ANTHROPOMETRICAL PROFILE AND BIO-MOTOR ABILITIES OF YOUNG ELITE WRESTLERS

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Abstract. *Aim:* This study investigated the association between motor performance and somatic type, anthropometric, body composition, physiologic and physical fitness profile in young wrestlers.
Material: 16 young wrestlers aging 16–19 with a 4–year–experience of taking part in national championships were selected for the study. Following the standard methods in the testing center of Alborz province some tests like aerobic power, muscular endurance, flexibility and agility speed tests and 1RM were taken to integrate the participants. Also, it should be noted that the participants' height, weight, the girth of thigh, elbow, calf and arm and skin thickness were measured.
Results: Somatotype, Somatotype Attitudinal Distance (SAD), Height Weight ratio (HWR) were calculated according to Carter and Heath anthropometric method. Body Fat Percentage (%BF), HWR and SAD resulted in 10.90±1.64, 43.27±0.87 and 0.94±0.87 respectively. Somatotype Standard Deviation and mean regarding endomorphic, mesomorphic and ectomorphic components were 2.16±0.46, 5.20±0.77 and 2.88±0.64 respectively. Physiologically, wrestlers VO_{2MAX} (kg/min) were 49.31±4.22 and their Resting Heart Rate (bpm) were 68.31±6.64.
Conclusion: As the present study illustrates, Somatotype of the Endomorphs, Mesomorphs and Ectomorphs were the same. As a result, coaches can plan wrestlers' training programs and review of techniques based on anthropometric and physiologic data driven from their sports performances. Besides, wrestlers could be well-informed about their performance. Moreover, aforesaid information could be beneficial to wrestling federations and all other organizations contributing the wrestling federation while holding talent identification programs and recognizing young wrestlers.
Key words: somatotype, wrestling, talent, test, physical.

Introduction

Wrestling is one of the most challenging competitive and anaerobic sports because of its stress on metabolic systems [1]. Therefore, the intensity of the wrestling match can determine muscle energy resources and the amount of all three resources consumed. Anthropometric and Physiologic features are considered as crucial concepts regarding athletes' performances among all sports [2]. The obtained capabilities and distinctive features could indicate the athlete's current condition and also could facilitate the comparison process of his previous and current results [3].

Physical fitness test results mark wrestles' weak points, strengths through wrestling matches and all the requirements for their future accomplishments. High capacity of aerobic and anaerobic, strength, power, agility, and flexibility in upper body and lower body are all considered as the most important physical fitness factors required to succeed in wrestling competitions [4,5].

Nowadays one of the most distinctive issues in sports is the process of discovering talented athletes. In other words recognizing, training and evaluating talented athletes at their early ages would help them constitute impressive future achievements. Sports instructors should dedicate the whole majority of their time and energy to elite athletes since they have potentials to succeed otherwise the presence of instructors would be inefficient. Thus most talented athletes with special aptitudes should be considered as the target goal of the instructors [6].

Following Carter and Heath, Somatotype provides significant information on special sports achievements [7]. Also Bloomfield et al. believe that Somatotype data can predict athlete's success in all fields of sport [8]. According to the analysis of the athletes' performance through international matches and Olympic Games, in order to succeed in competitions athletes should be equipped with bio-motor, anthropometry, structure and body compositions. By virtue of the data driven from the analysis, the evaluations on Somatotype features and comparing them with elite athletes' test results are regarded as a method to predict prominent athletes' success [9, 10]. Interestingly, the information achieved through aptitude and anthropometric tests play a crucial role in screening process [6, 9].

One of the most important criteria through the process of talent identification is the evaluation of somatotype information. Due to its variety, there have been several studies done on somatotype criteria. According to the analysis done on studies, there is a close relationship between the somatotype information of young and adult athletes' similarities and consistency of their somatotype features through all their lives [7]. Regarding the

point that somatotype features are greatly influenced by genetic factors rather than other factors such as practice and diet [2, 11, 12]. The obtained information are so eminent in identifying talented athletes. The key factors to achieve success in various athletic fields are anthropometry, structure evaluation, and physical features [13].

The present study aims at providing anthropometric features, body composition, somatotype, physiologic and body fitness factors contributing to young wrestlers' performance. The result of the study would provide a profile for young wrestlers in the different age range in order to devalue the comparison of adult wrestlers' talent aptitude test results and young wrestlers' results.

Material and methods:

Participants: The present study follows a field descriptive method. Also, the aim of the present research is categorized as a functional and practical research. The subjects were 16 young elite wrestlers aging 16–19 years old. It is necessary to mention that the participants had the experience of practicing wrestling and being the champion for 4 years.

Research Design

All the tests and measurements were done during the same time in 6 days. In order to homogenize participants and measure their aerobic power, a physical fitness tests including Bruce test, Trunk lift flexibility, Shoulder flexibility, Sit and Reach Test, Muscle Endurance (Curl up, Pull up), Bench Press Maximum Strength, Squat based on Brzycki [14] formula, speed (36 m) and agility (4×9 m Test) were held.

The Brzycki (1993) equation is as follows while recording anthropometric measurements, the number of practice sessions was reduced. All the measurements over anthropometric features, body structure, and other variables were taken according to an international association of ISAK while the wrestlers were resting. Somatotype was analyzed and calculated with Somatochart software (version 1.2). Body density (BD) was estimated using the method of Jackson and Pollock [15]. BD was transformed to %BF by the Brozek's equation [16].

Statistical Analysis

To analyze the data, descriptive statistic methods were used.

Results

Table 1 the results of the present research on Anthropometric features and body composition are presented; in table 2 Somatotype and table 3 bio-motor ability among of young elite wrestlers are shown.

Table 1. Anthropometric and body composition characteristics of young elite wrestlers

Variable	Mean	Std. Deviation	Maximum	Minimum
Age (years)	17.43	1.15	19	16
Experience (years)	4.21	1.35	7	2
Anthropometric				
Weight (kg)	66.70	8.48	87.50	57.40
Height (cm)	173.25	5.79	184	165
BMI (kg/cm²)	22.14	1.68	25.84	20.44
Sitting height (cm)	88.53	3.79	94	81
Skin-fold (mm)				
Chest	2.50	1.83	5	3
Axilla	3.76	2.65	7	5
Triceps	4.32	3.23	10	5
Subscapular	5.89	4.39	15	8
Abdomen	5.11	4.04	14	6
Suprailium	5.04	4.47	16	4
Front thigh	6.12	4.48	11	5
Biceps	2.03	1.43	4	2
Calf	3.55	2.70	8	4
Sum of 9 skin-fold (mm)	38.32	2.80	54	29
Body fat (%)	10.90	1.64	15	7.90
Lean body mass (kg)	58.96	7.10	73.90	50.20
Lengths (cm)				
Arm span	174.40	6.18	185	166
Humerus	74.06	4.58	85	64
Femur	105.75	8.71	118	93
Girths (cm)				
Flexed arm	28.79	1.90	33	26
Waist	73.75	5.06	87	67
Hip	91.40	4.39	101	86.20
Calf	35.35	2.26	40.50	32

Table 2. Somatotype variables of young elite wrestlers

Variable	Mean	SD	Maximum	Minimum
Endomorphy	2.16	0.46	2.9	1.4
Mesomorphy	5.20	0.77	6.5	3.3
Ectomorphy	2.88	0.64	3.7	1.8
SAD*	0.94	0.87	2.03	0.13
HWR*	43.27	0.87	44.1	41.53

* SAD (Somatotype Attitudinal Distance); HWR (Height to Weight Ratio).

Table 3. Bio-motor ability of young elite wrestlers

Variable	Mean	Std. Deviation	Maximum	Minimum
		physiologic		
Aerobic power				
VO_{2MAX} (kg/min)	49.31	4.22	59	42
VO_{2MAX} (l/min)	3.17	0.49	4	2.39
MET*	14.05	1.19	16.80	12
Heart Rate (bpm)				
Resting Heart Rate	68.31	6.64	78	57
Maximum Heart Rate	198.68	8.63	218	186
Flexibility (cm)		**Physical fitness**		
Sit and reach	41.93	5.45	55	35
Trunk	46.81	7.72	58	31
Shoulder	29.56	7.70	47	16
Muscular endurance (number of repetitions)				
Poll ups	11.18	3.31	18	6
Sit and reach	49.25	5.25	60	40
Maximal strength (kg)				
Bench Press	72.88	13.73	103.64	50.63
Squat	100.27	18.07	145.18	77.14
Speed (seconds)				
36 m.	4.26	0.26	4.91	3.93
Agility (s)				
4×9 m	8.86	0.48	9.72	8.10

*Metabolic Equivalent

The calculated somatotype was achieved through anthropometric features of height, weight, femur breadth, elbow breadth, calf girth, flexed arm girth, body composition. Also, their triceps skinfold, subscapular, suprailium and calf skinfold were calculated in two- dimensional based on Heath – Carter's method [2]. In order to do the analysis, the researcher used the Somatochart software (version 1.2) which is presented in figure 1. As the schematic figure illustrates, the mean is 2.2 – 5.9 – 2.9.
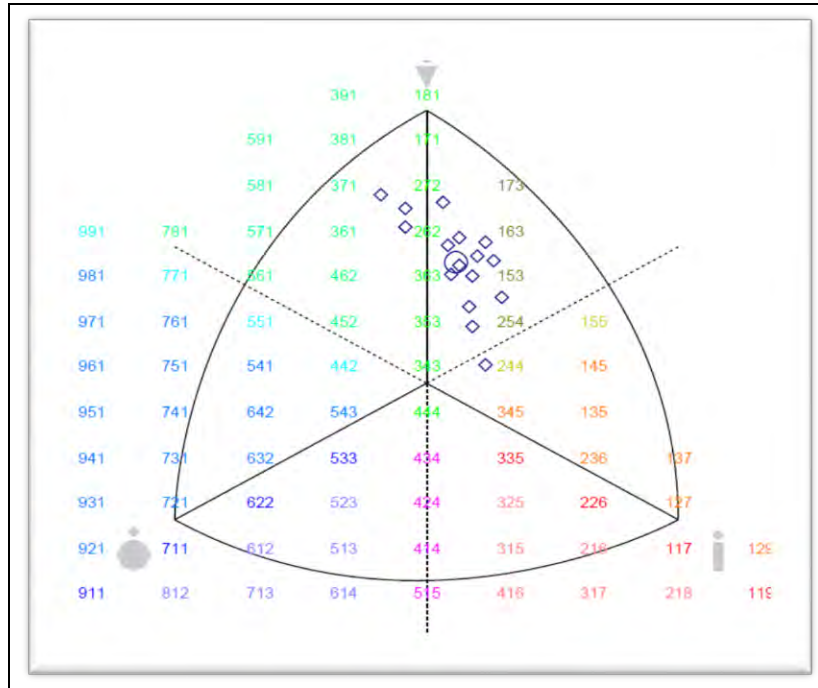
Figure 1. Somatotype features of young elite wrestlers. O = somatotype mean (2.16 – 5.9 – 2.9)

Discussion

One of the scientific aims of training is to use laboratory experiments to predict the athletes' performances. It has been proven that when athletes have the minimum amount of Body Fat %, they have the highest amount of Oxygen intake [13]. Mirzaei and Sadeghi did a study on the introduction to the state of physical fitness among adult wrestlers in freestyle wrestling national team. Based on their findings, VO_2Max was 50.6 ± 5.7 ml/kg/min and the amount of body fat% was 11.5 ± 5.3 [17]. According to all researches done on wrestlers, one of the most important criteria that wrestling coaches should consider is Cardio Vascular Endurance. Additionally, the wrestler should have anaerobic power, agility, flexibility endurance and 1Repitation Maximum. Besides all these factors, the anthropometric variables increase as wrestlers aging 10–14 grow older and it would lead to advance in physical fitness records of the wrestlers [18].

Therefore, it is better to consider the age range of wrestlers while the talent identification process is being held since the obtained results would be more generalizable to evaluate the profiles. Robinson Ramirez-Velez reported VO_2Max as 49 ml/kg/min [19]. Also through other fact-findings VO_2Max counted as 45.9 ml/kg/min [12, 20], and 41.2 ml/kg/min among American wrestlers [3]. The concordance failure might be due to variety of athletes' practicing methods, body weight and fitness level of their body while doing the test or even because of environmental differences such as height, temperature and so forth [19].

The present study measured wrestlers' resting heart rate (68.31 bpm). The mean of resting heart rate was 60-100. Arslanoglu Erkan conducted a research on Turkish young wrestlers' resting heart rate. However, Arslanoglu's report on resting heart rate (63.2 bpm) did not concur with the result achieved by the present study [21]. On the other hand, according to Yoon's research, the maximum amount of elite wrestlers' heart rate was 197.5 [22] which was concurrent with the findings of the present study (198.68).

Based on the results achieved through the present study, the mean amount for the sit and reach test was 41.93 cm which follows the national norm of Iranian wrestlers [17]. Mirzaei et al. stated that the flexibility record among various weight range was very close to each other [3]. However, in a case study Mirzaei et al. reported the sit and reach test as 45cm [23]. In contrast, some experimental researches concluded that when the wrestlers' muscle strength increases, their flexibility does not decrease [22]. Following the statement mentioned above, many types of research done on wrestlers' physical fitness, the most prominent factor is muscle strength [17]. One of greatest features of wrestlers is the strength of upper and lower body (1RM) chest press and squat were 72.88 and 100.27 kg respectively. All the aforesaid amounts were less than Mirzaei et al.'s findings [23] and followed the national norm of Iran [3].

In the present study 4×9 m test, the agility was 8.86 seconds which was in accordance with the national norm of Iran. Based on researchers' agility is one of the most influential features of a successful wrestler. Due to

the point that wrestling is associated with fast directional changes, body performance, and frequent flounce, what is required to fulfill the goal is a sharp reaction in the meantime [4].

A wrestler's anthropometric feature plays a crucial role in determining his/her potentials to succeed in matches. Specific physical features and anthropometric profiles are required in order for the maximum performance of the athletes in special sports. In addition to physiologic features mentioned through the present research, young elite wrestlers' anthropometric features, somatotype features, and body composition should be perused. According to Yoon, the appropriate amount of body fat % for wrestlers is 7 to 10 and in order to balance this measurement the wrestler must go on a specific diet and do suitable aerobic exercises [22]. Zakani also studied Italian national team wrestlers anthropometric features and their body compositions. There were 32 wrestlers aging 18-33 taking part in his study. Through his study some variables such as anthropometric weight, height, sitting height, some girth and body composition were measured and the minimum amount of body fat % was 5 [1,18]. Mirzaei et al. described the freestyle young elite wrestlers' profile and calculated their body fat % as 10.6±3.8 [3]. They resulted in the agreement between Iranian young elite wrestlers' physiologic profile and young elite wrestlers physiologic profiles of other countries. Sterkowize et al. studied the somatotype of heavyweight and finally they concluded that heavyweight wrestlers are either mesomorph or endomorph [24]. However, through this research, the somatotype of young wrestlers weighing about 66.70 ± 8.48 was considered as a mesomorph. Based on their findings it is clear that weight classes among lighter wrestlers were more like mesomorph and their body fat % were lower.

Robinson Ramirez-Velez did a research on 21 national Colombian wrestlers Mesomorph – ectomorph – somatotype mean (3.8– 5.3–1.6) of the wrestlers were analyzed by a related software which is shown in Figure 2 [19]. Data- driven from diagram 2 do not concord with the results of the present study. It is obvious that the mesomorphy is dominant and endomorph and ectomorph are equal (or the measured difference is only half a unit). In order to identify each body composition and compare various factors, the researcher must take special anthropometric girth into account and also include data mentioned in present research as a reference. Additionally, the present study would be advantageous for practical purposes as well as electing elite wrestlers and design their practicing plans through future researches and talent identification programs.
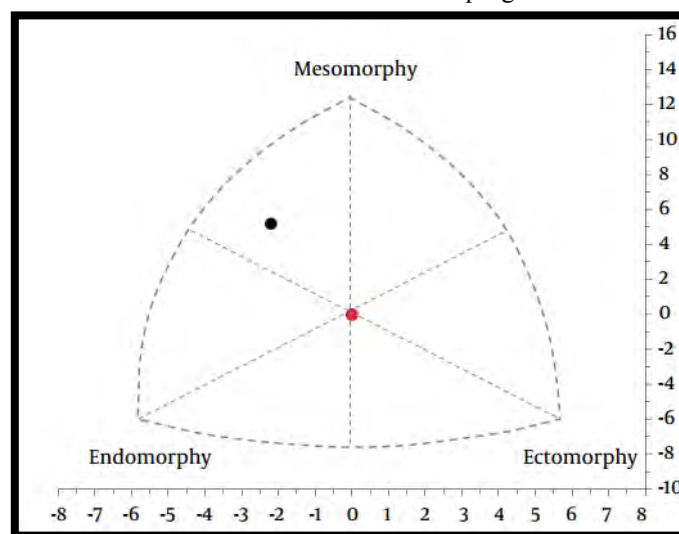

Figure 2. Somatotype average characteristics of Columbia wrestlers' national team. O = somatotype mean (3.8 – 5.3 – 1.6), [19].

Conclusion

The results of the present study would provide wrestling coaches with anthropometric features, body composition and somatotype profile of elite wrestlers. Such information including relative physiologic factors and body fitness could help wrestling coaches to balance wrestlers' practice schedules based on anthropometric profile and their sports performances. It is important not to ignore the role of energy resource in wrestling matches since they are more anaerobic but energy producer especially while wrestlers' recovery through taking aerobic system pathway. Therefore, information such as high VO_{2MAX}, low resting heart rate, agility, 1RM, high speed and flexibility would be beneficial.

Also considering anthropometric characteristics of lightweight tend to be more mesomorph, medium height and have low BMI and low body fat % could help young wrestlers to analyze performance information and appropriate practicality of such information themselves. Moreover, sports associations and wrestling federation

could use driven information from the present study for talent identification plans and identification of elite wrestlers at their early ages.

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Conflict of interests

The authors declare that there is no conflict of interests.

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