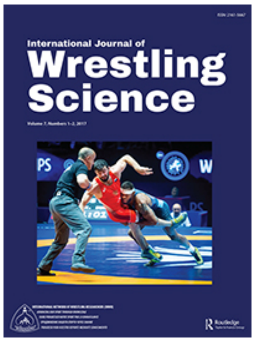

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The University of Mary Wrestling Anaerobic Performance Test: A New Wrestling-Specific Protocol

Brendan Eichmann,[1] Jason Kobes,[2] Chris Sherve,[2] Adam Aho,[1] and Moran Saghiv[2]

ABSTRACT. The University of Mary Wrestling Anaerobic Performance Test (UMWAPT) protocol simulates the requirements of a full wrestling match. The purpose of the study was to compare and correlate the mechanical outcomes of the WAnT and the UMWAPT. Fifteen wrestlers randomly underwent both protocols. Mechanical outputs (W) and fatigue index (%) were calculated and compared between the protocols and within the UMWAPT. Peak power correlations between protocols were weak to moderate and weak to strong within the UMWAPT test. Mean power correlations between protocols were weak and weak to strong within the UMWAPT test. Anaerobic capacity correlations between the protocols were weak and weak to strong within the UMWAPT test. Fatigue index correlations between protocols were weak and weak to moderate within the UMWAPT test. All participants indicated the UMWAPT as a very accurate simulation of their most challenging wrestling match. In conclusion, The UMWAPT seems to be a very good protocol to simulate a wrestler's most challenging match. The UMWAPT allowed the wrestlers to utilize their own technique, leading to better mechanical outputs, and, thus, it seems that this study gives hope that a wrestling-specific all-out performance protocol such as the UMWAPT may be utilized rather than a nonspecific protocol such as the WAnT.

Keywords: anaerobic performances, peak power, mean power, anaerobic capacity, fatigue index, BW relative mean power, Wingate Anaerobic Test, University of Mary Wrestling Anaerobic Performance Test

INTRODUCTION

The sport of wrestling is very popular in the United States and has needs of its own. Physically, this sport is a combination of aerobic fitness, possible submaximal and perhaps maximal anaerobic power bouts, technique, and isometric work. Often, field and lab tests are utilized to predict submaximal and maximal performance. Such protocols exist in regards to both aerobic and anaerobic capacities (García-Pallarés, López-Gullón, Muriel, Díaz, & Izquierdo, 2011; Hübner-Woźniak, Lutoslawska, Kosmol, & Zuziak, 2006). The Wingate Anaerobic Test (WAnT) is an all-out anaerobic performance exercise test, consisting of 30 seconds of maximal cycling on a cycle ergometer against 8% of the subject's body weight (kg), while fully seated on the cycle. In sport science, the WAnT is a widely administered protocol that, despite its short duration, evokes substantial cardiac work by requiring peak power outputs (Watts) up to 300% of maximal workload (Wmax; Astorino, Bovee, & DeBoe, 2015).

In wrestling, repetitive forceful muscle contractions are required during most of the sport's maneuvers and the upper-body anaerobic power of an athlete is considered an important factor influencing competitive success (García-Pallarés et al., 2011; Hübner-Woźniak et al., 2006). Relatively few data exist regarding power and wrestling, the majority of which are from nonwrestling-specific performance protocols, and some relate more to martial arts rather than wrestling (Aedma, Timpmann, Lätt, & Ööpik, 2015; Nikooie, Cheraghi, & Mohamadipour, 2015; Ratamess et al., 2013; Zi-Hong et al., 2013). The University of Mary Wrestling Anaerobic Performance Test (UMWAPT) mimics the structure of a full wrestling match

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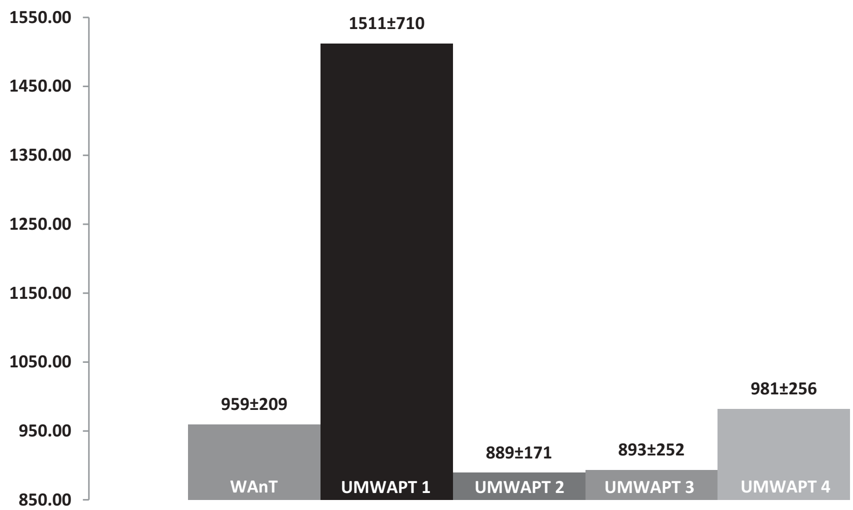

WAnT = Wingate Anaerobic Test; UMWAPT = University of Mary Wrestling Anaerobic Performance Test; UMWAPT 1,2,3,4 = order of sled pushing sessions during the UMWAPT.

Significant differences: $p \leq .05$ (as indicated in Table 2).

FIGURE 1 Comparison between peak powers produced during the WAnT in comparison to the UMWAPT (mean ± *SD*).
WAnT = Wingate Anaerobic Test; UMWAPT = University of Mary Wrestling Anaerobic Performance Test; UMWAPT 1,2,3,4 = order of sled pushing sessions during the UMWAPT.
Significant differences: $p \leq .05$ (as indicated in Table 2).

while incorporating features and components of the WAnT. To the best of the researchers' knowledge, no wrestling-specific performance protocol exists that allows the measuring of a wrestler's true mechanical output while utilizing the most wrestling-like techniques. Figure 1 presents peak power produced during the WAnT ans UMWAPT (mean ± SD).

The utilization of nonwrestling-specific performance protocols may influence a coach's decision or interpretation of results, thus acting against the coach and athlete's best interest. The same can be said for any athlete in any sport (Huijgen, Elferink-Gemser, Lemmink, & Visscher, 2014; Robbins, 2010). Thus, it was the aim of this study to investigate the application of wrestling-specific techniques while pushing a one-man football blocking sled, and its ability to allow the production of better, same, or worse mechanical outcomes in comparison to the WAnT.

METHODS

Fifteen University of Mary male wrestlers (20.07 ± 1.75 years old) volunteered to participate in this study. The wrestlers were notified that the study was for one of the coaches' thesis and that in no way do they have to volunteer and that refusal to take part would not result in any consequences regarding their studies or wrestling-team-related issues. The wrestlers were given direct access to Dr. Saghiv in case they felt mistreated by the coaches if they had not volunteered. Subjects' Wingate Anaerobic Test mechanical results (peak power [Watts·5 seconds^{-1}], mean power [Watts· second^{-1}], body-weight relative power [Watts·30 seconds^{-1}·kg^{-1}], anaerobic capacity [Watts·30 seconds^{-1}), and fatigue index [%]) were compared and correlated to those of the UMWAPT (peak power [Watts·5 seconds^{-1}], mean power [Watts· second^{-1}], body-weight relative power [Watts·30 seconds^{-1}·kg^{-1}], anaerobic capacity [Watts·30 seconds^{-1}], and fatigue index [%] of the first session of pushing the sled). Each subject visited with the research team a total of three times. The first visit was dedicated to familiarization with the Monark cycle, the WAnT protocol, the football sled, the UMWAPT protocol, and the lab. In addition, during the first visit to the lab, the subjects received a detailed explanation about the purpose of the study, and its importance, design, benefits, risks, and protocols.

All subjects signed an informed-consent form. Those who agreed to participate in this study underwent risk stratification via a health questionnaire, according to the American College of Sports Medicine (ACSM) guidelines (ACSM, 2013). Subjects found to be of low risk only were included in the study. Baseline resting measurements, including height (m), weight (kg), resting heart rate (bpm), and resting blood pressure (mmHg), were measured. The adjustment of the cycle seat height was also recorded. During the second visit to the lab, all subjects underwent either the WAnT or the UMWAPT protocol in random order.

For the Wingate Anaerobic Test, the researchers ensured that the equipment was fully functional and safe and that the weight was calculated correctly for the subject (8% of body weight). The research team also ensured that an automated external defibrillator (AED) was present and working the whole duration of data collection. When the subject arrived, the researchers started out by confirming that nothing had changed with the subject's physical condition by measuring resting heart rate (HR) and blood pressure (BP) and that the subject had complied with the instructions given prior to testing. The cycle's seat height was then set for the subject as recorded during the first visit.

The subject began by sitting on the cycle while the video camera was prepared to record the repetitions per minute (RPM) screen of the cycle. The subject then cycled with no resistance for 55 seconds at a warm-up pace and then cycled as fast as he could for 5 seconds. The subject repeated this warm-up procedure two more times (for a total of three times) as the warm-up before the actual test. Then, the subject sat on the cycle for 2 minutes doing nothing at all. After 2 minutes, the subject pedaled into maximal cadence within 3–5 seconds. The weights were then released by an automatic mechanism (by means of pushing a button on the Monark 884E ergometer), which was a total of 8% (including the basket's weight) of the subject's body weight (kg), and the subject cycled as fast as he could with verbal encouragement from the research group for 30 seconds. During the test, the subject held to the handles of the cycle at all times and had full contact with the seat of the cycle. Video recording of the RPMs produced was obtained during this phase. The results in RPMs were noted by two different people to increase reliability. The subject then continued to cycle without resistance for a cool down of 2 minutes. The subject then got off the cycle and stood beside the cycle with their hands on the cycle to become accustomed to not being on the cycle for 3–5 seconds. The subject then laid down on a plinth for 15 additional minutes to ensure that his hemodynamic responses returned to normal and that he did not have any lightheadedness, nausea, a need to vomit, or any other response to the test. When the subject's heart rate was lower than 100 beats per minute and blood pressure was within 5 mmHg of the resting blood pressure, the subject was allowed to leave with the instructions to avoid driving immediately and to avoid exercise for the rest of the day. If the subject did not meet the criteria mentioned above, he stayed under the supervision of the research team until all criteria were met. Peak power, relative peak power, fatigue index, mean power, and anaerobic capacity were calculated and explained to the subject immediately.

For the UMWAPT protocol, the researchers ensured that the equipment was fully functional and safe. The research team ensured that an AED was within 3 minutes reach and working during the duration of data collection. When the subject arrived, the researchers ensured that nothing had changed with the subject's physical condition. At this time, the football blocking sled (Gilman one-man tackle-back) was loaded with weights to a total weight (sled's actual weight + added weights) equivalent to 2.5 times the subject's body weight. The sled's actual resistance was calculated by taking into consideration the coefficients of static friction and dynamic friction calculated at multiple loads for the surface. Subjects were to grasp the sled at the height of their own waist (a holding point believed to be the most representative of a wrestling match). To warm up, the subject was instructed to run in place for 2 minutes and 55 seconds. When the subject reached that mark, they were to sprint in place for 5 seconds. After 5 seconds, they continued to jog in place for another 2 minutes and 55 seconds. There are three rounds of this warm up. Afterwards, the subject sat down and did nothing for one minute and 50 seconds. The subjects then stood up right near the sled and took their "holding point" on the sled. In order to ensure that the test mimicked real wrestling movement as much as possible, each subject was allowed to use his own technique relevant to the position. Subjects pushed the football blocking sled as far as they could for 30 seconds. They pushed the sled across a Mondo indoor track surface that was not wet and had no debris on it. The surface was also examined to make sure that it has no holes or safety hazards and that the surface was relatively flat. Although the sled weighs 265 pounds (120.45 kg), it did not oppose resistance equal to its full weight. The actual resistance the sled opposed was only about 45% of its total weight (119.25 pounds /54.2 kg). Thus, weight was added to the sled to ensure that every participant was working against the same amount of resistance relative to their body weight. A measuring wheel was used to measure the total distance traveled (m), whereas the distance traveled every 5 seconds (m) was marked with a bean bag. The deviation from the main line and the distance traveled forward were measured separately in order to utilize the Pythagorean Theorem and to calculate the actual distance traveled with the sled. These measurements allowed the researchers to create a graph of the distances traveled during the test and every 5 seconds of the test, as well as convert distance into the force produced (Watts·5 seconds^{-1}) while pushing the sled. Immediately after the subject finished the initial 30-second sled push, he drilled double legs with a teammate for 2½ minutes (150 seconds) at a live drill pace (roughly 20–25 double legs in total). Then the subject rested for 20 seconds before pushing the sled for a second time for 30 seconds as fast and far as possible. The subject then immediately engaged in drilling half nelsons with a prebreakdown with a teammate for 1½ minutes (90 seconds) at a live drill pace (roughly 15–20 repetitions). The subject once more rested for 20 seconds and pushed the sled for a third time for 30 seconds as fast and far as possible. The subject then immediately engaged in drilling escapes with a teammate for 1½ minutes (90 seconds) at a live drill pace (roughly 20–25 repetitions). Immediately after resting for 20 seconds, the subject pushed the sled for the fourth and final time for a duration of 30 seconds as fast and far as possible. The subject then lay supine for 15 minutes. When

TABLE 1 The Mechanical Outputs and Fatigue Index (FI) During the WAnT and the UMWAPT (Mean ± SD)

Variable	*WAnT*	*UMWAPT 1*	*UMWAPT 2*	*UMWAPT 3*	*UMWAPT 4*
Peak power (Watts·5sec^{-1})	959 ± 236	1511 ± 710	889 ± 171	893 ± 252	981 ± 256
Mean power (Watts·sec^{-1})	716 ± 194	903 ± 222	628 ± 165	627 ± 145	672 ± 158
Anaerobic capacity (Watts·30sec^{-1})	4301 ± 1169	5421 ± 1334	3770 ± 997	3765 ± 874	4033 ± 949
Fatigue index (%)	40.48 ± 13.28	45.63 ± 19.58	39.7 ± 24.19	40.47 ± 17.34	39.65 ± 21.8
BWRPP (Watts·kg·5sec^{-1})	12.17 ± 1.39	19.57 ± 11.32	11.31 ± 2.63	11.41 ± 3.65	12.44 ± 3.5
BWRMP (Watts·kg^{-1}·sec^{-1})	9.09 ± 1.03	11.53 ± 3.56	7.93 ± 2.06	8.73 ± 1.47	8.53 ± 2.13

Note. WAnT = Wingate Anaerobic Test; UMWAPT = University of Mary Wrestling Anaerobic performance Test; BWRPP = body weight relative peak power; BWRMP = body weight relative mean power; UMWAPT 1, 2, 3, 4 = order of sled pushing sessions during the UMWAPT.

the subject's heart rate was lower than 100 beats per minute and blood pressure was within 5 millimeters of mercury of resting blood pressure, the subject was allowed to leave with the instructions to avoid driving immediately and to avoid exercise for the rest of the day. If the subject did not meet the criteria mentioned above, he stayed under the supervision of the research team until all criteria were met. Peak power (Watts·5 seconds^{-1}), mean power (Watts· second^{-1}), body-weight relative power (Watts·30 seconds^{-1}·kg^{-1}), anaerobic capacity (Watts·30 seconds^{-1}), and fatigue index (%) were calculated for every time the sled was pushed and was explained to the subject immediately.

The results of the WAnT were compared with the first session of the UMWAPT, and all sessions within the UMWAPT were compared to each other. Immediately after the UMWAPT, the wrestlers were asked to compare the UMWAPT with a wrestling match. Utilizing SPSS 23.0 for windows, a correlation between the results of the WAnT and UMWAPT was calculated, as well as the correlation between the sessions of the UMWAPT itself. Results are presented as average ± *SD* where appropriate and at a significance level of 5% ($p \leq .05$) or less. Feedback from the wrestlers is presented as qualitative information rather than quantitative information.

RESULTS

All subjects completed the whole study including both protocols without difficulties or abnormal symptoms or reactions. During the WAnT, the wrestlers worked against an average resistance of 6.43 ± 1.15 kg (8% of body weight), while during the UMWAPT, the wrestlers worked against an average resistance of 180.88 ± 32.55 kg (225% of body weight).

Analyzing the data, the research team became aware of a pattern in regards to the mathematical relationship between the mechanical outputs during the WAnT and the UMWAPT. According to this pattern, the values of UMWAPT 1 were always higher than the value for the same variable during the WAnT, the values for the UMWAPT 2 and 3 were (for the most part) lower than the values for the WAnT, and UMWAPT 4 was (for the most part) higher than the values of UMWAPT 2 and 3 for the same variable. Table 1 presents a comparison of values for the mechanical outputs during the WAnT and UMWAPT.

Table 2 presents the levels of difference significance (*p* value) between the mechanical outputs of the WAnT and the UMWAPT and within the UMWAPT.

All subjects rated the UMWAPT as a more challenging test than the WAnT and, yet at the same time, indicated that the UMWAPT accurately simulates a full wrestling match against their most challenging opponent.

DISCUSSION

The aim of this study was to establish the UMWAPT as a wrestling-specific maximal anaerobic performance test, which allow wrestlers to both incorporate their preferred technique, to utilize a wrestling-like position, and to produce better mechanical outcome than during the WAnT.

In addition, the aim of the study was to gather qualitative information of the way the wrestlers perceived the UMWAPT while comparing it to a wrestling match against their most challenging opponent.

Table 3 presents the mechanical outputs within the UMWAPT. The results of this study clearly show that the UMWAPT allows wrestlers to present an ≈60% higher mechanical output during the first session in comparison to the WAnT, as well as to achieve similar mechanical outputs to those of the WAnT during the second, third, and fourth sessions of the UMWAPT.

Sport-specific characteristics of trunk muscles in collegiate wrestlers and judokas were investigated in 2008. This study clearly indicated that the sport-specific characteristics of the cross-sectional areas of the trunk muscles and trunk muscle strength obviously differed between the two similar sports. In addition, the study indicated that athletes should practice the sport-specific training of trunk muscles and develop sport specificity in their sports. Particularly, wrestlers have to train in trunk flexion

TABLE 2 Value of the Differences' Significance (*p* Value) Between the Mechanical Outputs of the WAnT and the UMWAPT and Within the UMWAPT

Variable	*UMWAPT 1*	*UMWAPT 2*	*UMWAPT 3*	*UMWAPT 4*
Peak power (Watts/5sec)	†	†,1	†,1,2	1,2,3
Mean power (Watts/sec)	†	†,1	†,1	†,1,2,3
Anaerobic capacity (Watts/30sec)	†	†,1	†,1	†,1,2,3
Fatigue index (%)	†	†,1	†,2	†,2
BWRPP (Watts/kg/5sec)	†	†,1	1	1,2
BWRMP (Watts/kg/sec)	†	†,1	1,2	†,1

Note. WAnT = Wingate Anaerobic Test; UMWAPT = University of Mary Wrestling Anaerobic performance Test; BWRPP = body weight relative peak power; BWRMP = body weight relative mean power; UMWAPT 1, 2, 3, 4 = order of sled pushing sessions during the UMWAPT.

† = significant differences between the variable and the same variable during the WAnT; 1 = significant differences between the variable and the same variable for UMWAPT1; 2 = significant differences between the variable and the same variable for UMWAPT2; 3 = significant differences between the variable and the same variable for UMWAPT3; significant difference.

$p \leq .05$.

TABLE 3 The Average Mathematical Ratio (% of the WAnT) Between the UMWAPT Mechanical Outputs and Those of the WAnT

Variable	*UMWAPT 1*	*UMWAPT 2*	*UMWAPT 3*	*UMWAPT 4*
Peak power (Watts/5sec)	157.55	92.7	93.11	102.29
Mean power (Watts/sec)	126.11	87.7	87.56	93.85
Anaerobic capacity (Watts/30sec)	126.04	87.65	87.53	93.76
Fatigue index (%)	112.5	97.5	100	97.5
BWRPP (Watts/kg/5sec)	160.8	92.93	93.75	102.21
BWRMP (Watts/kg/sec)	126.84	87.23	96.03	93.83

Note. WAnT = Wingate Anaerobic Test; UMWAPT = University of Mary Wrestling Anaerobic performance Test; BWRPP = body weight relative peak power; BWRMP = body weight relative mean power; value > 100 = outcome during the UMWAPT is greater than that of the WAnT; value < 100 = outcome during the UMWAPT is lower than that of the WAnT.

and extension motions, and judokas need to strengthen trunk rotation and lateral flexion motions (Iwai et al., 2008).

In 2015, Asim Cengiz investigated the effect of dehydration on young male wrestlers (age 20.45 ± 2.69 years). Peak power produced during the WAnT was found to be 864.7 ± 85.6 Watts·5sec^{-1}, body weight relative peak power was found to be 10.7 ± 1.1 Watts·Kg^{-1}·5sec^{-1}, and the fatigue index found to be 55.6 ± 4.4%.

While comparing freestyle wrestling to that of Greco-Roman, it has been reported that peak power was 895 ± 210 and 906 ± 250, respectively (Demirkan, Kutlu, Koz, Özal, & Favre, 2014). The same study reported body weight relative peak powers of 13.2 ± 2.0 and 13.5 ± 1.6 Watts·Kg^{-1}, respectively.

In a double-blind, counterbalanced, crossover study, 14 trained wrestlers ingested either placebo or 5 mg/kg caffeine and completed four 6-minute upper body intermittent sprint performance tests with 30-minute recovery periods between consecutive tests (Aedma, Timpmann, & Ööpik, 2013). Peak power was recorded and reported as 277.2 ± 34.6 Watts.

In 2007, Arzu Vardar et al. reported peak power in adolescent elite wrestlers to be 615.4 ± 114.3 Watts and a body relative peak power of 8.5 ± 1.0 Watts·kg^{-1}.

In 2003, 20 active international-level male wrestlers (ages 22–27 years) participated in a study aimed at investigating the effect of high-dose oral creatine supplementation on anaerobic performance (Koçak, & Karli, 2003). The study's results indicated body weight relative peak power to be 10.523 ± 1.0 Watts·kg^{-1}.

In 2015, Lunn, Zenoni, Crandall, Dress, and Berglund conducted a study aimed at determining the effect of different pretest pedaling cadences on power outcomes obtained during the Wingate Anaerobic Test (WAnT). The study included 14 young adult men (aged 24.9 ± 1.2 years), who were nonwrestlers. Peak power was reported to be 788.3 ± 43.5 Watts.

In 2014, Attia et al. evaluated relative and absolute reliability of the 20-second anaerobic test (WAnT20) versus the 30-second Wingate anaerobic test (WAnT30) to verify how far the various indices of the WAnT30 could be predicted from the WAnT20 data in male athletes.

The highest peak power reported in the study was 999 ± 153 Watts.

In 2016, the peak anaerobic power of cyclists and triathletes aged 32.3 ± 3.0 was found to be 933 ± 189.5 and 796 ± 74.6 Watts, respectively (Arslan & Aras, 2016). Body weight relative peak power was reported to be 12.4 ± 2.3 for the cyclists and 10.7 ± 1.3 for the triathletes.

In 2015, Sultan Harbili reported national and Olympic cyclists' (aged 21.50 ± 3.09 years) peak power to be 738.96 ± 116.92 Watts. In addition, the highest fatigue index was reported to be 52.16 ± 10.92%.

In 1989, gender specific norms for active young adults were suggested for the results of the WAnT according to percentiles (Maud & Shultz, 1989). At the 90th percentile, peak power for males was suggested to be ≥ 822 Watts.

While comparing the mechanical outputs of the UMWAPT to those previously reported in the professional literature, for wrestlers and nonwrestling athletes, the mechanical outputs achieved by the wrestlers in this study are significantly greater for peak power and body weight relative power.

CONCLUSIONS

The UMWAPT is the first wrestling-specific anaerobic performance protocol offered and seems to be a protocol that allows the wrestlers to maximize their mechanical outputs while accurately simulating a full and the upmost challenging wrestling match.

Allowing wrestler to utilize a technique that is closest to their wrestling technique improves the wrestler's mechanical outputs, presenting with the wrestler's true power potential.

The protocol should be further studied with a greater sample size and wrestlers of all ages, sexes, and levels. Future research should be conducted to investigate one's ability to determine the optimal weight in which a wrestler should compete according to the results of the UMWAPT.

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