Anthropometric Characteristics and Physical Performance of Colombian Elite Male Wrestlers

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Background: Wrestling was an important part of the ancient Olympic Games and is still one of the most popular events of the modern Olympic Games. Studies indicate that general physiologic profile of successful wrestlers is high anaerobic power and capacity, muscular strength, above average aerobic power, exceptional flexibility, fat free mass, and a mesomorphic somatotype.
Objectives: The objective of the present study was to evaluate anthropometric characteristics and physical performance of elite male wrestlers.
Patients and Methods: The Colombian Wrestling Team was evaluated while in preparation for the Olympic Games (n = 21; age, 27.9 ± 6.7 years). Athletes were tested on anthropometric and fitness parameters: body composition, somatotype distribution according to Heath-Carter, aerobic capacity, vertical jump, and anaerobic power.
Results: The evaluations showed a mean body fat percentage of 13.6% ± 3.0% (95% CI, 12.2%-15%), muscle mass of 46.4% ± 2.2% (95% CI, 45.4%-47.4%), Ponderal index of 41.0 ± 1.8 (95% CI, 40.2-41.8), body adiposity index (BAI) 25.1 ± 3.6 (95% CI, 23.5-26.8), and somatotype distribution mesomorphic-ectomorph (5.3-1.6-3.8). Mean aerobic capacity was 45.9 ± 6.6 mL/kg/min (95% CI, 42.8-48.9), vertical jump was 36.4 ± 6.6 cm (95% CI, 11.8-16.6), and anaerobic power was 92.6 ± 19.5 kg/s (95% CI, 83.7-101.5).
Conclusions: These results provided a profile of elite wrestlers that could be used as training targets for developing athletes. The results may also provide information for training and tactical planning.

Keywords: Wrestling; Anthropometric; Aerobic Power; Anaerobic Power; Anaerobic Capacity; Colombia

1. Background

Wrestling was an important part of the ancient Olympic Games and is still one of the most popular events of the modern Olympic Games. Studies indicate that general physiologic profile of successful wrestlers is high anaerobic power and capacity, muscular strength, above average aerobic power, exceptional flexibility, fat free mass, and a mesomorphic somatotype (1, 2). During the 1980s, a few studies examined fitness profiles for wrestlers at different competitive levels in order to identify physiologic differences that may contribute to success (3-5); however, few studies have examined physical fitness characteristics in term of success in modern wrestling performance following changes in rules and evolution in training methods during the last 20 years (1).

2. Objectives

The objective of the present study was to evaluate anthropometric characteristics and physical performance of contemporary elite male wrestler.

3. Patients and Methods

3.1. Subjects and procedure

A total of 21 elite male wrestlers from the Indervalle (National Institute of Sports, Physical Education and Recreation of Valle del Cauca, Colombia), who had > 3 years experience of elite competitions between 2008 and 2012, were recruited. Subjects signed declarations of informed consent and of agreement to participate in the study. Ethical approval was obtained from the institutional ethic committee. Exclusion criteria were previous diagnosis of inflammatory or metabolic diseases. All variables were measured after an overnight fast by a Level-2 anthropometrist, certified by the International Society for the Advancement of Kinanthropometry (ISAK), in accordance with the ISAK guidelines (6).

3.2. Anthropometric, Body Composition, and Somatotype Characteristics

Body weight was measured using an electronic scale

(Seca 700 scale, Seca gmbh, Hamburg, Germany) and was rounded to the nearest 0.1 kg. 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 flexed arm, relaxed arm, forearm, thigh, calf, chest, waist, and hip with a constant-tension steel tape (Lafayette Instrument Company, Lafayette, IN, USA). Diameters of the elbow, knee, and wrist joints, and the bi-acromial and bi-iliac breadths were measured (Body Trends, Carpinteria, CA). Skinfold-thickness was measured at biceps, triceps, subscapular, chest, abdomen, suprailiac, anterior thigh, and medial calf regions on the right side of the body with the Lange skinfold caliper (Holtain Ltd., Crymych, Dyfed); then they were used to determine body fat (%), absolute body fat (kg), muscle mass (%), and absolute muscle mass (kg) from the nomogram proposed by Jackson and Pollock (7). Somatotype was determined by the Heath-Carter anthropometric somatotype method (8). From these measurements, the Ponderal index (PI) was calculated as follows:

$$PI = height/(weight)^{-3}$$

Body adiposity index (BAI) was calculated according to the following equation, which refers to Bergman et al. (9);

$$BAI = [hip\ circumference/(height)^{1.5}] - 18$$

3.3. Physical Performance Characteristics

Aerobic capacity was assessed with the modified Astrand-Rhyming protocol for predicting VO2 max (10) by a Monark 818E cycle ergometer (Monark AB, Varberg, Sweden), interfaced with a computer and monitored heart rate (HR) using a Polar A-5 pulse meter (Polar Electro Oy, Kernpele, Finland). Three measures of anaerobic power were assessed: vertical jump (VJ), standing broad jump (SBJ), and Wingate Anaerobic Test (WAnT). VJ height was converted to anaerobic power using the Lewis nomogram. The 30-second WAnT (11) was performed on the Monark ergometer (Monark AB, Varberg, Sweden) with peak power, anaerobic capacity (AC), and fatigue index (FI) (%) being calculated and recorded.

3.4. Statistical analysis

Data was analyzed with IBM SPSS 20 (SPSS/IBM, Chicago, IL, USA). Anthropometric and physical fitness characteristics were expressed as mean ± standard deviation (SD).

4. Results

The anthropometric characteristics of the participants are presented in Table 1. Body composition and somatotype characteristics of the participants are presented in Table 2. The somatotype component values for endomorphic, mesomorphic, and ectomorphic components characterized the group as mesomorphic-endomorphic, as shown in Figure 1. The physical performance of the participants is presented in Table 3.

Table 1. Anthropometric Characteristics of Elite Male Wrestlers

Characteristics	Mean ± SD	95% CI
Variables		
Age, y	27.9 ± 6.7	24.8-30.9
Height, cm	165.6 ± 8.7	161.6-169.6
Body Mass, kg	66.3 ± 10.6	61.5-71.2
Circumferences, cm		
Chest	87.4 ± 18.8	78.8-95.9
Waist	73.7 ± 6.8	70.6-76.8
Hip	91.8 ± 6.4	88.8-94.7
Relaxed Arm	29.2 ± 2.7	28.0-30.5
Flexed Arm	33.0 ± 3.0	31.6-34.4
Forearm	26.4 ± 2.6	25.1-27.6
Thigh	59.1 ± 8.1	55.4-62.9
Calf	36.2 ± 5.2	33.8-38.6
Skinfolds, mm		
Triceps	9.8 ± 4.5	7.7-11.9
Biceps	5.0 ± 2.6	3.8-6.2
Subscapular	12.9 ± 4.3	10.9-14.9
Supraspinal	12.2 ± 5.9	9.4-14.9
Iliac Crest	14.7 ± 7.6	11.3-18.2
Abdominal	15.0 ± 7.5	11.6-18.5
Front Thigh	13.4 ± 6.1	10.6-16.2
Medial Calf	9.1 ± 5.4	6.6-11.5
Diameter, cm		
Bi-acromial	40.4 ± 4.7	38.3-42.6
Bi-iliac	29.1 ± 2.3	28.0-30.2
Elbow	6.3 ± 0.5	6.0-6.6
Knee	8.9 ± 0.7	8.6-9.3
Wrist	5.1 ± 0.4	4.9-5.3

Table 2. Body Composition and Somatotype of Elite Male Wrestlers

Characteristics	Mean ± SD	95% CI
Body Composition		
Percent Body Fat	13.6 ± 3.0	12.2-15.0
Absolute Body Fat, kg	9.1 ± 2.6	7.8-10.3
Sum of 6 Skinfolds, mm [a]	72.3 ± 29.3	58.9-85.6
Sum of 8 Skinfolds, mm [b]	100.5 ± 39.9	82.3-118.7
Muscle Mass, %	46.4 ± 2.2	45.4-47.4
Absolute Muscle Mass, kg	30.7 ± 4.6	28.6-32.8
Indexes		
Ponderal Index	41.0 ± 1.8	40.2-41.8
BAI [c]	25.1 ± 3.6	23.5-26.8
Somatotype		
Endomorphy	3.8 ± 1.5	3.1-4.5
Mesomorphy	5.3 ± 1.4	4.7-6.0
Ectomorphy	1.6 ± 1.0	1.1-2.1
X-axis	2.1 ± 2.3	1.1-3.2
Y-axis	5.2 ± 3.5	3.6-6.8

[a] Sum of triceps, subscapular, supraspinal, abdominal, front thigh, and medial calf.
[b] Sum of triceps, subscapular, biceps, iliac crest, supraspinal, abdominal, front thigh, and medial calf.
[c] Body adiposity index.

Table 3. Physical Performance Characteristics of Elite Male Wrestlers [a]

Characteristics	Mean ± SD	95% CI
Aerobic		
VO2 max, mL/kg/min	45.9 ±6.6	42.8-48.9
METS	13.1 ± 1.9	12.2-13.9
Maximum Power, W	233.3 ± 43.5	213.5-253.1
Maximum HR, bpm	176.0 ± 10.3	171.2-180.7
Jump Performance		
Vertical Jump, cm	14.2 ± 5.2	11.8-16.6
Anaerobic Power, kg/s [b]	92.6 ± 19.5	83.7-101.5
Standing Broad Jump, cm	217.4 ± 12.1	211.9-223.0
Wingate Test		
PP, W	602.5 ± 89.3	561.9-643.2
PP, W/kg	269.1 ± 41.9	249.9-288.2
AC, W	5986.6 ±1485.6	5310.3-6662.8
AC, kg/s	17959.8 ±4456.8	15931.1-19988.5
AC, Kg/J	1950.3 ±549.4	1685.4-2215.1
AC, W/kg	4.9 ± 0.9	4.5-5.3
FI, %	30.5 ± 6.7	27.3-33.6

[a] Abbreviations: PP, peak power; AC, anaerobic capacity; FI, fatigue index; HR, heart rate; and bpm, beats per minute.
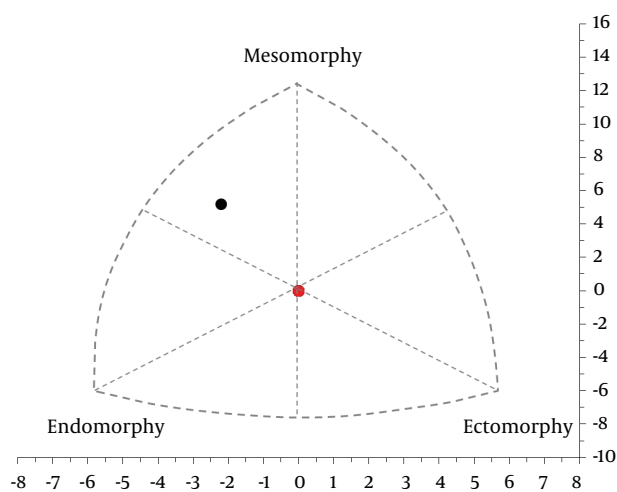[b] Derived from Lewis nomogram.

Figure 1. Somatotype Distribution according to Heath-Carter Somatotype Method

5. Discussion

To our knowledge, this was the first report of anthropometric characteristics and physical performance of Colombian elite male wrestlers. Utter (12) found that the mean height and weight for elite male wrestlers (N = 21; 19.0 ± 0.2 years of age) was about 176 cm and 75.5 kg, which was higher than those of other sportsmen. Wrestlers from the present study were shorter in comparison with participants in other sports although the mean of their height was similar to other reports (1, 13, 14). Yoon (2) suggested that body fat percentage of world champions is less than 10% and suggested that the ideal body fat percentage for a wrestler should be between 7% and 10%, which can be achieved with dietary manipulation and aerobic training. These values are lower than the percent of body fat that we noted in the Colombian elite wrestling team (mean, 13.6%; 95% CI, 12.2%-15.0%). Horswill (4) reported that in the well-trained state, body fat percentages of wrestlers typically ranged from 3% to 13%. Mirzaei et al. (13) reported that the mean of body fat percentage in young wrestlers (mean age, 19.8 ± 0.9 years) was 10.6% with 20.1% in heavyweight wrestlers and between 7.4% to 11.4% in other weight categories. in Collegiate Wrestlers (age, 23 years), body fats percentage of 11.6% ± 3.9% was observed (15). The higher body fat percentage in the Colombian wrestlers might be due to practicing severe weight control methods by fewer athletes. Nonetheless, the ectomorphic-mesomorph somatotype in the present study was consistent with previous reports (16). An average VO2 max of 49 mL/kg/min was reported in other studies on wrestlers (14, 17), which was slightly higher than that of Colombian wrestlers (mean, 45.9 ± 6.6 mL/kg/min). However, lower values were reported for the United States Freestyle Wrestling team (41.2 mL/kg/min) (13). The differences in these findings could be due to the training practices of the athletes, body-weight status at the time of testing, and/or environmental differences (altitude 900 m).

Cankaya (14) reported a mean VJ of 36.4 ± 6.6 cm in Turkish male wrestlers, which was higher than values in the present study. In contrast, the mean of anaerobic power of the Colombian wrestlers in the present study was substantially higher than that reported for the United States elite freestyle wrestlers (mean, 73.0 ± 10.9 kg/sec) (14). Nevertheless, the Colombian wrestlers fatigue index, which represents the ability to maintain a high peak power output, was similar to that reported for the United States freestyle wrestling team (mean, 31.6% ± 9.6%) in the WAnT (14).

The present study evaluated anthropometric and physical performance variables that might affect wrestling performance. These data provided a profile of elite Colombian wrestlers and enabled comparison with international data. While these physiologic variables alone do not predict success in a sport where strategy and technique are also essential elements, they do provide useful reference values to determine training priorities for the development of the elite performer and in talent identification.

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