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Somatotype of Algerian Male Cadet Judokas by Weight Categories

النمط الجسمي حسب الفئات الوزنية للرياضيين الجزائريين في الجودو اشبال ذكور

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Abstract:

Aim of the study: Body structure may play a determining role in achieving high-level performance in judo, and it seems to influence the type of techniques applied. The objective of this study was to determine the somatotypes of national-level male cadet judokas in different weight categories in order to observe possible differences between athletes. **Material and methods:** A total of 68 male judokas, lightweights (n=35) with an age of (15.5 ± 0.7 years), middleweights (n=23) with an age of (15.12 ± 0.68 years), and heavyweights (n=10) with an average age of (15.39 ± 0.57 years) participated in this study. Anthropometric variables were used to calculate somatotypes, which were determined using the Heath-Carter method. Analysis of variance and Tukey's post hoc test were used to determine differences between weight categories. **Results:** Somatotype differences between weight categories in male cadet judokas were observed. All categories could be classified into three somatotypes in male cadet-athletes. **Conclusion:** The lighter categories were recognized as Meso-ectomorph. The middle categories had the Endo-mesomorphic somatotype and the heaviest athletes had more extreme cases of Meso-endomorphs. According to the results obtained, the judokas have a different body composition than the cadet judokas at the international level. Therefore, coaches should prepare specific training programs for athletes who belong to different somatotypes, as well as monitoring diet.

Keywords: Judo; Skinfolds; Somatotype; Weight categories; Cadet

الملخص: قد تلعب بنية الجسم دورًا حاسمًا في تحقيق أداء عالي المستوى في الجودو ، ويبدو أنه يؤثر على نوع التقنيات المطبقة. و الهدف من هذه الدراسة هو تحديد الأنماط الجسدية لرياضيي الجودو المتدربين على المستوى الوطني في فئات الوزن المختلفة من أجل ملاحظة الفروق المحتملة بين الرياضيين. **المواد والطرق:** إجمالي 68 رياضي جودو ذكور، الأوزان الخفيفة (العدد = 35) مع عمر (15.5 ± 0.7 سنة) ، الأوزان المتوسطة (العدد = 23) مع عمر (15.12 ± 0.68 سنة) ، والأوزان الثقيلة (ن = 10) بمتوسط عمر (15.39 ± 0.57 سنة) شارك في هذه الدراسة. تم استخدام المتغيرات الأنثروبومترية لحساب الأنماط الجسدية ، والتي تم تحديدها باستخدام طريقة هيث كارتر. تم استخدام تحليل التباين واختبار Tukey لتحديد الفروق بين فئات الوزن. **النتائج:** لوحظت اختلافات في النمط الجسدي بين فئات الوزن عند رياضيي الجودو اشبال ذكور. يمكن تصنيف جميع الفئات إلى ثلاثة أنماط جسدية عند هذه الفئة العمرية. **الخلاصة:** تم التعرف على الفئات الأخف على أنها Meso-ectomorph. اما الفئات الوسطى نمطها الجسدي Endo-mesomorphi و اما لدى الرياضيين الأثقل حالات أكثر تطرفًا من Meso-endomorphs. وفقًا للنتائج التي تم الحصول عليها ، فإن لاعبي الجودو لديهم تكوين جسم مختلف عن اولئك المتدربين على المستوى الدولي. لذلك ، يجب على المدربين إعداد برامج تدريبية محددة للرياضيين الذين ينتمون إلى أنماط جسدية مختلفة ، بالإضافة إلى مراقبة النظام الغذائي.

الكلمات المفتاحية: الجودو؛ طيات الجلد؛ النمط الجسمي؛ الفئة الوزنية؛ اشبال.

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Introduction:

Specific somatotype, appropriate body proportions, and defined body composition can determine the success of athletes in different sport disciplines, such as combat sports (Pieter et al., 2009), kayakers (Diafas et al., 2011), etc... Adaptation to exercise during the training and selection process, resulting in a decrease in somatotype diversity in athletes of similar disciplines, in contrast to sedentary populations (Tanner., 1964). Even less somatotype diversity can be observed among athletes practicing the same sport and using the same techniques (Charzewski et al., 1991; Krawczyk et al., 1997; Kuźmicki and Charzewski, 1987; Franchini et al., 2005). The somatotype of athletes is most often compared to the body type of high-performance athletes which serves as a model (Pieter et al., 2009).

Weight categories have been established in combat sports to promote balanced competition for athletes of different sizes and to ensure the safety of participants. Athletes wish to lower their body weight as much as possible to compete in a lower weight category and thus gain an advantage.

Judo is a high-intensity intermittent combat sport, in which many physical attributes are required to achieve optimal technical-tactical development and competitive success (Casals et al., 2017; Dimitrova., 2017; Drid et al., 2015; Trivic et al., 2016). A high level of muscular power is required for decisive moments in the fight, such as throwing and counter-attacking techniques, with the goal of scoring points (i.e., Wazari) or finishing the fight (i.e., Ippon) (Miarka et al., 2012). The body structure may play a key role in achieving high-level performance in judo (Buśko et al., 2017; Krstulovic et al., 2006), and appears to influence the type of techniques applied (Drid et al., 2018; Dimitrova., 2009). Body fat is generally low in these athletes, except in heavyweights (Stachoń et al., 2014; Franchini et al., 2011).

Furthermore, it has been reported that body fat is negatively associated with judo athletes' performance in aerobic and anaerobic tests (Franchini et al., 2005; Kim et al., 2011). For this reason, several studies have sought anthropometric parameters, such as body composition, bone diameter, and bone circumference, because of their great importance for performance (Claessens et al., 1987; Franchini et al., 2005; Kubo et al., 2006). Callister et al, (1991) reported lower fat mass in high-level judo athletes compared to non-high-level athletes (5.1% ± 0.6% vs. 8.2% ± 0.8%). In addition, Kubo et al, (2006) demonstrated that judo athletes who participated in the Olympic Games or Asian Games had significantly greater free fat mass than collegiate judo athletes who did not participate in intercollegiate competitions. Franchini et al (2005) found no significant difference in skinfold thickness between elite and non-elite judo athletes but identified higher circumference (flexed arm, forearm, wrist, and calf) and width (arm and bi-trochanteric) values in elite athletes than in non-elite athletes.

For this reason, it is important to analyze the changes in the somatotype according to the period of preparation in which the judokas are, and the weight category to which they belong.

Through anthropometric measurements, we can make a classification of a physical constitution based on the concept of somatotype (Ross and Wilson, 1974).

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Somatotype of Algerian Male Cadet Judokas by Weight Categories

Some studies carried out in judo suggest that the average somatotype of adolescent judokas is Endo-Mesomorphic (Franchini et al, 2011).

It is known that judokas usually increase their muscle mass and decrease the fat mass in each weight category to obtain an advantage over weaker opponents and that this process begins in early adolescence, with the aim of increasing muscle power (Artioli et al, 2010).

Despite the fact that the judokas begin the competition at a young age, with participation in various cadets' championships at a national and international level, nevertheless, we note a lack of studies on the somatotype of the Algerian cadet judokas by weight categories. The knowledge of the anthropometric characteristics of cadets can help in the process of identification of sports talent, and allow the orientation of its nutrition.

Thus, the purpose of our study is to compare the somatotypes of different weight categories (Lightweight, Middleweight and Heavyweight) of the Algerian cadet judokas.

1. Material and methods

1.1. Participants

The sample of this study is composed of 68 male Algerian cadets at national level where all weight categories are represented: Lightweight Category (- 46 kilos and - 60 kilos) (n = 35), Middleweight category (- 66 kilos and - 81 kilos) (n = 23), and Heavyweight category (-90 kilos and + 90 kilos) (n = 10). The age of subjects was between 15 and 16 years, with experience of practice that varied between five (05) and ten (10) years.

Written consent was obtained from each subject, and all procedures were performed in accordance with the Declaration of Helsinki.

All the athletes have undergone the same anthropometric measurements during the competitive period. In this respect, it is important to analyze the changes of the somatotype in accordance with the period of preparation in which the athletes are and the weight category to which the judoka belongs. Thanks to anthropometric measurements, we can establish a classification of the physical constitution based on the concept of somatotype (Ross and Wilson, 1974).

1.2. Anthropometric measurements

Anthropometric variables were collected according to the protocol developed by the International Society for the Advancement of Kinanthropometry (ISAK). Anthropometric variables included body mass, height, 7 skinfolds (biceps, triceps, subscapular, suprailiac, abdominal, thigh, and calf), 3 circumferences (flexed arm, thigh, calf), and 3 diameters (arm, bicretal, and bi -trochanteric). Body height was measured to the nearest 0.5 cm using a Martin anthropometer (GPM, Switzerland). Weight was measured to the nearest 0.1 kg using a scale (Avery Ltd., St. Albans, UK). Skinfold thickness was obtained using a John Bull caliper (British Indicator Ltd., UK) accurate to 0.1 mm. Circumferences were performed with a Gulick anthropometric tape (Creative Health Products, Plymouth, USA), whereas diameters

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were measured with small calipers (Siber Hegner, Switzerland). Skinfolds were taken three times at each point in a rotating system and the average of 3 measurements was used in the analysis as stipulated by Heyward's protocol (2007). The same trained technician took all measurements. Somatotypes were determined according to the method of Heath-Carter (1990).

1.3. Statistical analysis

The results obtained are presented as mean values and standard deviation (±). Analysis of variance and Tukey's post hoc test were used to determine differences between weight categories. The significance level was set at 5%. All analyses were performed using IBM SPSS Statistics 19.0 software.

1.4. Results

According to the results obtained, male cadet judokas differ in terms of body size according to weight category. These two parameters, weight and height, increase proportionally. In terms of skinfolds, significant differences were found on all folds for all three groups of weight categories, where doubled values were recorded between lightweight and middleweight categories, and up to four times between lightweight and heavyweight categories were recorded (Table 1).

Table 1. Presentation of sample parameters weight (kg), height (cm) and skinfolds (mm)

	Lightweight	**Middleweight**	**Heavyweight**	**Statistics**
Age (years)	15,5 ± 0,7	15,12 ± 0,68	15,39 ± 0,57	
Weight (Kg)	52,14 ± 6,38	72,46 ± 8,02	97,72 ± 9,77	
Height (cm)	161,92 ± 6,37	171,41 ± 7,24	175,82 ± 5,13	F= 12,36, p= 0,000
Skinfolds (mm)				
Biceps	3,25 ± 1,17	6,32 ± 3,27	16,72 ± 2,54	F= 4,32, p= 0,003
Triceps	5,54 ± 1,65	11,84 ± 4,15	28,61 ± 4,12	F= 5,68, p= 0,000
Subscapular	7,42 ± 1,14	13,37 ± 5,28	31,14± 9,75	F= 6,82, p= 0,000
Suprailiac	8,51 ± 3,63	16,9 ± 9,17	33,15 ± 6,54	F= 13,15, p= 0,000
Abdominal	7,26 ± 2,55	17,48 ± 7,56	34,40 ± 8,27	F= 12,75, p= 0,000
Thigh	10,12 ± 5,23	17,43 ± 6,45	28,19 ± 9,16	F= 5,28, p= 0,001

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Calf	8,92 ± 3,94	14,33 ± 5,16	27,18 ± 7,40	F= 5,73, p= 0,002

The circumferences are different between three weight categories (lightweight, middleweight and heavyweight). Regarding to the diameters of the elbow, wrist and knee, we can see that all categories differ from each other. According to the weight categories, the athletes are different by their somatotype (Table 3).

Table 2. Diameters (cm) and circumferences (cm)

Diameters	**Lightweight**	**Middleweight**	**Heavyweight**	**Statistics**
Forearm	5,26 ± 0,37	5,59 ± 0,41	5,88 ± 0,27	F= 0,72, p= 0,602
Arm	6,12 ± 0,79	6,87 ± 0,64	7,18 ± 1,26	F= 1,85, p= 0,097
Thigh	8,99 ± 0,14	9,84 ± 1,01	10,35 ± 1,85	F= 6,75, p= 0,000
Circumferences				
Flexed Arm	21,77 ± 2.,51	27,76 ± 2,12	32,72 ± 3,29	F= 18,15, p=0,000
Thigh	50,11 ± 4,83	56,24 ± 5,63	70,39 ± 3,21	F= 12,51, p=0,000
Calf	30,15 ±2,57	34,56 ± 2,36	41,89 ± 2,77	F= 26,21, p= 0,000

Based on the somatochart, we note that the Lightweight category is Meso-ectomorphic, the Middleweight category is Endo-mesomorphic, while the Heavyweight category is Meso-endomorphic (Fig. 1).

Table 3. Somatotype by weight categories

	Lightweight	Middleweight	Heavyweight	Statistics
Endomorphy	2.25 ± 0.67	4.52 ± 0.71	7.95 ± 0.57	F= 2,98, p= 0,021
Mesomorphy	3.48 ± 0.95	5.39 ± 0.56	6.92 ± 1.26	F= 5,18, p= 0,000
Ectomorphy	3.98 ± 0.54	3.22 ± 0.73	0.98 ± 0.62	F= 4,79, p= 0,000

Linear growth is observed in skinfold value in cadet judoka.

Humerus diameters in male judoka increased linearly across categories, with no exceptions to be noted.

The results of the arm circumference measurement in male judoka were different between three weight categories. The calf circumference values in the three categories were different between them too.

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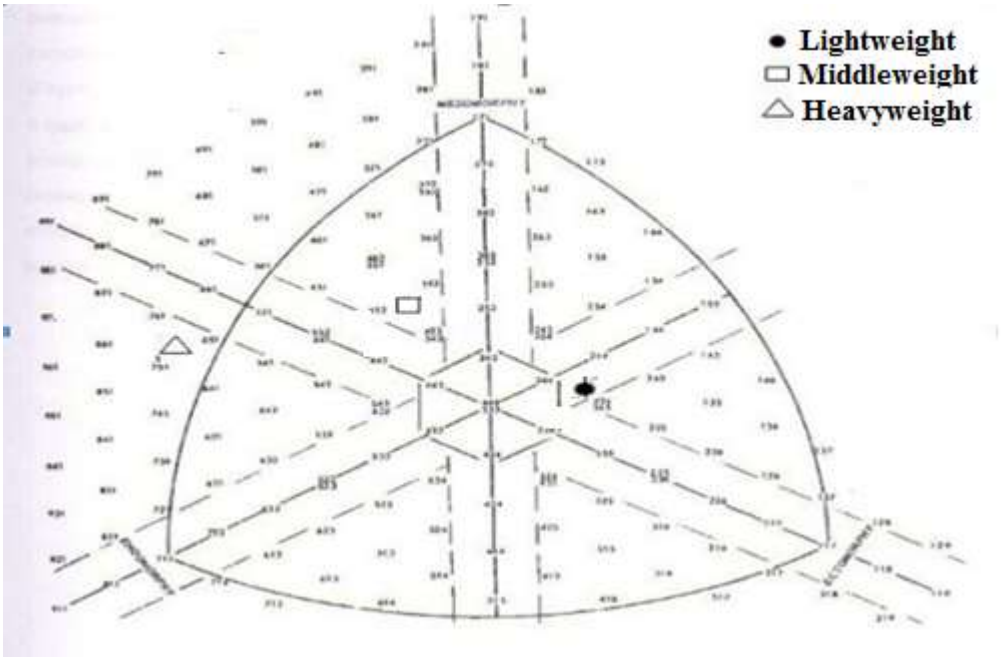
According to the results, the athletes of lightweight category (-46 kg, -50 kg, -55 kg and -60 kg) are Ecto-mesomorphic. The presence of an ectomorphic component could be the result of a low percentage of body fat among the lighter categories in combat sports. For the middleweight category from -66 kg to -81 kg, the athletes belong, according to their body type, to the meso endomorphic type, as shown in figure 1. This body type is most probably the result of the strong muscular component in cadet judokas. Only the heavyweight category (-90 kg and +90 kg) showed a somatotype extremely different from the others (meso endomorphic where the endomorphic component is very pronounced).

Figure 1. Somatotype by weight categories



2. Discussion

There are several publications regarding the somatotype of judo athletes in the literature. These have indicated the anthropometric attributes that are required in this sport. Following the study on the somatotype of athletes from different sports, wrestlers and judokas are the most robust, with a higher level of mesomorphy and a very low level of ectomorphy (Krawczyk et al, 1997). But, to our knowledge, few studies have addressed the somatotype of cadets (15-16 years), while weight categories have not been mentioned (Krstulovic et al, 2006).

In the study by Jagiello (2013), body weight and height of cadet judokas increased linearly and this is consistent with the results of our study.

Pérez and Sanagua (1996), reported lower values of body fat percentage in male cadet judokas participating in the world championship compared to the estimated values in both groups of weight categories in our sample (middleweight and heavyweight categories), while the lightweight category is relatively at the same level. Similarly, the study by Franchini et al, (2011), reported mean somatotype values of Spanish cadets (3.06±0.5-5.2±0.3-1.9±0.3) as endo mesomorphic type. The middleweight category is of the same type (4.52 ± 0.71-5.39 ±

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0.56-3.22 ± 0.73), where the endomorphic (fat) component is higher and the mesomorphic (muscle) component is slightly higher in our middleweight judokas in comparison with the Spanish cadet judokas. When we compare the somatotype of our middleweight judokas with the Spanish cadet judokas who participated in the World Championship, which are of endo mesomorphic type (Pérez and Sanagua., 1996), the endomorphic and mesomorphic components of Algerian athletes are significantly lower.

The other two categories that are lightweight (Meso-ectomorphic), and heavyweight (Meso-endomorphic) are different from both samples composed of Spanish cadets (Pérez and Sanagua., 1996; Franchini et al, 2011).

Comparing the results of different authors who have studied the physical fitness of judokas, it can be concluded that with the increase in the level of competitors in this sport, the value of mesomorphy increases, while the value of endomorphy decreases (Franchini et al. 2011; Jagiełło, 2013; JiWoong et al. 2014). Motor skills, strength and power are important components of physical performance in judo, and are closely related to anthropometric variables.

Lewandowska et al., (2011) study of Polish judoka indicated that mesomorphic component values influenced muscle strength and power generation. Competitors with higher levels of mesomorphy may develop greater acceleration and overcome greater external resistance. This factor can have a substantial influence on the effectiveness of a judo bout (Jagiełło, 2013). Judoka's strength and power ratings were highly correlated with mesomorphy (positively) and ectomorphy (negatively). The strength and power assessment variables were not correlated with endomorphy.

The lightweight category of Algerian judokas has lower mesomorphy values and higher ectomorphy values than both Spanish samples, while the Algerian heavyweight category has lower mesomorphy values and higher endomorphy values than both Spanish samples.

According to Franchini et al, (2011), morphologically, high-level cadet judo athletes are similar to older (senior) athletes, and coaches can select them from these ages, although other aspects (technical, psychological, physiological, etc.) must be considered.

3. Conclusion

Judo being a weight category sport, our study explored the 3 weight category groups in cadet boys. The somatotype subdivision of judo athletes resulted in approximately 3 different body type groups overall. The results of our study show similarities with the results of other previous studies regarding the middle category, whereas the other two categories are different. Since the current study showed somatotype differences between weight categories, coaches need to apply their knowledge and skills to prepare judokas according to their specific body type to improve their performance. They can guide their training by taking into account the desirable body profile that athletes should have.

Nutritionists can also benefit from these findings to prepare an appropriate diet for athletes who need to achieve a specific body type profile.

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Appendices

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