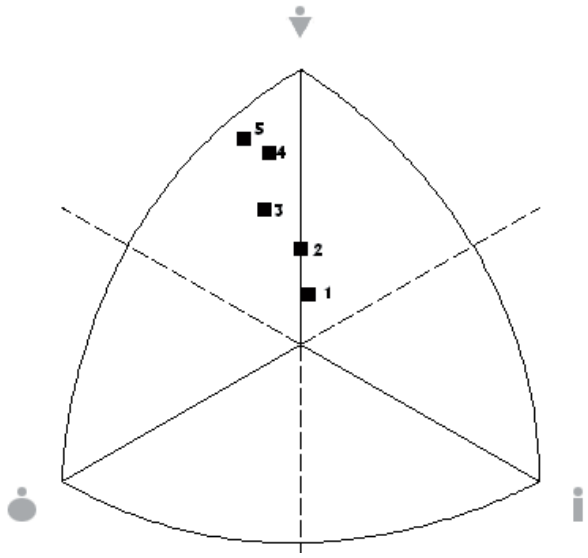

Fig. 3. Group somatotypes for judo contestants in age categories: 1 – youngest judoists POL; 2 – cadets POL; 3 – juniors POL; 4 – senior contestants POL; 5 – participants of world championships

exhibiting smaller flexed arm circumference and humerus epicondyle bone breadth compared to junior and seniors, and lower absolute muscle mass compared to seniors [27]. The relationship between body mass and age, which suggests high stability of development of an individual in terms of specific development is essential to athletic training practice since it allows for forecasting future weight classes in adolescent sportsmen [28]. There is very few data concerning longitudinal observation of somatotype changes in competitors. Throughout the period of three years of the study, the judoists who were ranked higher became more mesomorphic than their weaker counterparts [5]. The elite group had better measurements considered for calculation mesomorphy, i.e. greater circumferences (flexed arm and calf) and breadths (femur and humerus). The elite athletes exhibited higher mean and peak power in upper body found in the Wingate test. They were also characterized by significantly better performance in Special Judo Fitness Test, where the biggest effect size was found for the factor of sport skill level. The indices of skinfolds, hand grip strength, aerobic power and capacity, did not differ between the groups of elite and non-elite judoists [29].

There were some dependencies between the techniques preferred and somatotype components. The judo athletes who have higher mesomorphy tend to be more effective in shoulder throw *Seoi -nage* [23], that is typical of a hand techniques class [30] or techniques of physical lever applied with variable arm group [31]. Judoists who present higher ectomorphy tend to more often use supporting-foot lift pull throw *Sasae-tsuririkomi-ashi* [23], which is typical of the leg techniques [30] or techniques of physical lever applied with maximum arm [31]. A person who represents higher endomorphy often look forward to perform outer wrap-around throw *Soto-makikomi* [23] that is representative for hand techniques [30], but also typical of the techniques of physical lever applied with minimum arm [31]. Judoists who performed mainly leg techniques were also higher and slender, had longer extremities than judoists who preferred hand techniques [32]. In consecutive 7 weight categories, the percent fat in the body mass increased markedly [33,34]. Different somatotypes were observed in subsequent weight categories (60 kg, 66 kg, 73 kg, 81 kg, 90 kg, 100 kg, + 100 kg): balanced mesomorph (in 60 kg mesomorphy is dominant, endomorphy and ectomorphy are less or equal or do not differ by more than a half unit), mesomorph-endomorph (in 66-90 kg, where endomorphy and mesomorphy are equal or do not differ by more than one-half unit) and mesomorphic endomorph (in both 100 kg and over 100 kg, where endomorphy is dominant and mesomorphy is greater than ectomorphy [34]. Heavyweights usually showed higher endomorphy and mesomorphy, and lower ectomorphy than those representing lighter weight categories [16, 20, 34]. Consequently, they had specific technical/tactical profile [35].

Somatotypes of female judoists

Women's judo has been an Olympic sport since Seoul Olympic Games (1988), but data about somatotypes [8,27, 36,37,38], and sexual dimorphism in judoists [8, 27] are rather scarce. Studies tend to present female judoists as mostly endomorphic mesomorph [8,27,36,38] or mesomorph-endomorph somatotype [37]. Although general, the results concerning sexual dimorphism with respect to the somatotype are important. It was found [6, p289] that "in the same sports and events, higher level of fitness or competitiveness do not reduce sexual dimorphism significantly". Male judo athletes were heavier, taller, had less body fat, higher muscle mass percentage and absolute values, higher circumferences and

bone diameters, lower endomorphic and higher mesomorphic components compared to females [27]. Furthermore, there was the likelihood of reduction in the sexual dimorphism in body build in judoists compared to the untrained subjects. Therefore, anthropometric profiling in judo is critical [8].

Concluding remarks

A typical somatotype among judo male and female contestants was endomorphic mesomorph, with dominant mesomorphy and endomorphy greater than ectomorphy. It can be concluded that many years of training and selection schemes contribute to the development of the somatotypes typical of judo contestants. The analyses of the somatotypes in relation to the factor of age, gender, weight categories and technique preferred are less frequently presented in the relevant literature and need further investigations. The information collected may be useful for judo coaches when making supplementary professional decisions.

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Address for correspondence:
Katarzyna Sterkowicz-Przybycień
ul. Wysockiej 2B m. 29, 31-580 Kraków, Poland
phone: 608-146-570, e-mail: wtsterko@cyf-kr.edu.pl or hapki77@poczta.onet.pl

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