

Assessment and Comparative Analysis of Individual Temperament and Somatotype in Young Athletes According to Iranian Traditional Medicine and Heath-Carter Method

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ABSTRACT

Objectives: This study examined the hypothesis that whether any significant differences exist or not in individual temperament and somatotype components in young athletes.

Methods: The cross-sectional study was carried out with 202 male athletes (age = 23 years \pm 2.7, mean \pm SE). They were categorized into four groups according to their temperaments by using a questionnaire. Also, the Heath-Carter method was applied to estimate the somatotype components. One-Way ANOVA followed by Scheffe's tests was organized ($p < 0.05$) for data analysis.

Results: In this research, the highest mesomorphy, ectomorphy and endomorphy components were observed in the Blood, Yellow Bile and Phlegm temperaments, respectively with means of 6.1 ± 0.28 , 3.9 ± 0.11 , and 5.9 ± 0.32 . Also, a significant difference was observed between Blood temperament and, mesomorphy component ($p < 0.001$) but Blood temperament had insignificant differences with other studied somatotype components ($p > 0.05$). Ectomorphy and mesomorphy components significantly differ among Yellow Bile temperament ($p < 0.05$), while an insignificant difference was found between Yellow Bile temperament and endomorphy component ($p > 0.05$). Significant differences also were showed between Black Bile temperament and all somatotype components ($p < 0.05$). Among Phlegm temperament and endomorphy component was a significant difference ($p < 0.001$), but there were no significant differences between the Phlegm temperament and the other two somatotype components ($p > 0.05$).

Conclusions: Given the importance of body type in sports performance, current findings suggest that coaches should be aware of the individual temperaments which could serve as a guide to design special training schedules for athletes.

KEYWORDS: Temperament; Somatotype; Traditional medicine; Heath-Carter method; Iran

INTRODUCTION

Today, the physical structure is considered as one of the most important aspects for athletic performance. In modern sports arena, it has been proven that the athlete's success depends upon balance in athletic ability level and body build. Body build comprises of body size, body composition and body type or somatotypes [1,2]. Throughout the time, most of the researchers focused on the importance of body size and body composition and disregarded body type but in these years, they inferred the importance of somatotypes [3]. Some of them believe that differences in body types can clearly determine athlete's success or failure in the most type of competitions. According to some authors, in order to create athlete's profile, it's very essential in all branches of sports and each sports needs specific body type from athletes [2-5].

Sheldon WH, et al. 1940 [6], one of the older pioneer of somatotype's researchers, reconstructed the term somatotypes and they build their own typology starting from the three primary germ layers. Depending on prevalence of one or other of three layers, he produced three body types (ectomorph, mesomorph and endomorph) [6]. After that many researchers have attempt to developed method to more objectively estimate the somatotype of an individual [7-9]. In particular, Heath and Carter (1967) [10] developed a three dimensional and formula based concept for the detailed classification of body structure. All this studies implied that one's somatotype is directly related to the proportion of the body, the amount of fat lean body mass and circular and transverse dimension of the skeleton and percentage of muscle mass of body. It consists of three numeral values representative of components: endomorphy or adiposity, mesomorphy or musculoskeletal robustness and ectomorphy or linearity [6-10].

Right from the past, exercise is an essential factor to maintain health and fitness in Iranian traditional medicine [11-16]. IbnSina, the father of Iranian medicine, considered the exercise as a priority in maintaining health on all elements, even nutrients [11]. In the opinion of traditional Iranian medicine, the key concept of health definition is based on individual temperament (Mizaj). Temperament is a main theory in Iranian traditional medicine and it can be described as all aspects of personality which explain a person's morphological, physiological and psychological status [11-14,17-20]. In this regard, this medicine is grounded in the four temperaments concept and they are including "Blood or Damavi (hot and wet), Yellow bile or Safravi

(hot and dry), Black bile or Saudavi (cold and dry) and Phlegm or Balgham (cold and wet)" [11,21]. In traditional medicine, temperament is defined as the only cause of individual differences and there is no absolute real moderate person and everybody is under the predomination of one temperament, therefore the similar and moderate temperaments are rare and never can two people considered similar despite their physical similarities [11,22-26]. Traditional medicine also indicated the important role of temperament in physical structure of each type of temperaments [15,19,27]. Furthermore, in the Iranian ancient medicine there is evidence of the association between temperament and body activity, also each tissue of the human body has its own temperament [7,11].

Also it is report that, human with different temperaments demonstrate unique performance capacity during exercise and physical training [27-29]. Excessive body activities increase the Yellow bile in blood and after a while, mal-temperament (Sue Mizaj) of Yellow bile, drainage of energy and the predomination of Black bile or Phlegm temperament in the body will be occurred. For this reason, heavy physical activity isn't recommended to Yellow bile temperament. Also, long time activities or heavy exercise involved muscles spasm and kin in dry temperament person [30]. Since one of the major goals of these studies is use the role of somatic elements and their taxonomy in the development of exercise planning in sport sciences. Therefore, it's important for the community to find ways that contribute to improve health life of athletes.

Based on the aforementioned, it has been suggested that body type may be influenced by individual temperament and it can be considered as a decisive advantage to selecting an appropriate exercise for each athlete. Given to the importance of body types and temperament in sports performance and due to lack of related data in the literature, this study was conducted to investigate and analyze the individual temperament and body types of young athletes based on the Iranian traditional medicine and the Heath-Carter method.

MATERIALS AND METHODS

This study was conducted in October 2019, over a period of 10 days. Anthropometric measurements were followed the guidelines set of the International Society for Advancement of Kinanthropometry (ISAK) with a technical error of measurements less or equal to 1%. The sample consisted of 202 volunteer men aged 22.7 to 48.3 years old (age = 23 years \pm 2.7), who have been participating in sports for more than two

years at a gym in Ahvaz, Iran. All participants signed informed consent after receiving both oral and written information of the purpose and procedures of the study and were familiar with the study's method and their participation was also optional and they could leave in at any stage of the study.

Before performing the experimental treatment, due to effects of some diseases on Mizaj and anthropometric measurements, a complete medical examination was done and participants with any chronic disease such as cardiovascular complications, kidney, hepatic and thyroid disorders, diabetes, addicted to alcohol and drugs, orthopedic or any disorders that might affect muscle function were excluded. A research-made questionnaire was prepared to determination of Mizaj, due to the lack of a standard questionnaire. For this reason, we review books and articles and interview researchers in the field of traditional medicine, we prepared a list with subjective and objective variables on physical, behavioral and emotional characteristics, appetite and thirstiness and sleep status and 5 experts commented on its validity and reliability [19,22]. A questionnaire consist of 100 questions was performed and participants were asked to filed it out and determination of Mizaj was accomplished by trained traditional medicine specialist into four temperament groups including "Blood or Damavi (hot and wet), Yellow bile or Safravi (hot and dry), Black bile or Saudavi (cold and dry) and Phlegm or Balgham (cold and wet).

To determination of participant's somatotype, the Heath and Carter method was used [10]. The method consists of ten anthropometric measurements including body weight (kg), height (cm), four skinfolds (mm) (triceps, subscapular, supraspinal and medial calf), two circumferences (cm) (flexed arm, maximum calf) and two bone diameters (cm) (humeral, femur). Somatotype measurements were taken on the same day in a resting state after eight hours of fasting with participants barefooted and wearing light clothes and in order to minimize the technical errors and reliability of the test all measurements repeated three times for each participant the value recorded was the average of three consecutive measurements of each body region. In the study, the equipment used to each participant's body weight and height were measured with an electronic scale (SECA, Germany) and a stadiometer with an accuracy of 0.1 kilogram (kg) and 0.01 meter (m), respectively. Skinfold thickness were measured with a skinfold caliper (Harpender, UK) with an accuracy of 1mm. Circumferences measurements (cm) were performed with flexible but non-stretchable tape (Harpender, UK) to the nearest 0.1 cm and bone diameters (mm) were determined with the elbow and knee joint flexed to 90° and the caliper rods (Harpender, UK) at 45° in relation of them. The height to weight ratio (HWR), calculated by dividing height by the cube root of weight, was used in somatotyping. In order to calculate the anthropometric somatotype of each participant, the following equations (1-4) were used:

$$\text{Endomorphy} = -0.7182 + 0.1451 (x) - 0.00068 x^2 + 0.0000014 (x^3) \quad (1)$$

Where x = sum of triceps, subscapular and supraspinal skinfold and for height corrected endomorphy multiplied by 170.18 / body height

$$\begin{aligned} \text{Mesomorphy} = & (0.858 \times \text{human breadth})(0.601 \times \text{femur breadth}) + (0.188 \times \text{corrected arm girth}) \\ & + (0.161 \times \text{corrected girth}) - (0.131 \times \text{height}) \\ & + 4.5 \end{aligned} \quad (2)$$

Where corrected arm girth is $\text{armgirth (cm)} - \frac{\text{triceps skinfold}}{10} (\text{mm})$ and corrected arm girth is $\text{armgirth (cm)} - \frac{\text{calf skinfold}}{10} (\text{mm})$

$$\text{Ectomorphy} = (0.732 \times \text{HWR}) - 28.58 \quad (3)$$

If HWR was found as $38.25 < \text{RPI} < 40.75$

$$\text{Ectomorphy} = (\text{HWR} \times 0.463) - 17.63 \quad (4)$$

If HWR was found as an equal to or less than 38.25 give a rating of 0.1.

Each participant was described three numbers determining their morphological structure, which represent respectively endomorphy, mesomorphy, and ectomorphy components of somatotype. Then all participants were assigned to three groups according to the highest value of their somatotype components. The mean and standard deviation, One-Way ANOVA and Scheffe's tests were done to compare four temperament groups according to their somatotypes. All statistical analyses were

performed with the "IBM SPSS 21" software package. For all tests, significance level adopted was $p < 0.05$.

RESULTS

Given the values obtained by analyzing of the subject's temperaments and somatotypes, they were divided into four temperament groups consist of Blood (n = 63), Yellow Bile (n

= 58), Black Bile (n = 32) and Phlegm (n = 49). Furthermore, the mean somatotype components among the temperament groups are shown in the figure below and in figure 1. Blood temperament had the highest mesomorphy component among

the four temperament groups (6.1 ± 0.28). Highest ectomorphy component was observed in Yellow Bile temperament (3.9 ± 0.11). While, Phlegm temperament had highest endomorphy component between all (5.9 ± 0.32).

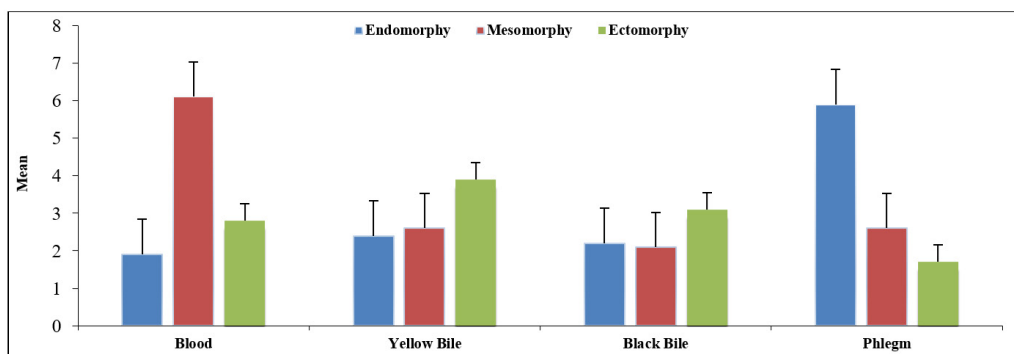


Figure 1: Means of somatotype components among the Blood, Yellow Bile, Black Bile and Phlegm temperament groups.

The results of One-Way ANOVA test in table 1 indicate significant difference between each temperament group interms of somatotype components. Scheffe’s test confirms that significant difference existing between Blood temperament and mesomorphy component ($p < 0.001$), while there was insignificant difference between the Blood temperament and other two somatotype components ($p > 0.05$). Also, significant differences were observed among the Yellow Bile and Black Bile temperaments with ectomorphy components ($p < 0.05$). In addition, there was a significant difference between the

Yellow Bile and Black Bile temperaments with mesomorphy component ($p < 0.05$), furthermore insignificant difference was found in Yellow Bile temperament and endomorphy component ($p > 0.05$), while there was significant difference between Black Bile temperament and endomorphy component ($p < 0.05$). Significant difference was observed between Phlegm temperament and endomorphy component ($p < 0.001$) but there were no significant differences between the Phlegm temperament and other two somatotype components ($p > 0.05$).

Variable	Statistical Analysis	Endomorphy	Mesomorphy	Ectomorphy
Blood or Dam	Mean + SD	1.9 ± 0.18	6.1 ± 0.28	2.8 ± 0.24
	F-Value	15.07		
	Significance of F	p < 0.05		
	Scheffe’s F Ratio	0.029	11.652	7.113
	Significance of Scheffe’s Ratio	p > 0.05	p < 0.001	p > 0.05
Yellow Bile or Safravi	Mean + SD	2.4 ± 0.14	2.6 ± 0.14	3.9 ± 0.11
	F-Value	21.99		
	Significance of F	p < 0.05		
	Scheffe’s F Ratio	0.22	11	14.44
	Significance of Scheffe’s Ratio	p > 0.05	p < 0.05	p < 0.05
Black Bile or Saudavi	Mean + SD	2.1 ± 0.14	2.2 ± 0.17	3.1 ± 0.15
	F-Value	16.17		
	Significance of F	p < 0.05		
	Scheffe’s F Ratio	2.21	2.00	9.89
	Significance of Scheffe’s Ratio	p < 0.05	p < 0.05	p < 0.05
Phlegm	Mean + SD	5.9 ± 0.32	2.6 ± 0.35	1.7 ± 0.21
	F-Value	13.17		
	Significance of F	p < 0.05		
	Scheffe’s F Ratio	28.02	0.13	1.34
	Significance of Scheffe’s Ratio	p < 0.001	p > 0.05	p > 0.05

Table 1: One-Way ANOVA to compare four temperament groups according to somatotype components.

DISCUSSION

This study explored to investigate and analyze the individual temperament and somatotype of young athletes based on the Iranian traditional medicine and the Heath-Carter method. Undeniably, it is important in sports scientists to evaluate the somatotype for talent identification and designing any training schedule to get maximum benefit and prevent sport hazards [3,31,32]. Indeed, it is thought that somatotype is a major predictor of success in competitive sport and with a careful analysis of somatotypes, there emerges a necessity to make a training programs specific to each player's somatotypes [31,33]. Despite the extensive studies on the importance of the somatotypes as one of the decisive factors for success in sports, there is a lack of appropriate reference value in the literature for the athletic population [32]. To our knowledge, this is the first study that evaluates the association between individual treatments and somatotypes and even though in support of this hypothesis more clinical researches is required based on individual temperament of the trained players.

Additionally, since talents defined as inherent and specific traits for human's ability, may be individual temperament could be considered as a property to choose appropriate athletes for different sports fields.

In this regard, according to traditional medicine each person has a unique temperament and two persons, never considered identical, despite their similar traits. So the traditional medicine scientists suggested the genetic inheritance as a rational explanation of this situation [11,20]. In our previous study in 2019, we concluded that to achieve balance in temperament and health of the body each person with dominant individual temperament required appropriate physical activities according to his temperament [28].

The results of the present study demonstrated that, there are significant differences between the endomorphy, mesomorphy and ectomorphy components of the Blood, Yellow bile, Black bile and Phlegm temperaments of the participants of this research and seemingly it can be claimed that individual temperament determines the somatotypes of the humans. Therefore, significant difference existing between Blood temperament and mesomorphy component ($p < 0.001$) and they had highest mesomorphy component among the four temperament groups. In the view of traditional medicine, typically, Blood temperament persons has a muscular body with large muscle mass, strong body, energetic traits and enjoy

physical movements [20]. Mahdizadeh R [29] in 2013 argued that individual temperament is a determinative factor of human motivation to have body activity [32]. It is reported that the Blood temperament persons have a physical structure that is essential to hard physical activity [20,33,34]. These physical traits of Blood temperament are similar to mesomorph traits that expressed by Sheldon WH, et al. [6] and Chatterjee P, et al. [35].

Also Zar A, et al. [27] observed that there is a significant correlation with the level of body activity and Blood temperament and that is in accordance with founding about mesomorph components. It is observed that most of the trained martial art players mostly have mesomorph somatotypes [5] and this finding might partially explained that mesomorphy component provides a comparative advantage to these players which is indeed similar to those of Mahdizadeh R [29] and our findings. Gualdi-Russo E, and Graziani I [36] in 1993 determined the somatotypes of 717 male young sport participants and found that the mesomorphy component was greater than the other two components [36].

Moreover, our findings revealed that Phlegm temperament had highest endomorphy component than other temperaments did and significant difference was observed between Phlegm temperament and endomorphy component ($p < 0.001$) but there were no significant differences between the Phlegm temperament and other two somatotype components ($p > 0.05$). Based on the studies in traditional medicine, Phlegm temperaments have over developed digestive system, low muscle mass, round shape with more body fat and heavy body weight [12,14,20]. Also muscular mass build-up is difficult for them [37]. Rahati M, et al. [37] in 2018 reported that Phlegm temperaments have the low muscle mass in comparison with people who have hot temperaments and in the other hand, they were more obese than the hot temperaments [37]. Therefore, these traits are approximately identical to the traits that Heath and Carter defined for endomorphs [10]. Furthermore, these findings are similar to those of Bolonchuk W, et al. [38] reported significant correlation between endomorphy and densitometrically determined percent fat in men and women ($r = 0.8$) and Bolonchuk WW, et al. in [38] found a significant correlation between dominant endomorphy and body fatness and fat weight, $r = 0.872$ and 0.687 , respectively.

In terms of yellow bile and black bile temperaments, we noticed that ectomorphy component was the highest somatotype

component ($p < 0.05$). Generally, according to the sight of traditional medicine, yellow Bile temperament's have a high energy level, thin with low and dense muscle and low body fat, while Black Bile temperament's have a thin, weak body with light muscle and high abdominal obesity [11,17,20]. In this scenes, as has been indicated earlier ancient scientist, body fatness and energy level are discriminating factors among individuals with Yellow Bile and Black Bile temperaments [18]. Also it is reported that excess metabolic activities cause renal dysfunction [28], so it is very important to modulate the physical training and exercise of players by observing their temperaments and somatotype. In this regard, considering the literature of traditional medicine, heavy physical activity is not recommended to yellow bile temperaments because of increased yellow bills in their blood [29,29]. which is in contrast with the study of Oroles in 2016 [40] that reported if ectomorph somatotypes training with weight, progress in terms on muscular mass is slow and difficult and immediate consequence is over-training. Besides, Sayah M, et al. [41] in a study which they have done in 2015 they reached to a result that black bile temperament's considering to their traits such as being weak and indecisive, they have less tendency to take part in sport activities that is agree with those found by Sheldon WH, et al. [6] in 1940. Moreover, Cicarli F, and Kafkas M in 2019 found that the ectomorph character has appositve effect on aerobic capacity and the ectomorph athletes can't have a good power outputs [31] and Piechaczek H, et al. in 1996 [42] determined the somatotype of 13 judo players and found that there is a negative correlation between the power outputs of all regions and ectomorph components that these findings are in contrast to those findings about black bile temperaments but in agreement with those about power output and energy level in Iranian traditional medicine [12,30]. In terms of this, Bolonchuk WW, et al. [38] in 2000 stated that high standing height, but in combination with the least of body weight, skinfold fat and girth was characteristics of the dominant ectomorph group and ectomorphy was significantly have a negative correlation with body fatness ($r = - 0.33$) [32], which is agree with the characteristics of yellow bile and black bile temperaments.

Ultimately, aforesaid results represent that and our primary results might help to analyses the quality of athletes and their somatotype components according to their individual treatments. Among the limitations of our study, one can state the limited time of study due to lack of facilities for a long period, hoped to be considered in future studies.

CONCLUSION

Based on the results of this study it can be concluded that there are significant differences between individual temperament and endomorphy, mesomorphy and ectomorphy components of the participants of this research and there are significant differences between the endomorphy, mesomorphy and ectomorphy components of the blood, yellow bile, black bile and phlegm temperaments. While, mesomorph component in blood temperament had highest mesomorphy among all the somatotype components. Yellow bile and black bile temperaments, we noticed that ectomorphy component was the highest and endomorphy component in comparison to other components of somatotypes, generally corresponds to Phlegm temperament. Current findings suggest that coach should be aware of the individual temperaments and give especial training considering their temperaments since they can ensure a high level of performance in athletes.

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