SOMATOTYPE OF YOUNG TAEKWONDO COMPETITORS

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(Original scientific paper)

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Abstract

The aim of this study is to compare the somatotype of young cadet male and female taekwondo competitors. The subject sample includes 32 Croatian female taekwondo cadets and 30 Croatian male cadets. Mean chronological age of girls was 14.08±0.91 years, mean body height was 158.20±9.14 and body mass was 46.86±8.51. Boys' mean chronological age was 13.80±1.45, body height was 161.81±12.79, and body mass was 51.06±11.10. Mean somatotype values calculated by the Heath-Carter method were 3.71-3.19-3.70±1.42-1.02-1.14 for girls and 3.45-4.17-3.58±1.94-1.12-1.58 for boys. Based on a Category Chart, nine somatotype categories were found for female competitors and seven categories for male competitors. The majority of young female participants fit the balanced ectomorph (28.13%) and mesomorphic ectomorph (15.63%) category. Among male competitors, the highest percentage (43.33%) fit the mesomorphic ectomorph category, followed by the mesomorphic endomorph category (23.33%).There were no significant differences found by analysis of variance (SANOVA) in somatotype between young male and female taekwondo competitors, with F=2.85 and the level of significance p=0.092.

Key words*: morphological characteristics, young male cadets, young female cadets, Heath-Carter, differences;*

INTRODUCTION

Taekwondo belongs to poly-structural contact combat sports that are dominated by open or semi-open movement structures which are performed in variable conditions. It can be said that taekwondo is an individual sport in which movements are practiced in advance (*attack-counter attack*), but their performance depends on the opponent's reactions. High automatization of movements which requires a competitor to react as quickly as possible in certain situation is essential for achieving top results.

The somatotype is a convenient shorthand descriptor of overall physique in terms of body shape and composition independent of body size. Because of its uniqueness, *somatotyping* has been used to study many aspects of exercise, sports sciences and human biology, which may be important in identifying talented young athletes for particular sports (Carter, Ackland, Kerr, & Stapff, 2005).

The application of new *Somatotype Ver.1.2.5*. software package according to Goulding (2010) has caused investigations on somatotype of different athletes and populations to evoke greater interest and become more attractive to many scientists because the programme uses certain age and gender coefficients in addition to basic morphological measures necessary for somatotype calculation.

Investigations conducted by Gao (2001) and Gao, Zhao & Liu (1998) established that the percentage of subcutaneous fat tissue in elite taekwondo athletes is relatively lower in comparison to average athletes. Pieter, Palabrica, & Bercades (1998) established that the mesomorphy component is predictive for success in taekwondo. It can be expected, due to characteristics of using leg techniques and a system of weight categories, that more successful taekwondo athletes should, among other things, also be more ectomorphic (*length of extremities*), which should be further investigated and tested.

Training taekwondo athletes, from the scientific point of view, represents a great challenge for coaches because taekwondo is, kinesiologically speaking, still a relatively unexplored area. In the

lack of relevant scientific studies and knowledge on planning and implementing training processes, coaches are still relying greatly on their own experience and traditional methods that have never been proven in preparing competitors for competition (Pieter, 2009).

In the available literature, the authors have not succeeded in finding any studies that have investigated somatotype on taekwondo competitors of younger age categories.The aim of this scientific study was to determine the somatotype of young male and female cadet taekwondo competitors aged 13 to 15 years and to analyse their differences.

SUBJECTS AND METHODS

The subject sample included 62 young Croatian cadet taekwondo competitors, which was divided according to gender into 32 females and 30 males. Mean chronological age of girls was 14.08±0.91 years, mean body height was 158.20±9.14 and body mass was 46.86±8.51. Boys' mean chronological age was 13.80±1.45, body height was 161.81±12.79, and body mass was 51.06±11.10. All the subjects have participated in taekwondo competitions, from city to international competitions.

The sample of predictor variables included a set of ten anthropometric measures aimed at calculating the somatotype by Heath-Carter method (1967, 1990): body height, body mass, triceps skinfold, back skinfold, abdominal skinfold, calf skinfold, upper arm circumference flexed, calf circumference, elbow diameter, and knee diameter. The variable is represented by mean of two measurements of anthropometric measures. All measurements were taken in closed taekwondo courts during morning hours.

Methods of data analysis included the calculation of descriptive statistical indicators of ten morphological measures: middle value (Median), mean (M), standard deviation (SD), minimum and maximum value (Rank), and calculating the MaxD value for determining the normal distribution of variables by KS-test. The existence of statistically significant differences between the somatotypes of male and female taekwondo competitors was tested by SANOVA analysis of differences.

Data analysis was performed by *Somatotype* and *Statistica Ver.11.00*software packages.

RESULTS AND DISCUSSION

The results of descriptive statistics of morphological variables of 32 female young cadet taekwondo competitors are presented in Table 1. The analysis of distribution parameters indicates that the variables showed no significant deviations from normal distribution. The testing of distribution normality was performed by Kolmogorov-Smirnov test with critical value of 0.24.

Young female taekwondo competitors tested in this study were averagely 3 cm shorter and 3 kg lighter than 152 female students of primary school Bijaći from Kaštela and 25 female Croatian karateka of approximately the same age tested in a study conducted by Katić, Jukić & Milić (2012). In relation to female handball players of the same age (Zapartidis, Vareltzis, Gouvali, & Kororos, 2009), female Croatian taekwondo competitors tested were averagely 2 cm shorter and 2 kg lighter. Comparing body height and mass with young female volleyball players, young female taekwondo competitors are averagely 10 cm shorter and 10 kg lighter (Milić, Grgantov, & Katić, 2012). This indicates that body height is not crucial for success in taekwondo as it is in volleyball nor is body mass crucial for success as in handball. Young female taekwondo competitors are also averagely 5 cm shorter and 6 kg lighter than their karateka peers (Jukić, Katić, & Blažević, 2012).According to the Norms of the Republic of Croatia these female competitors are also 3 cm shorter and 5 kg lighter (Katić et al., 2012).

All skinfolds, both circumferences and diameters in female volleyball players of the same age have higher values than those in young female taekwondo competitors (Milić, Grgantov, & Katić, 2013).

Young female cadet karateka also have higher means of skinfolds, circumferences and diameters, but in a relatively smaller degree than female volleyball players. Therefore, it can be noticed that female representatives of combat sports share similar morphological build (Jukić et al., 2012).

The results of descriptive statistics of morphological variables of 30 Croatian young male cadet taekwondo competitors are presented in Table 2. The analysis of distribution parameters indicates that the variables showed no significant deviations from normal distribution, except for the abdominal skinfold which had the limit value of 0.26, so parametric analyses can be applied in further analysis.

Table1 Descriptive statistics of variables of morphological characteristics of young female cadet taekwondo competitors (N=32)

Variables	Median	M	SD	Rank	KS
Body height	158.97	158.20	9.14	142.1-178	0.09
Body mass	46.50	46.86	8.51	32.5- 6.9	0.08
Triceps skinfold	11.48	12.87	5.41	5.3-30.83	0.22
Back skinfold	7.55	8.19	2.83	4.6-16.7	0.16
Abdominal skinfold	12.14	13.72	7.26	4.2-33.97	0.23
Calf skinfold	10.82	11.97	4.84	4.97-22.73	0.18
Upper arm circumference flexed	23.50	23.84	2.19	20.3-29.18	0.06
Calf circumference	32.00	32.09	2.45	27.8-38.13	0.06
Elbow diameter	5.81	5.87	0.26	5.4-6.5	0.09
Knee diameter	8.53	860	0.50	7.8-10.25	0.06
					Test= 0.24

LEGEND: Median – middle value, M – mean, SD – standard deviation, Rank – minimum and maximum value, KS – Kolmogorov-Smirnov test

Table 2 Descriptive statistics of variables of morphological characteristics of young male cadet taekwondo competitors (N=30)

Variables	Median	M	SD	Rank	KS
Body height	159.30	161.81	12.79	138.5-186.5	0.16
Body mass	52.75	51.06	11.10	33-69.2	0.11
Triceps skinfold	9.93	11.93	6.42	5.07-30.22	0.24
Back skinfold	7.13	8.40	4.01	4.97-21.7	0.23
Abdominal skinfold	8.41	13.03	9.54	5.03-40.48	0.26
Calf skinfold	9.25	12.24	7.23	4.03-30.2	0.21
Upper arm circumference flexed	26.11	25.60	3.24	19.25-31	0.11
Calf circumference	33.54	33.15	2.90	27-37.75	0.17
Elbow diameter	6.47	6.50	0.62	5.6-8.08	0.09
Knee diameter	9.41	9.25	0.81	5.93-10.1	0.11
					Test= 0.25

LEGEND: Median – middle value, M – mean, SD – standard deviation, Rank – minimum and maximum value, KS – Kolmogorov-Smirnov test

The testing of distribution normality was performed by Kolmogorov-Smirnov test with critical value of 0.25.

Young male taekwondo competitors included in this study are averagely 4 cm shorter and 7 kg lighter than male students of primary school Bijaći from Kaštela, and are 10 cm shorter and 9 kg lighter than male Croatian karateka of the same age investigated by Katić et al. (2012). As in female competitors, this indicates that body height is not crucial for success in taekwondo. Young male taekwondo competitors are also averagely 6 cm shorter and 6 kg lighter than their karateka peers (Jukić et al., 2012). By comparing the results of young judeka of the same chronological age investigated by Đapić-Caput, Krstulović, & Katić (2013) with male taekwondo competitors from the present study, it can be noticed that judo athletes are averagely 7 cm taller and 10 kg heavier. This indicates that there are important differences within combat sports. Young male taekwondo competitors, as well as their female colleagues, have lower values of skinfolds, circumferences and diameters in relation to young karateka and judeka of the same chronological age.

After presenting descriptive statistics and determining normality, somatotype of young male and female cadet taekwondo competitors aged 13 to 15 years was calculated according to the Heath-Carter method (1990), by using the Somatotype Ver 1.2.5 software package according to Goulding (2010), which uses certain age and gender coefficients during analysis aside from the previous morphological measures.

Descriptive parameters of somatotype components of the overall sample are presented in Table 3. All somatotype components are expressed in averages (ranging from 2.5 to 5).

Regarding the values of each somatotype component, young female competitors averagely fit the *central* category, and male competitors fit the *mesomorphic endomorph* category.

Somatoplot (Figures 1 and 2) shows mean values of somatotype of the overall sample of young male and female taekwondo competitors, as well as their individual somatotypes.

Table 3 Descriptive indicators of somatotype components of female (N=32) and male taekwondo competitors(N=30)

Somatotype components	FEMALE COMPETITORS (N=32)		MALE COMPETITORS (N=30)	
	M	SD	AS	SD
Endomorph	3.71	1.42	4.17	1.94
Mesomorph	3.19	1.02	3.58	1.12
Ectomorph	3.70	1.14	2.31	1.58

LEGEND: M– mean, SD – standard deviation

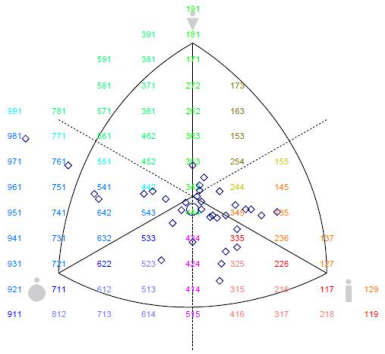

Figure 1 Somatoplot of young cadet female taekwondo competitors

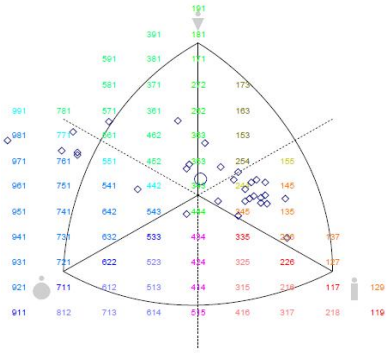

Figure 2 Somatoplot of young cadet male taekwondo competitors

The somatotype categories were obtained based on average values of a larger number of subjects in each somatotype component. Basic problem is that such an approach does not allow insight into somatotype specificities of individual male/female competitors, ie., does not provide information about which somatotype category individual subjects belong to. Thus, Table 4 shows somatotype categories to which each individual male/female competitor belongs. Frequencies (N) and percentage (%) of each somatotype category were calculated for the overall sample. Based on a Category Chart, nine somatotype categories were found for female taekwondo competitors and seven categories for male competitors (Table 4). The majority of young female participants fit the balanced ectomorph (28.13%) and mesomorphic ectomorph (15.63%) category. Among male competitors, the highest percentage (43.33%) fit the mesomorphic ectomorph category, followed by the mesomorphic endomorph category (23.33%).

The results of univariate analysis of variance, which was adapted for analysis of differences in somatotype (SANOVA) in the *Somatotype* computer programme, are presented in Table 5. There are no significant differences in somatotype between male and female competitors. The level of significance of p=0.092 indicates a possible tendency, so the research should be repeated on a larger number of subjects.

The obtained results are congruent with previous studies (eg., Gao et al., 1998, 2001; Pieter, 1998a, 1998b; Chan et al., 2003) which indicate higher endomorphy in women and dominant somatotype of proportional build, well developed muscles and skeleton, and small percentage of subcutaneous fat tissue and lower muscle mass in comparison to male and female judo competitors.

CONCLUSIONS

Constitution is a specific set of structural-morphological, physiological-functional and psychological cognitive-conative characteristics of a person which differentiates them from others. It is influenced by genetics, but also by a number of environmental factors. It is determined in order to assess the disposal and readiness of the tested individuals for overcoming physical and psychological exertion, as well as reactions to different environmental influences, and to express that by using biostatic methods with numbers, norms and tables

Table 4 Frequency and percentage of somatotype categories among young male and female taekwondo competitors

Somatotype category	Female competitors (N=32)		Male competitors (N=30)	
	N	%	N	%
Endomorph-ectomorph	1	3.125	0	0.00
Ectomorphic endomorph	2	6.25	0	0.00
Balanced endomorph	1	3.125	0	0.00
Mesomorphic endomorph	4	12.50	7	23.33
Mesomorphic ectomorph	5	15.625	13	43.33
Balanced ectomorph	9	28.13	2	6.66
Central somatotype	8	25.00	0	0.00
Mesomorph- ectomorph	1	3.125	2	6.66
Balanced mesomorph	1	3.125	3	10.00
Endomorphic mesomorph	0	0.00	2	6.66
Ectomorphic mesomorph	0	0.00	1	3.33

LEGEND: N – frequency of subjects, % – relative values

Table 5 Analysis of differences (SANOVA) in somatotype of young male and female taekwondo competitors

Sample		M	SD
Somatotype of female competitors	N=32	3.71-3.19-3.70	1.42-1.02-1.14
Somatotype of male competitors	N=30	3.45-4.17-3.58	1.94-1.12-1.58
SANOVA		F=2.85	P=0.092

LEGEND: M – mean, SD – standard deviation;

based on the observed principles. In the present study, the somatotype data were collected on a sample of 32 young female cadet taekwondo competitors and 30 young male cadets from Croatia.

With the purpose of calculating the somatotypes (by Heath-Carter method), 10 anthropometric measures were taken.

Mean somatotype values for girls were 3.71-3.19-3.70 ± 1.42 - 1.02 - 1.14 and 3.45 - 4.17-3.58 ± 1.94-1.12-1.58 for boys. Regarding the values of each somatotype component, young female competitors averagely fit the central category, and male competitors fit the mesomorphic endomorph category. Based on a Category Chart, nine somatotype categories were found for female taekwondo competitors and seven categories for male competitors. The majority of young female participants fit the balanced ectomorph and mesomorphic ectomorph category. Among male competitors, the highest percentage fit the mesomorphic ectomorph category, followed by the mesomorphic endomorph category.

Differences in somatotype between young male and female taekwondo competitors were calculated by analysis of variance (SANOVA). There were no significant differences at F=2.85 and the level of significance of p=0.092, but a tendency is visible and a new study is recommended on a larger number of subjects.

Besides increasing the number of subjects among male and female taekwondo competitors in future investigations, the authors suggest a comparison of somatotypes with competitors from other combat sports.

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СОМАТОТИП НА МЛАДИТЕ ТЕКВОНДО НАТПРЕВАРУВАЧИ

УДК:796.856.012.1-053.6(497.5)
(Оригинален научен труд)

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Абстракт

Целта на ова истражување е да се спореди соматотипот на теквондо натпреварувачките и натпреварувачите од младата кадетска возраст. Истражувањето е реализирано на примерок од 32 хрватски теводно натпреварувачки и 30 хрватски теквондо натпреварувачи, млади кадети. Просечната хронолошка возраст на девојките изнесуваше 158.20±9.14, а телесната маса 51.06±11.10.Просечната вредност на соматотиповите пресметан со Heath-Carter метода изнесуваше 3.71-3.19-3.70±1.42-1.02-1.14 за девојките и 3.45-4.17-3.58±1.94-1.12-1.58 за момчињата. Врз основа на категориските дијаграм добиени се девет категории на соматотипа за натпреварувачките и седум категори за натпреварувачите. Најмногу млади испитаници спаѓаат во категоријата на урамнотежен ектоморф (28.13%) и мезоморфен ектоморф (15.63%). Најголем процент од натпреварувачите се уврстуваат во категоријата на мезоморфни и ектоморфни, а потоа во категоријата мезоморфни ендоморф (23.33). Со анализата на варијанса (SANOVA) не се добиени значајни разлики во соматотиповите на младите теквондо натпреварувачки и натпреварувачи, F=2.85, односно нивото на сигнификантност е p=0.092.

Клучни зборови *морфолошки карактеристики, млади кадети, малди кадетки , Heath-Carter разлики*