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The influence of somatotype on competitive successfulness of table tennis player

Abstract

The main objectives of this research that was carried out on a group of 62 of the best young Croatian table tennis players, the young cadets and the cadets (age 10-14), were to determine to which of the body types does each of the players belong, to find out if a certain body type is dominant in this age group, and also to establish whether the subjects classified in groups according to their somatotype, differ in age, years of training, and competitive successfulness.

Computer program Somatotype 1.1. was used in order to determine the somatotypes using the Heath and Carter (1967) method. Based on the gathered data the subjects were classified into three groups formed according to similarities of their body type.

Although the results reveal that none of the three chosen body types is sufficiently dominant to be named the model body type of a table tennis player belonging to this specific age group, the predominance of the mesomorph somatotype component is evident and obviously emphasized on half of the subjects. The ectomorph somatotype component is also significant, for it was established as a dominant component on more of the third of the subjects. The least dominant component, as expected, is the endomorph component.

The results of the analysis of variance (breakdown & one way) reveal that the subjects of each group are of the same age and have the same playing experience, and that the groups do not differ in competitive success, thus concluding that body type at this age is not a crucial factor in achieving competitive success.

The dominance of the mesomorph-ectomorph body type reveals only a potential advantage of this body type, that increases the success probability, but is in no way a deciding factor that directly influences the competitive successfulness of the young table tennis players.

Key words: *somatotype determination,table tennis players, competitive success*

INTRODUCTION

The anthropometric measurements are without a doubt a crucial element of every diagnostic procedure used to determine the morphological status, that is, body constitution and body structure of an athlete. Having established this it is important to keep in mind that morphological characteristics are at the same time the result of genetic heritage and various external factors, such as training and diet.

According to Sergienko (1999), who studied over 600 sources related to the subject of human genetic development, heritage control is the crucial factor in the development of the human morphological characteristics. Therefore for the selection processes are especially important those anthropometric measurements that are dominantly influenced by hereditary factors (lengths, bone breadths and diameters), thus unable to be significantly altered by training procedures, while in evaluation of the results of various training processes especially important are those anthropometric measurements that can be influenced by external factors, such as training and diet (skin folds, girths).

Collecting of the data regarding morphological characteristics of athletes using different anthropometric measurements and methods, used to determine their body constitution, represents a basis for any selection process in the world of professional sports and enable effective monitoring and evaluating of various training processes.

The attempts to categorise and describe human beings through different somatotypes date back to Hypocrite, and throughout history many attempted to establish the connection between somatotypes and different anthropological determinants. The most frequently used model for somatotype determination today is the Heath and Carter method (1967) which uses 10 anthropometrical measurements and Sheldon`s type classification to establish the value characteristics of the three somatotype components; the *endomorph* (high degree of hypodermic fat tissue), the *mesomorph* (highly developed musculoskeletal system) and the *ectomorph* component (linearity of the body is emphasized). It is important to keep in mind that most of the people do not belong to any of the extreme body type categories, but combine a number of different mild varieties, belonging to all of the named body types.

According to Carter (1984) successful athletes competing in different sports belonging to different competitive classes show similarities in body dimension and body constitution, and this similarity becomes more evident in higher competitive classes. Thus the model body type for a specific sport is most easily determined studying the top athletes.

It is also evident that within specific sports, sport disciplines and different playing positions dominates an almost identical body type, while this similarity is less present within some other sports, that is, the morphological constitution of an athlete does not play a crucial role in achieving good competitive results.

The structural characteristics of table tennis reveal that this is a highly complex sport, and like many sports games is conditioned by a great number of factors that determine the final outcome (unlike the monostructural sports). So it would be an interesting fact to determine whether and to what extent the morphological characteristics themselves affect the competitive successfulness of young table tennis players belonging to different age groups. In other words, to find out how important is the role of a somatotype in achieving competitive results.

The **main objectives** of this research are to determine to which of the body types do the best young Croatian table tennis players, (the young cadets and the cadets) belong to, to find out whether a certain body type is dominant in this age group, and also to establish whether the subjects that are classified in groups according to their somatotype, differ in age, years of training, and competitive successfulness.

METHODS

1.1 Sample of cases

Subject sample includes table tennis players participating in the Croatian national championship for the young cadets and cadets that took place at Dugo Selo from the April 12 till the April 15, 2007. The Croatian national championship is a closed competition, that is, competitors have to earn the right to compete through the regional qualifications or place within best 16 on national rank list, to be invited. So all of them are high level players within their age group (YC, C; age10-14) and all of them can be found on the CTTA (Croatian Table Tennis Association) rank lists for the season 2006/2007, and have been playing from 3 - 8.5 years.

Variable sample

The subjects were measured using the 14 anthropometric parameters selected under the assumption that there are four latent dimensions (the longitudinal dimension of the skeleton, the transversal dimension of the skeleton, the circular dimension of the skeleton and hypodermic fat tissue) which describe the latent structure of morphologic dimensions (*Momirović i sur. 1966; Momirović i sur. 1969; Kurelić i sur. 1975; Stojanović i sur. 1975; Bala, 1977; Mišigoj - Duraković, 1989; Katić i sur. 1994*).

The following 3 measurements have been selected for the assessment of the longitudinal skeleton dimensionality:

- ***body height (VISTIJ)***
- leg length (DUŽNOG)
- arm length (DUŽRUK)

The following 3 measurements have been selected for the assessment of the transversal skeleton dimensionality:

- ***knee diameter (DIJKOLJ)***
- ***elbow diameter (DIJLAK)***
- wrist diameter (DIJRUZ)

The following 4meaurments have been selected for the assessment of the circular skeleton dimensionality (body mass and body volume):

- ***body mass (MASTIJ)***
- chest span (OPSGRU)
- ***lower leg (calf) span in the standing posture (OPSPOT)***
- ***upper arm span during flexion and contraction (OPSNAD)***

The following 4 measurements have been selected for the assessment of the hypodermic fat tissue:

- ***upper arm (triceps) skin crease (NABNAD)***
- ***skin crease of the back - subscapular (NABLEĐ)***
- ***abdominal skin crease- suprailiocrystal (NABTRB)***
- ***lower leg (calf) skin crease (NABPOT)***

This group of subjects is by its nature heterogeneous (the age of the subjects, 10-14), that is, the age difference between the subjects, the growth and development differences are too significant to be directly compared using the selected anthropometrical measurements. Therefore, the following analysis includes only 10 of the anthropometrical measurements that are necessary to determine somatotype using the Heath and Carter method (1967).

When determining the somatotype the only relevant interrelation is that between the 10 anthropometrical measurements and the chronological age of the subjects, this fact nullifies the age difference and enables further comparison.

The following variables have been selected as **criteria variables**:

- age of the subjects (DOBIGR)
- years of training (GODTRE)
- competitive success (NATUSP) – based on the points won and registered on the ranking lists for each category (cadets and young cadets) for the season 2007/2008.

Data processing methods

The data obtained using anthropometrical measurements was entered into computer program Somatotype (Sweat Technologies) which calculates the somatotype using the 10 anthropometrical measurements, and is based on the Heath and Carter method (1967).

The results, or the numerical values obtained for each of the three somatotype components (endomorph, mesomorph, ectomorph) have been processed using statistical package Statistics 7 (StatSoft, USA). The subjects were then classified into three groups according to their body constitution similarity using taxonomic analysis – K- means method (by selecting the three clusters).

Basic descriptive statistical parameters and distribution normalities have been calculated for each of the three selected groups and criteria variables, and the differences between the formed groups and criteria variables have been determined using the analysis of the variance (breakdown& one way).

RESULTS AND DISCUSSION

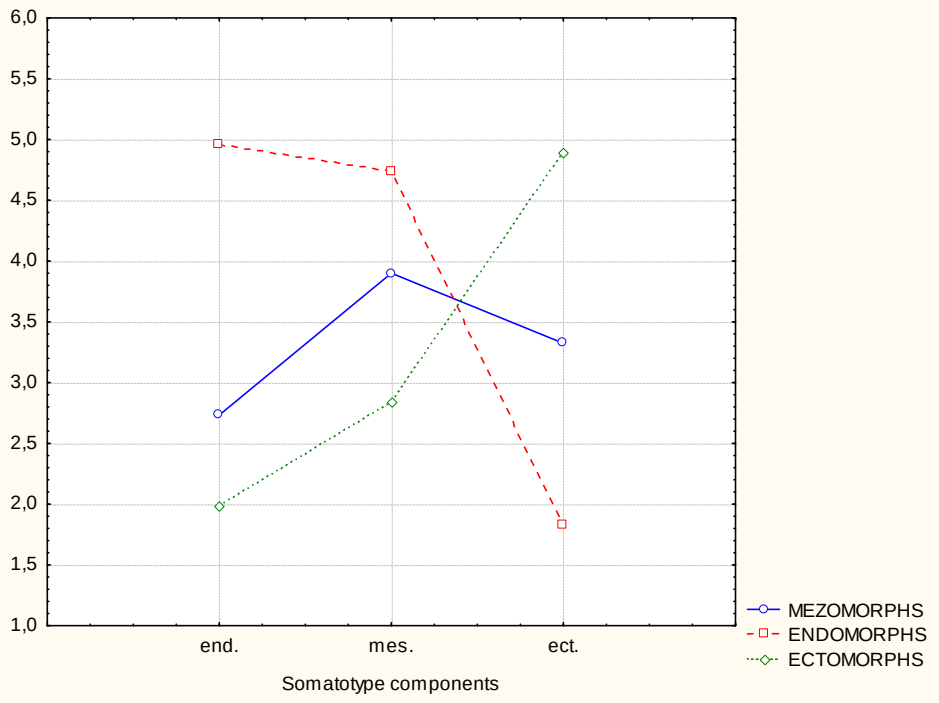
Numerical values obtained on the basis of 10 anthropometrical measurements using the computer program somatotype 1.1 determine the level of belonging to a certain somatotype component (endomorph,

mesomorph, ectomorph), for each subject individually, using numbers 1-7, and in such way that an extreme endomorph would be defined with somatotype 7-1-1, extreme mesomorph 1-7-1, and extreme ectomorph 1-1-7.

The majority of the subjects does not belong to any of the extreme body types, they in fact posses a mixture of mild characteristics belonging to different somatotypes. Each mixture is individual and determines the body type of a specific subject. Computer program somatotype 1.1 recognises different combination of the individual components of a somatotype and places the subjects into different groups and sub-groups depending on the influence of the each component. In order to enable the formation of three basic body types via all of the mentioned groups, sub-groups, between and within of each somatotype component, based on the numerical values calculated for each body type component, subjects were classified into three different groups (*using taxonomic analysis – K-means method- by selecting three clusters*) established on the body type similarities (*table 1*).

Table 1. The division of subjects into three basic body types based on the numerical values for each of the somatotype components (according to Heath and Carter method)

	MESOMORPHS (n=30)		ECTOMORPHS (n=22)		ENDOMORPHS (n=10)		ANOVA	
	AS	SD	AS	SD	AS	SD	F	p
end.	2,73	0,66	1,98	0,41	4,96	0,94	74,56	**0,000**
mes.	3,90	0,57	2,84	0,66	4,74	0,69	36,30	**0,000**
ect.	3,32	0,41	4,90	0,87	1,83	0,60	85,56	**0,000**



Picture 1. Graphical display of somatotype components values for each of the three body types

According to the results gained using taxonomic analysis (*table 2*.) the majority of the subjects, 48,39 %, belong to the group dominated by the **mesomorph somatotype component**. This group (n = 30) is made up of subjects with high numerical values of the mesomorph component compared to other two somatotype components (*endomorph and ectomorph).* Based on the values of those two components it is possible to further divide the subjects of this group into those dominated by the endomorph component of the mesomorph somatotype (the endomorphic mesomorph), those dominated by the ectomorph component (ectomorphic mesomorph), and those under a balanced influence of the two components (balanced mesomorphs).

Little more than one third of the subjects (35,48 %) form the second group, 22 players (n=22) with a dominating **ectomorph somatotype component**. The values of the other two components (*endomorph and mesomorph)* subdivide this group into two ectomorph subtypes (mesomorph and balanced).

The third group, the smallest one, (16,3) is formed of 10 subjects with a dominating **endomorph somatotype component**. This group is made up of endomorphs, the majority of them have an accentuated mesomorph component (mesomorphic endomorph) followed by those with a balanced influence of the two components (mesomorph-endomorph), there are also a few mesomorphs with an accentuated endomorph component.

Table 2. The frequencies (F) and percentage (%) of the subjects belonging to a particular body type

	F	%
end	10	16,13
mez	30	48,39
ect	22	35,48
TOTAL	62	100,00

The results of the K-S (Kolmogor- Smirnov) test confirm that all of the variables from this research have a normal results distribution, and the basic descriptive statistical parameters show that an average subject is almost 13 years old or little younger, that has been training table tennis for more than 5 years, and that the average values of the mesomorph and ectomorph somatotype component dominates over the values of the endomorph component (*table 3.*).

Table 3. The basic descriptive statistical parameters and the results of the K-S test for all of the variables

	Mean	N	SD	Min.	Max.	max D	K-S
End.	2,82	62	1,19	1,3	6,2	0,171272	p < ,10
mes.	3,65	62	0,91	1,3	6,3	0,063375	p > .20
Ect.	3,64	62	1,25	0,8	7,4	0,080675	p > .20
age	12,83	62	1,7	10,07	14,9	0,124070	p > .20
year.train.	5,23	62	1,53	3,00	8,5	0,176648	p < ,05
comp.suc.points	535,12	62	450,35	2,1	1580	0,135456	p > .20

Limit max D = 0,175

Still the results obtained by the analysis of the variance (breakdown & one way) reveal a lack of significant difference between the three particular groups, dominated by a specific somatotype component, on each of the criteria variables. This also can be confirmed by looking at the descriptive statistical parameters (*table 4.*).

Table 4. Descriptive statistical parameters (arithmetic mean – AM and standard deviation – SD) for each of the three body types, with variance analysis in order to determine the significance in differences between the groups based on the three criteria variables.

	ENDOMORPHS (n=10)		MEZOMORPHS (n=30)		ECTOMORPHS (n=22)		ANOVA	
	AM	SD	AM	SD	AM	SD	F	p
age	13,09	1,44	12,44	1,63	13,24	1,84	1,573	0,216
year. train.	5,90	1,47	4,88	1,41	5,41	1,65	1,929	0,154
com.suc.points	536,58	486,49	578,76	474,25	474,95	413,03	0,330	0,720

The subjects from all of the three groups do not differ significantly in age or in years of training, that is why those two variables were not relevant for subject differentiation, their age is similar, so are the years of training.

These results enable a quality comparison of the subjects from the aspect of the third variable, that is, their competitive success, which also reveals the lack of significant difference between the competitive successfulness of the subjects (points won during the competitive season). As a result it becomes evident that somatotype domination of any kind does not have a crucial influence on the young table tennis players of this specific age group and their competitive success.

CONCLUSION

The results of this research reveal that none of the three chosen body types is sufficiently dominant to be named the model body type of a table tennis player belonging to this specific age group, but the predominance of the mesomorph somatotype component with these top young Croatian table tennis players (young cadets and cadets) is evident on half of the subjects. The ectomorph somatotype component is also significant, for it was established as a dominant component on more than a third of the subjects. The least dominant component, as expected, is the endomorph component.

The connection between the three body types, dominated by different somatotype components, and competitive success of the players was not established, in other words, there are no significant differences between the three formed groups on the competitive successfulness of the players belonging to each group. This leads to the conclusion that, at this age, body constitution is not a crucial factor in achieving top results.

In a structurally complex game, such as table tennis, competitive success is primarily a result of quality and degree of the technical and tactical knowledge. So, the differences in competitive success of the young table tennis players are mostly a result of different levels of their technical-tactical skills. At this competitive level these differences are highly emphasised, while the top senior level implies a high level of technical-tactical knowledge.

It is possible to conclude that the existence of suitable morphological features represents a certain advantage and body constitution, as an integral part of the player's basic anthropological status, plays an important role in achieving competitive success, especially with top players, but it is not a crucial one and it can't by itself guarantee top results.

The dominance of the mesomorph-ectomorph body type reveals only a potential advantage of this body type that increases the success probability, but is in no way a deciding factor that directly influences the competitive successfulness of the young table tennis players.

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