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Power Measures of Athletes in Combat Sports Using a Modified Rowing Ergometer

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Abstract Combat sports such as wrestling and mixed martial arts (MMA) require athletes to produce high levels of muscle power to increase athletes' chances of winning during sport competitions. Recently, combat sport athletes in wrestling and MMA began using rowing as a training method because this exercise engages upper and lower extremity muscles of the body and focuses on explosive muscle power. The problem with using rowing as a training technique for athletes in combat sports is that current bases of support designed for rowing ergometers limit the position of the athletes' feet to only a close stance (athletes' feet positioned apart at a distance less than shoulder width). Combat sports in wrestling and MMA, however, require the use of wide (feet positioned apart at a distance slightly wider than shoulder width) or staggered (feet positioned apart at a distance slightly wider than shoulder width and one foot farther forward than the other) stances. Due to this concern, the purpose of this study was to examine the effect of different bases of support (close, wide, and staggered) on athletes' power output when using a Concept2 Rowing Ergometer. Fifteen male combat sport athletes (wrestlers and mixed martial arts athletes) were selected for this study. The athletes completed three exercise sessions in which they were required to row for five minutes in each session with a different base of support (close, wide, and staggered). The power output was measured in watts and the data were analyzed by using a repeated measures ANOVA. The results revealed a significant difference between the close and wide stance. The outcome of this study may have implication for coaches and researchers because it provides an avenue to improve the effectiveness of power training in combat sports when using a Concept2 Rowing Ergometer.

Keywords Rowing, Power Measures, Combat Sports

1. Introduction

Wrestling and mixed martial arts (MMA) are combat sports that require an intensive body workout during competitions. These combat sports rely on aerobic and anaerobic energy pathways, strength, flexibility, speed, and explosive power[1, 2, 5].

Wrestling combat sport competitions last approximately six minutes, consisting of three two-minute rounds[7]. MMA competitions last approximately fifteen to twenty-five minutes, consisting of either three five-minute or five five-minute rounds[17]. These competitions are physically demanding and rely on the athlete maintaining a high level of muscle power output to have an advantage and a better chance at winning[5, 4, 6, 9]. In order to maintain a high level of muscle power output during sport competitions, a combat sport athlete must have a strong fighting stance; without one, the athlete's chance of winning is limited[3, 16] A strong fighting stance is the position in which the athlete is balanced, has equal weight distribution, can utilize his/her strength, and is relaxed and focused. Furthermore, a strong fighting stance allows the athlete to have quick and powerful mobility in every direction[3].

There are two main stances used for wrestling and MMA combat sport competitions: the wide stance and the staggered stance. Both stances require the athlete's feet to be positioned apart at a distance slightly wider than shoulder width, the knees to be flexed and the back to be straight. In addition, both stances require the combat sport athlete to lower his or her centre of gravity to allow for greater balance[3, 15]. Specifically, a wide or staggered stance maximizes a combat athlete's balance and gives the athlete greater ability and mobility to defend against, shoot in or throw an opponent[15, 16].

One technique used to train combat athletes for wresting and MMA is by using rowing ergometers because the use of this technique requires a full body workout. In addition, it involves the coordination of the upper and lower extremity muscles to maintain high levels of muscle power in order for the athlete to perform well[8, 12, 14].

One concern when using rowing ergometers for training athletes in combat sports, however, is that the bases of

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support designed for these devices limit the position of athletes' feet to a close stance. Combat sports, such as wrestling and MMA require the use of a wide or staggered stance.

One solution to make athletes' training in combat sports more specific to the sport demands is to integrate a wide and staggered stance when using a rowing ergometer. As stated by Hawley (2008) and Morris et al., (2009), athletes' training techniques for a sport should follow the principle of specificity, meaning that the program and techniques used should be as close as possible to the sport's demands to achieve the skills and specific adaptations required to perform that sport.

The purpose of this study was to examine the effect of different bases of support (close, wide, and staggered) on athletes' power output when using a modified Concept2 Rowing Ergometer. The dependent variable measured in this study was power output, which represented the athlete's energy consumption over time exerted as external power on the rowing ergometer flying wheel. The independent variable was bases of support, which represented the foot-stop modifications made to the rowing ergometer for each stance (close, wide and staggered).

2. Method

2.1. Participants

Fifteen healthy competitive combat sport athletes from a Varsity Wrestling Team and Leading Edge MMA participated in the present study. Each participant was required to be a male over the age of 18 years, have more than four years of experience in competitive combat sport, have some experience using the rowing ergometer, and have not sustained or be suffering from any injuries that could affect his performance.

2.2. Instrument

A modified Concept2 Rowing Ergometer with three different foot-stop positions (close, wide, and staggered) as depicted in Figure 1, 2 and 3 was used. A video camera focused on the monitor was also used to record the power output.

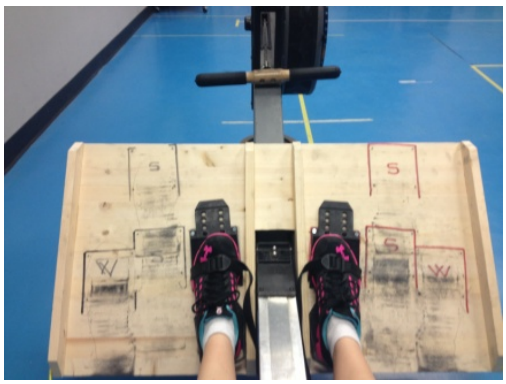

Figure 1. Foot-stop modification for a close stance

Figure 2. Foot-stop modification for a wide stance

Figure 3. Foot-stop modification for a staggered stance

2.3. Procedure

Each participant was asked to perform three fifteen-minute exercise bouts that included a five-minute warm-up stretch, five-minute row at an intensity of 30-40 strokes per minute, and a five-minute cool down and stretch. The exercise bouts were performed over three separate days with randomized foot positions tested each day. During the five-minute row, the monitor of the rowing ergometer was videotaped to record the average power output generated in watts.

2.4. Data Analysis

A descriptive statistical analysis was conducted to compute and compare the means and standard deviations from the power output measures for each stance (close, wide and staggered). A repeated measures ANOVA was also conducted to determine if there were any significant differences between close, wide, and staggered stances. Finally, a Bonferroni post hoc analysis was conducted to identify the pair mean comparisons between stances that were significantly different.

3. Results

Descriptive statistics, as depicted in Figure 4, revealed that the power output measures for the close stance (M=179.87, SD=46.31) was higher than the power output measures for the wide (M=159.20, SD=55.10) and staggered (M=163.67, SD=46.18) stances.

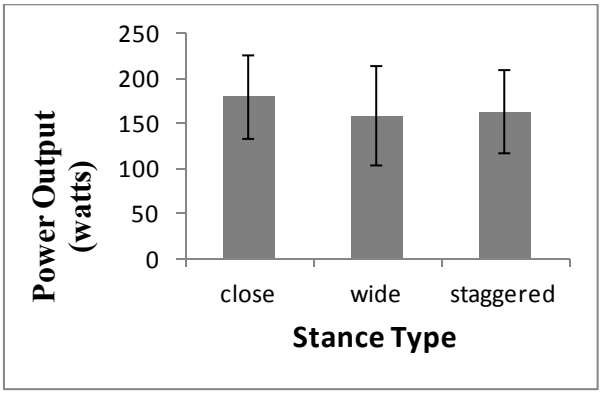

Figure 4. ean power output generated for each rowing stance.

The repeated measures ANOVA revealed significant differences between the power output measures for the close, wide, and staggered stances with a large effect size, $F(2,28) = 4.89$, $p = .015$, $\eta^2 = .26$. The post hoc analysis, however, revealed that the significant difference in power output measures was between the close and wide stance, $p = .045$.

4. Discussions

This study examined the effect of different bases of support (close, wide, and staggered) on combat athletes' power output when using a Concept2 Rowing Ergometer. The outcome indicated that the power output measures for the close stance were higher than the power output measures for the wide and staggered stances. Inferential statistics, however, only revealed significant differences in power output measures between close and wide stances when using a modified Concept2 Rowing Ergometer.

While combat sport athletes are not always required to sustain maximum power output during the entire match, the results of this study support the notion that when training for a sport such as wrestling or MMA, it is important for the athletes to train with techniques that are specific to the sport to help them develop a strong fighting stance (e.g., wide and staggered)[3, 16]. That is, the training techniques used for these combat sports should include not only a close stance but also wide and staggered stances. This approach may allow athletes to develop and improve their ability to generate maximal power output levels needed for wrestling or MMA. As Hawley (2008) and Morris el al., (2009) stated, when training for a sport, the program or techniques used should be as close as possible to the demands of the sport for athletes to increase their chances at winning in sport competitions.

Although in the current study only the power output levels during the close stance were significantly higher than those in the wide stance, these results seemed to suggest that the wide and staggered stances were more physically demanding during the five-minute row. One explanation for this outcome may be that the staggered and wide stances seemed to minimize leg flexion. On the contrary, the close stance seemed to allow the athletes to generate a larger stroke length because the legs were fully flexed producing a larger thigh rotation and an increase in speed. As a result higher muscle power seemed to have been transferred to the ergometer handle, causing an increase in external power generated by the flying wheel. This rational can be supported by the work of Greene et al., (2011), which stated that the presence of a foot-stop in the design of an ergometer (i.e., close stance) increases the magnitude of power generation and absorption throughout the rowing stroke.

Given the mean power output differences among the stances in the current study and the notion that wrestling and MMA are physically demanding combat sports that rely on anaerobic and aerobic energy pathways, strength, stability, and the production of high power outputs[5, 9], it seems appropriate that combat athletes train using an ergometer system that is more specific to their sport. It was for this reason that a modification in the Concept2 Rowing Ergometer was created, in order to allow athletes to take on a wide and staggered stance while training.

In addition, the results of this study revealed that the close stance had greater power output than the wide and staggered stances. Because power is important in combat sport, training in the traditional close stance may not be completely beneficial to the combat sport athlete to develop the ability to generate appropriate power levels to meet the demands of the sport. This outcome may have implications for athletes, coaches, and researchers because it seems to suggest another avenue to train combat sport athletes by using different foot-stops.

One limitation to the current study was the sample size. There is a need to include a larger sample size to minimize chances of committing a type II error and be able to make stronger generalizations to the population. Another limitation was that some athletes appeared to have experienced discomfort and had difficulty with the fixed stance positions, preventing them to perform to maximal potential. A recommendation to decrease this limitation would be to further modify the base for the foot-stops to adjust for each participant's anthropometric measures and stance preference.

There are a few recommendations for future research that may help understand the effect of foot-stop stances when training for a combat sport in the mechanics of rowing. Future research studies should test all participants in each stance position more than once to assess the reliability of the power measures for the five seconds. Furthermore, future studies need to investigate reliability and power output differences for a thirty second full effort sprint row with the three varying foot positions (close, wide, and staggered) to obtain a better representation of power outputs in relation to the total duration of a combat sport match competition. Lastly, future research should include EMG measures of upper and lower extremities to record muscle activation levels. For instance, many participants in the current study reported that the staggered and wide stances

were more difficult to perform and felt greater muscular fatigue. The use of EMG may give insight as to what muscles are being activated to better understand the transfer of muscle forces to the ergometer handle bar, which may have implications in the external power output production when rowing in each stance position.

5. Conclusions

Strength, muscular endurance, and power are all critical to athletes who compete in combat sports such as wrestling and MMA. The principle of specificity states that each of these components must be addressed when designing a strength and conditioning program. Rowing ergometer training incorporates each of these aspects. It allows athletes to train their anaerobic and aerobic energy pathways, while working on strength, muscular endurance, explosiveness, and power. Although current Concept2 Rowing Ergometers do not allow combat athletes to be in a stance as they would be in during a match, the outcome of this study in conjunction with the literature seems to indicate that the use of a modified Concept2 rowing ergometer with different foot-stop stances (close, wide and staggered) may be more beneficial for training athletes in combat sports.

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