

Correlation between Morphological and Functional Variables during a Specific Wrestling Test For Tunisian Cadet Greco-Roman Wrestlers

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Abstract:

The aim of this study was to determine the anthropometric characteristics and functional characteristics of Tunisian wrestlers from the cadet Greco-Roman national team. The present research was conducted on a sample of 20 male young wrestlers (10 of national team "A" and 10 of national team "B") aged 16-17 years. A variety of anthropometric surveys have been conducted. Maximal strength tests, wrestling specific test and Wingate test was conducted to identify anaerobic power and potency for both leg and arm. A one-way analysis of covariance was performed to compare the two groups. Correlation among the variables was calculated by the Pearson correlation coefficient. The main significant correlations observed were between the following variables: VO₂max and number of throws in the WST, percent body fat and estimated VO₂max and number of throws in the WST Chest circumference and bench press 1RM and row and Thigh and squat circumference 1RM. There was no correlation between the circumferences and 1 RM/kg body mass. These results was used to establish the elite wrestlers' profiles to be used as training targets for developing athletes. Based on these results, there was a profile of high performance wrestlers available to be used as training objects for developing athletes. It can also inform training and tactical planning.

Key Words: Wrestling - Anthropometric - Anaerobic Power - body composition..

Introduction

Wrestling is a sport that requires high levels of physical preparation from wrestlers (Sterkowicz-Przybycień et al., 2011). There are two styles of wrestling, the free style and the Greco-Roman style. The freestyle includes the upper and lower body and is characterized by an intermittent effort of short duration and high intensity and the duration of the bout is 6 minutes in total. The Greco-Roman wrestling style only permits upper body movements and also has a combat time of 6 min (2 rounds x 3 min). For Mirzaei et al, (2009) Greco-Roman wrestling is characterized by power due to the combat system, which uses explosive techniques. In the same sense, Hübner-Woźniak, et al, (2006) concluded that a wrestling bout is a physical intermittent effort with a variable intensity. Gullon et al. (2011) also states that a wrestling bout is characterized by techniques of repetitive sudden and explosive attacks and counter-attacks. Similarly for Palleres et al. (2011), a competitive wrestling bout is described as an intense and combative effort in which each wrestler attempts to throw his opponent on his back or to control him on the ground. In addition, (Kraemer et al., 2001; Mahdi, 2007) concluded that the composition of the technical wrestling techniques is demanding according to the muscle groups, which means that the contractile powers play an important role in the execution of the wrestling techniques (Baic et al. (2007). For Nilsson et al. (2002), wrestling, like many sports, requires anaerobic and aerobic energy systems of varying levels. Thus, in the wrestling anaerobic system, maximum power is provided by short and fast techniques during combat, while in the aerobic system, the ability of the wrestler to maintain his effort throughout the duration of the combat (Callan et al., 2000) is enhanced by the fact that the wrestler is stronger and has a greater impulse force than the opponent's average. Usually, energy systems, aerobic and anaerobic, are operating at the same time, with varying degrees of representation and this always depends on the technical and tactical situation of the combat (Demirkan et al., 2011).

Physical wrestling requirements are high and demand an optimal physical condition of the wrestler. The majority of bouts are of approximately 3 to 4 minutes in duration, intermittently with 20-30 seconds of intense activity, involving developed aerobic and anaerobic endurance (López-González, D. E., & Miarka, B., 2013). These characteristics of wrestling combat mean that wrestlers have high muscle strength depending on weight class and achieve very high performance in endurance tests in traction, push-up and sit-up (Utter et al., 1997). From this perspective, Wright et al (2015) have indicated that various research have pointed out the significance of certain anthropometric parameters ,as lower body fat and higher body fat mass, in improving wrestling performance. In fact, the purpose of a great earlier research study was to determine the anthropometric and fitness profiles of wrestlers by performance level, without focusing on the success factors that differ by weight (Wright et al (2015). In this regard, Kraemer et al (2001) have noted the importance of specific anthropometric parameters to improve wrestling performance, such as the minimum body fat level. Mirzaei et al., (2009)

recommend that coaches consider the physical composition of their wrestlers during the coaching process. In this way, Hübner-Woźniak et al., (2004) found that the practice of wrestling techniques varies by competitive weight category, and some studies point to significant differences in physical fitness and body composition among the 10 weight categories of young wrestlers (Barbas, et al., 2011).

The aim of this study was to determine the anthropometric characteristics and functional characteristics of Tunisian wrestlers from the cadet Greco-Roman national team and to identify the wrestling skills of every wrestler.

Material & methods

Participants

Twenty cadet wrestlers (16-17 years old) of Greco-Roman style, having on average five years of wrestling experience participated in this study, divided in two groups in order to separate the wrestlers' status into two teams; national team "A" (NTA) and national team "B" (NTB). The NTA = 10 wrestlers and NTB = 10 wrestlers. The first two of the individual Tunisian championship rankings were analysed in the ten weight categories listed in the International Olympic Wrestling Regulations, which are: 42 kg, 46kg, 50kg, 54kg, 58kg, 63kg, 69kg, 76kg, 85kg and +85 -100kg). All participants voluntarily participated in the study, after being informed of the procedures to be followed, and their parents signed a consent agreement. The research was approved by FTL (Tunisian Wrestling Federation).

Procedure

Body composition measurements

Body weight was measured using an electronic scale and rounded to the nearest 0.1 kg. The height was measured using a stadiometer (Seca 220 (CM), Seca gmbh, Hamburg, Germany) and rounded to the nearest 0.5 cm. Circumference was measured for the fixed arm, relaxed arm, forearm, thigh, calf, chest, waist with a constant tension tape. Skinfold thickness was measured to the nearest 0.5 mm with a calibrated Lange caliper (Beta Technology, Inc., Cambridge, MD) at the biceps, triceps, abdomen, with the Lange skin fold stirrup (Holtain Ltd., Crymych, Dyfed); then they were used to determine body fat (%) from the nomogram proposed by Jackson and Pollock (1988).

Physical fitness measurements

For physical performance measures a wingate test (WAnT) was applied to identify anaerobic power and capacity of the wrestlers for both leg and arm. We implemented that 7.5% of body weight for leg and 5.5% of it for arm as load in wingate test. We applied 4-5-minute-warm-up protocol including two or three sprints with the pedal speed of 60- 70 revolutions per minute longing 4-8 seconds. For maximal strength test was used a test to quantify a maximum repetition (1RM). All participants performed a specific warm-up, including two sets of leg flexion, from 12 to 15 repetitions at 50% of the value assigned by the wrestlers as 1RM value. Bench support and rowing exercises were performed on a bench and a wooden board, respectively, and a 10 kg bar with 20, 10, 5 and 1 kg rings was used for both exercises. Each athlete performed at least three and no more than three trials, with intervals of 3 to 5 minutes between them. The interval between exercises was at least 30 minutes (Table 2).

Wrestling Specific test (WST)

The test consists of three wrestlers (1 executor and 2 partners) of the same weight categories (same body mass and height), the distance between the 2 partners is 4m, while the executor is between the two partners at the 2m level (figure 1). The procedure is divided into three periods: 15 sec, 30 sec, and 30 sec, with rest intervals of 10 sec between them. The task was as follows: once the start of the test is reported, the executor runs quickly to his partner (A) and executes the requested "arm on the fly" technique then moves quickly to the partner (B) and repeats the same movement during each period several times up to 60 times possible. Immediately after 1 minute after the end of the test, the wrestler's heart rate is checked with a M400 Polar Heart Rate Monitor (Polar, Inc., Lake Success, NY, USA) which was placed around the chest of the examinee before the test, was used to measure the frequency of the pulse (figure 2). Based on the obtained results, the indexes of success were calculated as:

$$\text{index} = \frac{\text{HR}^{(\text{bpm})} (1\text{min})}{\text{Total number Throws}}$$

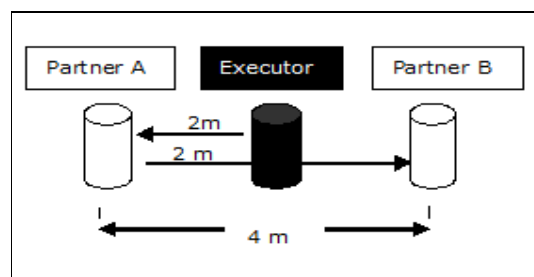


Fig 1. Structure of the Specific Wrestling Test.

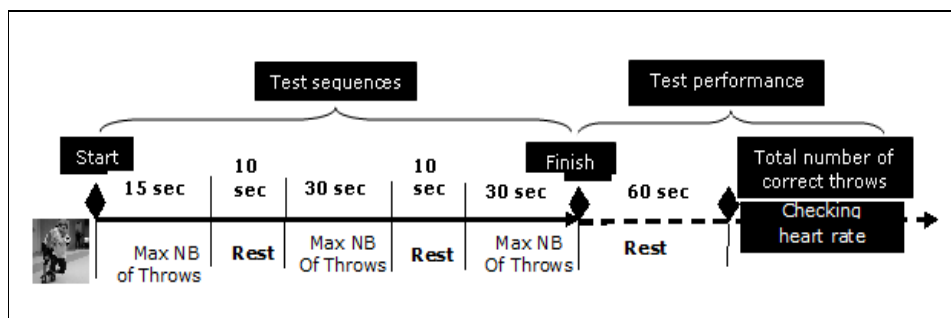


Fig 2: Protocol of the Specific Wrestling Test.

Statistical analysis

All the findings were examined by applying the basic descriptive statistics in which the following elements were calculated; mean, standard deviation, standard error (abs. and rel.), lower and higher 95% interval of confidence, minimum, maximum, and coefficient of variation. The correlation between the variables was calculated using the Pearson correlation coefficient. All statistical analysis was carried out by the software package SPSS 19.0, whereas the value $p < 0.05$ was used for the level of statistical significance.

Results

Morphological and Functional Characteristics of Participants

The anthropometric characteristics showed in Table 1 from participants in both analytical groups (national team "A" and national team "B") show no difference ($p > 0.05$).

Table 1. Anthropometric Characteristics (N=20)

Characteristics	NTA (mean ±)	NTB (mean ±)
Age, (year)	16.5±4.0	16.6±3.0
Weight (kg)	66.3 ±7.0	64.4 ±4.0
Height (cm)	166.5±2.0	167.5±5.0
Body Fat (%)	9.2±6.0	8.75±5.0
Relaxed arm circumference (cm)	22.3±4.0	21.8±4.0
Fixed arm circumference (cm)	24.2±8.0	22.6±6.0
Forearm circumference (cm)	19.3±7.0	18.3±7.0
Skinfolds biceps (mm)	2.3±7.0	3.0±7.0
Skinfolds triceps (mm)	3.3±4.0	3.1±6.0
Skinfolds abdominal (mm)	12.0 ±5.0	11.56 ±5.0
Circumferences chest (cm)	69.2±5.0	65.2±7.0
Circumferences waist (cm)	55.6±7.0	55.2±8.0

For the Wingate test (Table 2), the power and anaerobic capacity of leg and arm wrestlers were identified. We did not identify a statistically significant difference in the values of the average leg capacity (W) and average arm capacity (W/kg) of the wrestlers selected from National Team Group "A" and those who selected Group "B" with ($p > 0.05$)

Table 2. Characteristics of Anaerobic Power and Capacity of Wrestlers Selected for the National Team "A" And National Team "B" (N = 20)

Characteristics	NTA (mean ±)	NTB (mean ±)
Leg peak power (W)	1009±357	0944±382
Leg peak power (W/kg)	13,3±2,3	12±2,7
Arm peak power (W)	632±225	525±163
Arm peak power (W/kg)	8,6±2,8	7,3±2,2

For the specific wrestling test, the results of the wrestlers indicate, as shown in Table 3, that the lower the value of this component, the higher the wrestler's performance. The two study groups showed no difference ($p > 0.05$) in the number of throws, heart rate and test index.

Table 3. Performance and Heart Rate of Wrestlers Taking Part in the Wrestling Specific Test (N =20)

Characteristics	NTA (mean ±)	NTB (mean ±)
HR after (bpm)	109±6	105±4
HR 1min (bpm)	99±7	106±2
Index	9.77±1.0	10.27±1.0
total Throws	20±3.0	19±3.0

The results of the maximum strength tests indicate, as shown in Table 4, that no significant differences ($p > 0.05$) were noted for absolute or relative strength between the two groups.

Table 4. Maximal Strength Test (N=20)

Characteristics	NTA (mean \pm)	NTB (mean \pm)
1RM Bench-press (kg)	80.5 \pm 4.0	80.5 \pm 3.0
1RM Row (kg)	86.3 \pm 7.0	84.4 \pm 4.0
1RM Squat (kg)	90 \pm 2.0	90 \pm 2.0
1RM Bench-press (kg/kg of body mass)	1.02 \pm 6.0	1.0 \pm 5.0
1RM Row (kg/kg of body mass)	1.03 \pm 4.0	1.02 \pm 4.0
1RM Squat (kg/kg of body mass)	1.10 \pm 8.0	1.10 \pm 6.0

Correlation between morphological and functional variables during a specific wrestling test
 It was found in figure 3 that there is a positive correlations between weight and bench press, row and squat 1 RM. And in figure 4 there is a negative correlations between weight and specific wrestling test projections.

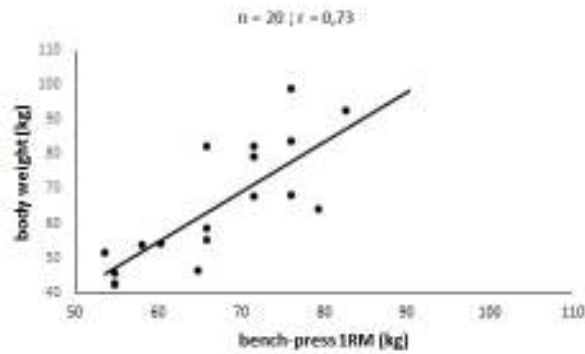


Fig 3. Relationship between Weight and Performances Variables (Bench-Press). Signification $P < 0.05$

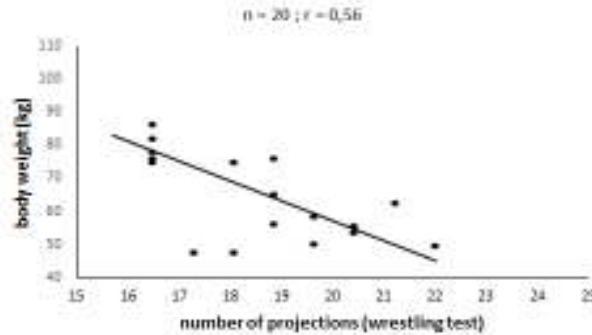


Fig 4. Relationship between Weight and Wrestling Specific Test (Projections). Signification $P < 0.05$

The results show that there is a significant correlation between: the index of the wrestling specific test and 1) body weight ($r = 0.43$; $p < 0.05$; $n = 20$), 2) body fat ($r = 0.46$; $p < 0.05$; $n = 20$). We noted a significant correlations regarding the relationship between leg power peak and the number of throws in the specific wrestling test ($r = 0.42$; $p < 0.05$; $n = 20$) (figure 5) and arm power peak ($r = 0.39$; $p < 0.05$; $n = 20$) (figure 6).

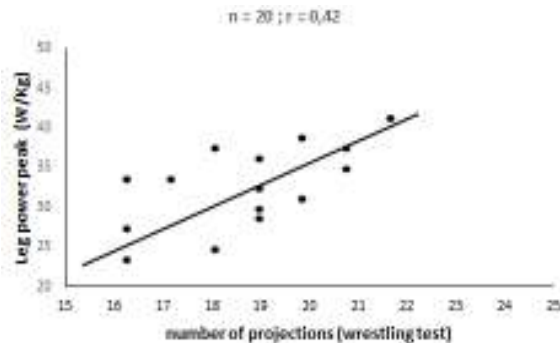


Fig 5. Relationship between Leg Power Peak and Wrestling Specific Test (Projections). Signification $P < 0.05$

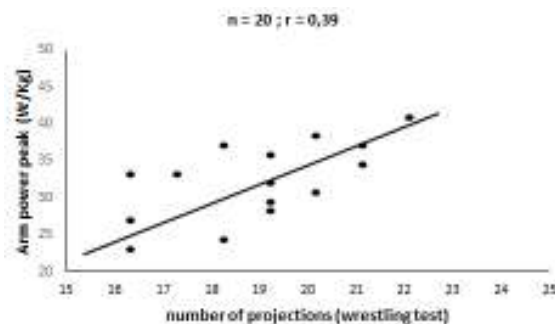


Fig 6. Relationship between Arm Power Peak and Wrestling Specific Test (Projections). Signification $P < 0.05$

Discussion

The main findings of this study indicate that the anthropometric characteristics of the two groups of wrestlers are identical, but it is interesting to note that both groups have a small skin fold thickness and a high percentage of body fat, while they have high circumferential values. Proving that these wrestlers were very slim. This is consistent with earlier studies in which no difference in anthropometric and physical characteristics was found between the two Greco-Roman style groups (Latyshev, and Korobeynikov, 2013). Indeed, the body fat rate of the two groups in this study is similar to the research of Stordopoulos et al., (2016) who have the same age and skill level. Moreover, based on the principles of ideal nutrition and aerobic training, the ideal percentage of body fat for a wrestler must be between 7-10% for this purpose, Vardar et al., (2007) concluded that the percentage of body fat for world champions must be less than 10%. Karnincic, et al., (2009) noted that in highly developed conditions, wrestlers' body fat percentages typically ranged from 3% to 13%. Abellán et al., (2010) also indicated that the mean percentage of body fat for young wrestlers (mean age, 19.8 ± 0.9 years) was 10.6%, with 20.1% for heavyweight wrestlers and between 7.4% and 11.4% for the other categories.

Wrestling is a sport requiring predominantly anaerobic action and demands aerobic system's contributions to support wrestler's efforts (Wright, et al., 2015). On the basis of these requirements, it is important to have specific tests to evaluate the physical condition of wrestlers in order to improve the training-related aspects and improve the level of performance in competition (Nilson et al., 2002). For the power and anaerobic capacity of leg and arm wrestlers. We did not identify any significant difference in the values of the average leg capacity and average arm capacity of the wrestlers selected in group "A" and those who selected group "B". The values observed in this research are lower than those observed in Gierczuk, and Ljach, (2012) study, which concluded that the general physiological profiles of successful wrestlers, for anaerobic power (5.1-6.5 W/kg for arms; 10.55-18.5 W/kg for legs) and capacity (3.8-4.2 W/kg for arms and 8.4-7.2 W/kg for legs). According to Sadowski and Gierczuk (2009), assessing the physical fitness of wrestlers is essential to designing an appropriate training program. However, the results found in this study suggest that there is a positive correlation between weight and bench pressure, row and squat 1 MR and a negative correlation between weight and the specific control test. In that way our research results aligned with Smith and Jones (2001) who confirmed that muscular strength is proportional to muscle size and a larger arm circumference can be beneficial. Thus, Wilmore et al., (2008) confirms that a greater circumference in the arm segments may indicate a larger cross-sectional area of the muscle mass and therefore a greater power and strength for these segments.

Conclusion

On the basis of the findings, it appears that there is a significant correlation between the index of the specific wrestling test and body weight and body fat. We noted a significant correlation regarding the relationship between the peak power of the legs and the number of throws in the specific wrestling test. On the specific wrestling test, the index is a combination of anaerobic and aerobic fitness, with a higher participation rate of the glycolytic system (Latyshev & Korobeynikov, 2013). Considering the differences revealed by the Wingate test, it is possible that the best index of the first group compared to the second group corresponds more to the best anaerobic condition. With the results of our research, we had the opportunity to study the anthropometric characteristics and functional characteristics of Tunisian wrestlers from the cadet Greco-Roman national team and to identify the wrestling skills of every wrestler. As a consequence of the results, we can conclude that the physical and morphological characteristics are not selective for the performance of the young wrestlers belonging to the Greek-Roman cadet national team. We also concluded that the higher percentage of fat, the lower performance of the specific wrestling test is. Finally, the wrestlers with large circumference have a higher absolute maximum force but this relationship cannot be significant when the force is expressed in relation to body weight.

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