Physiological Profiles of North Brazilian Mixed Martial Artists (MMA)

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ABSTRACT

Oliveira SN, Follmer B, Moraes MA, Santos JOL, Bezerra ES, Gonçalves HJC, Rossato M. Physiological Profiles of North Brazilian Mixed Martial Artists (MMA). JEPonline 2015;18(1):56-61. The aim of this study was to characterize the anthropometric, physiological, and performance profile of a group of North Brazilian MMA athletes. Eighteen experienced male athletes (age 27.89 ± 5.92 yrs) were evaluated. The assessment consisted of: (a) body composition by the air displacement plethysmography method; (b) VO₂ max and VO₂ at ventilatory thresholds 1 (VT1) and 2 (VT2) by incremental treadmill test; (c) flexibility (FLEX) via the sit and reach test; and (d) handgrip strength (HGS), velocity (Vₘₐₓ), and maximum heart rate (HR max) during VT1 and VT2. The anthropometric results were body mass of 78.39 ± 6.95 kg and percent body fat of 14.97 ± 7.27%. The physiological assessments were represented by VO₂ max (44.22 ± 6.69 ml·kg⁻¹·min⁻¹), VT1 (27.52 ± 5.78 ml·kg⁻¹·min⁻¹), and VT2 (37.33 ± 6.81 ml·kg⁻¹·min⁻¹). Performance aspects from athletes evaluation were: HGS (45.99 ± 8.99 kgf, right hand and 45 ± 8.50 kgf, left hand), FLEX (30.7 ± 7.33 cm), Vₘₐₓ (15.44 ± 1.20 km·h⁻¹), HR max (186.28 ± 10.64 beats·min⁻¹), and velocity and maximum heart rate during LV1 (10.78 ± 0.94 km·h⁻¹ and 154.36 ± 12.95 beats·min⁻¹, respectively) and LV2 (13.56 ± 1.25 km·h⁻¹ and 175 ± 11.58 beats·min⁻¹, respectively). Athletes presented average flexibility, elevated percent body fat and total mass, low VO₂ max and HGS when compared to other studies conducted on MMA athletes.

Key Words: Athletic Performance, Mixed Martial Artists Fitness
INTRODUCTION

Mixed martial arts (MMA) is a competitive combat sport that brings together athletes with various backgrounds (1). Although MMA has increased its worldwide popularity, scientifically few studies have investigated athletes’ physiological aspects (7). There are some fitness components that are accepted as essential to high level performance in MMA, such as strength (1), aerobic power (15,20), and flexibility (6). Unlike other athletes, few studies have evaluated these skills in the MMA fighters.

As among other combat sports, MMA categories are also defined by a weight class. This fact allows the fighters to manipulate their body composition to fit in lower categories. Significant changes in body weight can be achieved by strategies that involve dehydration (14) or other aggressive methods (10). Artioli and colleagues (4) claim that it is extremely unwise to compel athletes to compete in inappropriate weight classes, which generally does not correspond to the athlete’s typical physical features. Although studies are not clear about the stages of athletes’ physical preparation, fighters demonstrate lower percentage of fat (20).

The difficulty in assessing physiological and anthropometric parameters before, during, and after a fight has also been a limiting factor to the understanding and further improvement in the quality of training of MMA athletes. This demonstrates the need for further clarification of these variables, especially among these athletic fighters. Thus, the purpose of this study was to characterize the anthropometric, physiological, and performance variables of a group of North Brazilian Mixed Martial Arts (MMA) athletes.

METHODS

Subjects
Eighteen male MMA athletes (age 27.9 ± 5.9 yrs old with 8.1 ± 4.7 yrs of sport practice) volunteered to participate in this study. The subjects’ frequency of training was 5.5 ± 1.3 d·wk⁻¹ in connection with a regional competition. The subject sample consisted of 6 bantam weights (61.2 kg), 7 light weights (70.3 kg), 1 middle weight (77.1 kg), and 4 light-heavy weights (92.9 kg). The subjects were informed of the goals, the risks, and the procedures of the study. Each subject signed an informed consent form. The study was approved by local ethics committee.

Body Composition
Fat mass (%FM) and free fat body mass (%FFM) were recorded by means of air displacement plethysmography (BOD POD Body Composition System; Life Measurement Instruments, Concord, CA). The procedures adopted were previously described by Fields et al. (9). Boyle’s principle was used to verify the subject’s volume, enabling pressure measurement and volume variations to determine body density. Thus, body composition was assessed using the Siri protocol (24).

Handgrip force and flexibility
Maximum isometric strength was measured using a dinamometer Takei Physical Fitness Test® following standardized procedures previously described by Roberts et al. (22). Dynamometer was adjusted according to the size of the athlete’s hand. Three non-sequential attempts were made for each hand, and the highest value was used as the measure of handgrip strength (3). The Sit-and-reach test was conducted to determine the hip, back, and posterior flexibility of the lower limb muscles (12).
Incremental test

To measure VO₂ max, the subjects performed an incremental treadmill test based on the following protocol: 5 min warm up at 8 km·h⁻¹ followed by an initial speed of 9 km·h⁻¹ with an increase of 1 km·h⁻¹ every 1 min. The test was finished when subjects presented one of the following criteria: (a) changed stage without an increase in VO₂ values; (b) respiratory exchange ratio (RER) value higher than 1.15; and (c) inability to maintain the running pace. Throughout the test, respiratory and pulmonary gas exchange variables were measured using a gas analyzer VO2000® - Aerosport Medical Graphics.

Averages of each of the three respiratory cycles were used for plotting the graphs of each variable as a function of time and highest VO₂ value obtained was considered as the VO₂ peak. To determine the ventilatory thresholds, the procedure described by Wasserman (25) was implemented. Heart rate (HR) was monitored during the test by a Polar ® FT1 and the highest value registered was defined as maximum heart rate (HR max). All anthropometric, physiologic, and performance variables were described with measures of central tendency (mean) and dispersion (standard deviation).

RESULTS

Results of anthropometric, physiological, and performance are presented in Table 1.

Table 1. Anthropometric, Physiological, and Performance Profile from MMA Athletes.

<table>
<thead>
<tr>
<th>Anthropometric</th>
<th>Body Mass (kg)</th>
<th>Height (cm)</th>
<th>%BF (%)</th>
<th>%FFM (%)</th>
<th>Volume (l)</th>
<th>Density (g·cm⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>78.4 ± 6.95</td>
<td>172.5 ± 5.1</td>
<td>14.9 ± 7.2</td>
<td>85.7 ± 5.9</td>
<td>73.8 ± 7.2</td>
<td>1.066 ± 0.01</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physiologic</th>
<th>HR max (beats·min⁻¹)</th>
<th>VO₂ max (ml·kg⁻¹·min⁻¹)</th>
<th>VT1</th>
<th>VT2</th>
</tr>
</thead>
<tbody>
<tr>
<td>186.2 ± 7.0</td>
<td>44.22 ± 6.7</td>
<td>154.3 ± 12.9</td>
<td>27.5 ± 5.7</td>
<td>175.1 ± 11.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance</th>
<th>Handgrip</th>
<th>Flexibility</th>
<th>Velₘₐₓ</th>
<th>Vel. VT₁</th>
<th>Vel. VT₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>Left</td>
<td>(cm)</td>
<td>(km·h⁻¹)</td>
<td>(km·h⁻¹)</td>
<td>(km·h⁻¹)</td>
</tr>
<tr>
<td>45.9 ± 8.9</td>
<td>45.8 ± 8.5</td>
<td>30.7 ± 7.3</td>
<td>15.4 ± 1.2</td>
<td>10.7 ± 0.9</td>
<td>13.6 ± 1.2</td>
</tr>
</tbody>
</table>

DISCUSSION

The purpose of this study was to characterize the physiological profile of North Brazilian Mixed Martial Artists (MMA) fighters. Regarding body composition parameters, %FM is negatively correlated with performance in activities of locomotion with body mass as well as a successful performance in the application of force against external objects is positively related to the amount of lean mass and low percent body fat (2,11). Our results indicate that the percentages of fat mass (14.9 ± 7.2%), despite being considered within the normal range, are above studies that have evaluated MMA fighters
Higher values in the present study can be justified by the different weight classes and off competitive period of which the evaluated subjects are currently in.

Regarding handgrip strength, our results (right: 45.9 ± 8.9 kgf and left: 45.8 ± 8.5 kgf) were similar to those presented in MMA fighters (23). However, the results fall short of values reported for boxers (13) and karate fighters (18). In comparison to Jiu Jitsu athletes, the results were varied, being higher (3) and lower (17) than those reported in the literature. Though MMA athletes utilize some techniques from other martial arts involving upper limbs and jodogi grip, the lack of uniform that allow those practices can explain lower handgrip values in MMA athletes.

Flexibility has received considerable attention in fight training, especially since it is associated with a broader range of motion, the improvement of the execution of skills, and the reduction in the risk of injury (6). Perhaps high levels of flexibility are not necessary for MMA fighters as for Kung Fu athletes (23). Flexibility of MMA athletes analyzed in the present study (30.70 ± 7.33 cm) were lower than Jiu Jitsu (3) and Kung Fu athletes (5), but higher than in other studies with Taekwondo (12), wrestling (6) and even with MMA (23). However, the variety of methodologies used in the evaluation of flexibility prevents the comparison between the different martial arts.

MMA fights have an intermittent feature (3 to 5 rounds of 5 min), and its maintenance is dependent on high aerobic power (7). Our results (44.22 ± 6.7 ml·kg⁻¹·min⁻¹) are of concern since the level of aerobic fitness has been associated with resistance of fatigue (19) and a high fitness level is a success factor in the fight (4). The VO₂ max values are lower than those found among MMA fighters (4,13,16), wrestlers (21), boxers (13), Karate (21), Jiu Jitsu (3), and Judo fighters (8).

CONCLUSION

The data demonstrates that the athletes in the present study have a higher %FM and total body mass compared to other combat sports, regardless of the weight class. Fighters had a low VO₂ max, thus making it necessary to incorporate more effective aerobic conditioning programs into the training routine. Flexibility is within the average of other forms of combat, indicating particular attention for this training motor skill. Finally, HGS values are in accordance to other studies with MMA, though presenting low values that can compromise performance.

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