The relationship between anthropometric parameters, body composition and explosive power in cadet wrestlers

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Annotation:

Purpose: The purpose of the present study was to investigate the relationship between anthropometric parameters, body composition and explosive power in cadet wrestlers.

Methods: Seventeen male cadet wrestlers (age = 15.6 ± 0.73 yrs) from the Kurdistan province wrestling clubs participated in this study. Body composition (percent body fat), anthropometric parameters (height, sitting height, arm-span, upper arm length, leg length, upper leg length, arm circumference, middle thigh and calf circumference), explosive power (standing long jump and Medicine ball throw tests) were measured.

Results: Explosive power of upper body was significantly correlated with sitting height arm-span, upper arm length, arm circumference, weight ($p < 0.01$) and %BF ($p < 0.05$). Explosive power of lower body was significantly correlated with sitting height, arm-span and weight ($p<0.01$). No significant correlation was found between explosive power of lower body and leg length, upper leg length, middle thigh circumference and maximum calf circumference ($p>0.01$) Explosive power of upper body was also significantly correlated with explosive power of lower body ($p<0.01$).

Conclusion: Explosive power is an important parameter in wrestling. Having a high level of power along with an appropriate arm-span helps to the wrestler for performing techniques successfully in competition. Our study suggested that height isn't the only parameter affecting talent identification and other parameters such as arm span and sitting height should be seriously considered when criteria for the selection of a wrestler are set.

Key words:

wrestling, testing, performance, talent identification.

Бахман Мирзаеи, Навид Лотфи, Пайам Саеиди. Соотношения между антропометрическими параметрами, составом тела и взрывной силой юных борцов.

Цель: Целью настоящего исследования было изучение взаимосвязи между антропометрическими параметрами, составом тела и взрывной силой борцов-кадетов.

Методы: В этом исследовании участвовали 17 мужчин (возраст = 15,6 ± 0.73 лет) из провинции Курдистан из клубов по борьбе. Были измерены: состав тела (% жира), антропометрические параметры (высота, высота сиденья, диапазон движения руки, длина вытянутой руки вверх; длина ног, длина бедра; окружность плеча; обхват бедер и икр), взрывной силы (прыжок в длину, метание медицинбола).

Результаты: Взрывная сила верхней части тела достоверно коррелирует с высотой руки сидя, длиной вытянутой руки, окружностью плеча, вес ($p<0.01$) и % BF ($p<0.05$). Взрывная сила нижней части тела достоверно коррелирует с высотой вытянутой руки сидя и весом ($p<0.01$). Незначимая корреляция была найдена между взрывной силой нижней части тела и длиной ног; длиной бедра, средней окружностью бедра и максимальной длиной окружности тела ($p<0.01$). Взрывная сила верхней части тела также достоверно коррелирует с взрывной силой нижней части тела ($p<0.01$).

Вывод: взрывная сила является важным параметром в борьбе. Имея высокий уровень силы вместе с соответствующим размахом рук, борец имеет преимущества в поединке. Наше исследование показало, что рост спортсмена – это параметр, влияющий на выявление талантов и других параметров. Также влияет на отбор перспективных спортсменов высота сиденья спортсмена и другие, которые требуют серьезного рассмотрения.

борьба, тестирование, производительность, талант, идентификация.

Бахман Мирзаеі, Навід Лотфі, Пайам Саєіді. Співвідношення між антропометричними параметрами, складом тіла й вибуховою силою юних борців.

Ціль: Метою справжнього дослідження було вивчення взаємозв'язку між антропометричними параметрами, складом тіла й вибуховою силою борців-кадетів.

Методи: У цьому дослідженні брали участь 17 чоловіків (вік = 15,6 ± 0.73 років) із провінції Курдистан із клубів з боротьбі. Були обмірювані: склад тіла (% жиру), антропометричні параметри (висота, висота сидіння, діапазон руху руки, довжина витягнутої руки нагору; довжина ніг, довжина стегна; окружність плеча; обхват стегон та ікр), вибухової сили (стрибок у довжину, метання медицинбола).

Результати: Вибухова сила верхньої частини тіла вірогідно корелює з висотою руки сидячи, довжиною витягнутої руки, окружністю плеча, вага ($p<0.01$) і % BF ($p<0.05$). Вибухова сила нижньої частини тіла вірогідно корелює з висотою витягнутої руки сидячи й вагою ($p<0.01$). Незначуща кореляція була знайдена між вибуховою силою нижньої частини тіла й довжиною ніг; довжиною стегна, середньою окружністю стегна й максимальною довжиною окружності тіла ($p<0.01$). Вибухова сила верхньої частини тіла також вірогідно корелює з вибуховою силою нижньої частини тіла ($p<0.01$).

Висновок: вибухова сила є важливим параметром у боротьбі. Маючи високий рівень сили разом з відповідним розмахом рук, борець має переваги у двобої. Наше дослідження показало, що ріст спортсмена – це параметр, що впливає на виявлення талантів та інших параметрів. Також впливає на добір перспективних спортсменів висота сидіння спортсмена й інші, які вимагають серйозного розгляду.

боротьба, тестування, продуктивність, талант, ідентифікація.

Introduction

Power in wrestlers is related with quick and explosive effort that leads to wrestling success [16, 29]. Anaerobic power and capacity are important in wrestling because of the need of short-duration and high intensity performance [29]. Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle, and adipose (fat) tissue. Measures of subcutaneous adipose tissue are important, because some studies have reported that high body fat will reduce performance [2, 25]. The measuring of anthropometric parameters in wrestling, in addition to identifying success factors, helps coaches in talent identification. Talent identification alludes to the process of recognizing current participants with the potential to become elite athletes [23].

There are several investigations dealing with the relationship between some anthropometrical parameters and performance. Cvetcović et al (2005) studied technical efficiency of wrestlers in relation to some anthropometric and motor variables. They reported that technical efficiency in young top-level wrestlers depends on a large number of motor abilities as well as some morphological characteristics [5]. Vardar et al. (2007) investigated the relationship between body composition and anaerobic performance of elite young wrestlers. They reported that mean power was significantly correlated with fat free mass in male wrestlers [$r= 0.90$ $p < 0.05$]. They also reported that no relationship was obtained between anaerobic parameters and % fat mass [29]. Temfemo et al. (2009) studied the relationship between vertical jumping performance and anthropometric characteristics during growth in boys and girls. They reported strong correlations between average power output and lean body mass, and average power output and leg muscle volume (LMV) in each group [28]. Dejanović and Živković (2008) studied

the relationship between the anthropometric characteristics of the body and the isometric endurance of children. They reported that there are statistically significant relations between anthropometric characteristics and the isometric endurance of the lumbar and abdominal musculature of boys and girls aged 7 to 10 [8]. Wong et al. (2009) studied the relationship between anthropometric and physiological characteristics in youth soccer players. They reported that body height was significantly ($p < 0.05$) correlated with vertical jump height ($r = 0.36$) [32]. Reeves et al. (2008) studied the relationship between upper arm anthropometrical measures and vertical jump displacement. They reported that length of the ulna was the only upper body limb measurement that was significantly correlated with the vertical jump ($P = 0.04$) [26]. Davis et al. (2006) investigated the relationship of body segment length and vertical jump displacement in recreational athletes. The results of this investigation revealed that vertical jump displacement could not be predicted by skeletal length measures [6].

Due to importance of anthropometric parameters and fitness parameter in talent identification and successful implementation of techniques in the sport of wrestling, the purpose of present study was to investigate the relationship between anthropometric parameters, body composition and explosive power in cadet wrestlers.

Methods

Subjects

Seventeen cadet wrestlers were recruited from the Kurdistan province wrestling clubs and served as subjects in this study. They all had at least 3 years training experience and were representative from top wrestlers of Kurdistan province competing in Iran national competitions. Before participating, subjects' parents were informed of the potential risks and gave their written informed consent to participate their children in this study, which was consistent with the human subject policy of the Guilan research center. Subject characteristics were as follows (mean ± SE): age 15.60±0.73 yr; height 169.87±7.13 cm; weight 60.16±11.38 kg.

Testing procedures

Anthropometric characteristics

Initial anthropometric measurements, including standing body height, sitting height, arm-span, upper-arm length, leg length, arm and leg muscle volume and percentage of fat mass (%fat), were carried out. Arm-span was measured as the distance between the tips of the middle fingers of each hand when both arms are extended laterally and maximally at shoulder level, with the subjects standing against a wall [23]. Height, leg length, middle thigh circumference and maximum calf circumference were measured following the techniques recommended by the International Biological Program [30]. Skinfold thicknesses were measured on the right side of the body using the Lafayette skinfold Caliper. Subcutaneous body fat was measured at 3 sites (chest, abdominal and thigh). Body fat percent was computed through the formula developed by Jackson & Pollock (1978) [13, 22]. Leg muscle volume was assessed using the anthropometric method of Jones and Pearson [14] in which the leg is compared to a truncated cone. This method has been validated for adults as well as for children [28].

Upper arm length was measured through palpation of the acromion and following from the lateral lip to the greater tuberosity, which is inferior to the acromion's internal edge [12, 26]. The examiner followed the length of the humerus to the lateral epicondyle to complete the measurement. All one-sided measures were taken on the right side of the body. All measures were taken by the same experienced examiner [26].

Explosive power tests.

Explosive power tests included standing long Jump and medicine ball throw .In standing long Jump test, all subjects were instructed to perform a long jump from a standing position. Standardized instructions were given to subjects that permitted them to begin the jump with bent knees and swing their arms to assist in the jump. A line drawn on a hard surface served as the starting line. The length of the jump was determined using a tape measure, which was affixed to the floor. Each subject was given 3 trials, and the distance of the best jump was measured. The longest jump was used as the test score [1]. When the medicine ball throw test was administered, the examiner demonstrated the skill. Each subject sat on the floor with his back against the wall. The subject held the ball (3 kg) in front of him with both hands [9], resting it against his lap. The subjects were instructed that on the tester's command (''go''), that ''you will lift the medicine ball to your chest and throw it forward as hard as you can.'' Each subject performed two practice throws, and then the distance of the next three throws was recorded, with a 1- to 2-minute rest between each throw [7].

Statistical methods.

General characteristics of the subjects were presented as means and standard deviations. Pearson's correlation coefficients were used to express the relationships between anthropometrics parameters, body composition parameters and explosive power tests. A *P* value less than 0.05 was considered statistically significant. Statistical analysis was conducted using SPSS version 16.0 for Windows.

Results

Subjects' data, body composition characteristics and explosive power measures of subjects are shown in Table 1. Anthropometric parameters are shown in Table 2.

Explosive power of upper body was significantly correlated with sitting height ($r = 0.66$ $p < 0.01$), arm-span ($r = 0.72$ $p < 0.01$), arm length ($r = 0.78$ $p < 0.01$), upper arm length ($r = 0.71$ $p < 0.01$), arm circumference ($r = 0.79$ $p < 0.01$), weight ($r = 0.82$ $p < 0.01$) and %BF ($r = – 0.61$ $p < 0.05$). Explosive power of lower body was significantly correlated with sitting height ($r = 0.82$ $p < 0.01$), arm-span ($r = 0.77$ $p < 0.01$), upper arm length ($r = 0.54$ $p < 0.05$), arm circumference ($r = 0.52$ $p < 0.05$) and weight ($r = 0.53$ $p < 0.01$). No significant correlation was found between explosive power of lower body and leg length ($r = 0.26$ $p > 0.01$), upper leg length ($r = 0.49$ $p > 0.01$), middle thigh circumference ($r = 0.47$ $p > 0.01$) and maximum calf circumference ($r = 0.39$ $p > 0.01$). Explosive power of upper body was also significantly correlated with explosive power of lower body in cadet

Table 1.

Subjects' data, body composition characteristics and explosive power

Variable	Age (yr)	Weight (kg)	BF (%)	Medicine ball throw (cm)	Long jump (cm)
Result	15.60±0.73	60.16±11.38	6.46±2.58	355.60±47.54	200.47±21.58

Table 2.

Anthropometric parameters of subjects

Variable	SH (cm)	AS (cm)	LL (cm)	ULL (cm)	UAL (cm)	AC (cm)	MTC (cm)	MCC (cm
Result	78.93±20.14	170.00±7.01	85.80±3.87	39.33±2.43	33.80±1.74	26.46±2.74	46.93±3.91	34.20±5.08

SH: Sitting height, AR: Arm-span, LL: Leg length, ULL: Upper leg length, UAL: Upper arm length, AC: Arm circumference, MTC: middle thigh circumference, MCC: Maximum Calf circumference

wrestlers ($r = 0.71$ $p < 0.01$).

Discussion

By our knowledge, this is the first study to investigate the relationship between anthropometric measures and explosive power in cadet wrestlers.

The use of BMI in adolescents isn't standard criterion and the amount of subcutaneous fat being more reliable [19]. Therefore, in present study we haven't used BMI as a criterion for the body composition of cadet wrestlers. In present study, the %BF of subjects were lower than what Temfemo et al (2009) reported (6.46±2.58 vs. 17.9 ±18) [28]. This result shows that regular exercise has positive effect on fat percent in adolescent wrestlers. This result is in agreement with Mirzaei et al (2011) [22]. However, previous studies indicated that in most sports, higher than necessary fat percentage may affect physiological performance adversely [19].

Some wrestlers may perform many offensive actions in a short burst of time, whereas others may be more defensive and slow the action of the match. Nevertheless, threshold levels of body strength and power are important factors [15].

There was significant correlation between arm length and long jump measure. In the present study it was hypothesized that the longer arm would create additional acceleration through the longer lever arm generated by the arm swing, which is in agreement with Reeves et al (2008) [26]. Also, there was significant correlation between upper arm circumference and long jump. Having a thick arm can produce more force and help to increase primary velocity in long jump. The importance of lower-body power in wrestling lies in the ability of the athlete to lift his opponent during certain offensive maneuvers and to resist attacks by his opponent [4, 20, 21].

No significant correlation was found between long jump and calf circumference. According to previous studies, strength training-induced muscle hypertrophy has not been consistently observed in either prepubertal or pubertal boys [3, 11, 18] and neural adaptations are responsible to increase in strength [17].

There was no significant correlation between leg length and long jump, calf circumference and long jump, and middle thigh circumference and long jump. These results are in agreement with Wu et al (2003). They reported that there were no significant correlations between jump scores and anthropometry parameters and longer lower leg did not correlate well with the superior jumping performance [23].

There was significant correlation between the results of medicine ball throw test and upper arm length, arm span, sitting height and arm circumference. These results are in agreement with Skoufas et al (2003) [27]. Having stronger and taller arms is a mechanical advantage in the throwing action. Escapes from the bottom position or a Greco-Roman throw are examples of explosive movements in sport of wrestling [15].

There was significant correlation between medicine ball throw and standing long jump tests. This result indicates that there is strong relationship between explosive power of upper and lower body. Talent identification requires a multidisciplinary approach, including morphological, physical, technical, and psychological aspects [23] and for talent identification in wrestling a comprehensive set of anthropometric and performance measures should be used.

Conclusion

Explosive power is an important parameter in wrestling. Having a high level of power along with an appropriate arm-span helps to the wrestler for performing techniques successfully in competition. Our study suggested that height isn't the only parameter affecting talent identification and other parameters such as arm span and sitting height should be seriously considered when criteria for the selection of a wrestler are set.

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