MATTHEW JAMES MICHAEL GIBBS

ST 0600 2575

CARDIFF SCHOOL OF SPORT

UNIVERSITY OF WALES, INSTITUTE, CARDIFF

USE OF THE WINGATE TEST IN COMPARING THE ANAEROBIC POWER AND CAPACITY OF 100M AND 400M SPRINT TRAINED ATHLETES.

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Acknowledgements

I wish to acknowledge the help from my dissertation supervisor Mr Carl Beynon during the production of this piece of work, as well as the support received from family and close friends.

Abstract

The purpose of this study was to measure and compare the anaerobic power and capacity of University male under 23 age group 100m (n = 8) and 400m (n = 7) county level sprint trained athletes using a standard Wingate Anaerobic Test (WAnT). The Test involved pedalling maximally on a cycle ergometer (Monark) for 30 seconds against a predetermined resistance relative to 7.5% of a subject's body mass. The protocol developed by Ayalon (1974) was used.

An Independent T-test was employed to examine for statistical differences between the means of the measured parameters of both data sets. Results identified a significant difference between the Peak Power Output ($P = 0.006$) and Mean Power Output ($P = 0.019$) of both samples; both P values were less than the 95% level of confidence ($P<0.05$). However there was no statistical difference between the FI of both samples, ($P = 0.077$); this P value is greater than the 95% level of confidence ($P>0.05$). All 3 of the measured parameters were greater in the 100m sample than the 400m sample respectively; PPO = 991 ± 98 W and 819 ± 105 W; MPO = 750.20 ± 59.72 W and 657.23 W ± 75.01 and FI = 49 ± 8% and 40 ± 10%.

The increased mean anaerobic power (PPO & MPO) of the 100m sample can be attributed to their increased body mass and specialism in the phosphagen energy system. The WAnT is a valid method of evaluating maximal short term anaerobic power of athletes, however the duration of the test in not sufficient to stress the glycolytic energy system. These results indicate that event specificity influences the metabolic specialism of athletes; exceptional anaerobic power is displayed in the 100m sample when compared to the 400m sample under identical laboratory conditions. The development of an athlete specific protocol is needed for use with an athletic population to adequately test the anaerobic capacity of the body.

Chapter I

1.0 Introduction

The physiological performance of athletes has been subject to much scientific interest over the years. The ability to measure specific parameters of exercise has led to a greater understanding of the various energy pathways, their contributions to energy production and the capabilities of the human body. The difference between success and failure in modern competitive athletics is diminishing, as athletes improve their ability to run faster, throw longer or jump further and set new world records in the process. These superior performances can be attributed to the complex interaction of physiological, biomechanical, nutritional and psychological factors (Hawley and Burke, 1998).

Vince Lombardi aptly defined success as "Winning isn't everything, it's the only thing". Coaches, trainers and athletes are continuously seeking to determine optimal ways of identifying the key elements which contribute to athletic performance (Beckenholdt and Mayhew, 1983). Identifying these key factors was initially achieved through trial and error by coaches and athletes. However, it is becoming increasingly recognised that the most consistently effective methods of preparing athletes for the demands of elite competition are those based upon scientific principles. Qualified sports scientists are often employed to assist athletes in realising their full potential (Hawley and Burke, 1998).

A wide range of laboratory based physiological performance tests have developed through decades of research. Hawley and Burke (1998) suggested that the primary benefits are; identifying sport potential; determining the physiological and health status of an athlete; facilitating the process of sports specific physiological profiling; identifying relevant strengths and weaknesses to an athletes sport in order to help predict performance; providing an educational and motivational tool; and providing feedback to assist coaches in evaluating the success of training interventions.

Traditionally, research has focused on measuring the aerobic performance of athletes which has lead to a greater understanding of the capability and performance of the aerobic system in synthesising energy. The VO_2 Max test is considered to be the gold standard test in measuring aerobic performance. It has been long established as a valid and reliable test for determining the aerobic power of athletes (Shephard *et al*, 1968). The test measures the maximal amount of oxygen that can be taken in, transported and utilised by the body. It has been suggested that this is the most widely used test in exercise physiology, and probably the best method of assessing an athletes endurance capabilities (Hawley and Burke, 1998). However, Vanderwalle *et al* (1987) state that the evaluation of physical fitness cannot be summarised by the measure of maximal oxygen uptake alone. There are also other determining factors that contribute to athletic activities such as anaerobic metabolism, speed, strength and maximal power.

Anaerobic performance can be measured both in a laboratory and field based environment. It has previously been defined by many investigators as an individual's ability to do supra-maximal work for a short period of time, (Vanderwalle *et al*, 1985; Medbo *et al*, 1988). However, relatively less research has been conducted concerning the anaerobic pathways of energy production. Therefore determining the anaerobic power of an athlete has not been as clearly defined or tested (Beckenholdt and Mayhew, 1983). Winter *et al* (1996) define the difference between the terms maximal intensity exercise (supra-maximal exercise) and maximal oxygen uptake. Maximal intensity exercise has been defined as an 'all-out' effort such as maximally sprinting in a 100m event. Whereas, the term maximal oxygen uptake is used with reference to intensities that are normally associated with longer track events such as 1500-10000 metres.

The concept of generating a maximum amount of energy in a short amount of time does appear valid (Beckenholdt and Mayhew, 1983). Interest in anaerobic energy production of athletes has increased because investigators have identified that both individual and team sports require a huge contribution of anaerobic power in addition to aerobic power for energy production (Bulbulian *et al*, 1996).

The major problem facing these physiology and sports science investigators is the establishment of a gold standard test to measure an athlete's anaerobic performance, as there is no single and widely accepted test to identify this key factor. When conducting physiological tests, it has been suggested that it is advantageous to employ trained individuals due to their advanced motor skill development. This appears to play a role in successful performance (Beckenholdt and Mayhew, 1983). There are many laboratory and field tests employed to measure anaerobic performance. However these range in duration of up to 90 seconds (Gastin, 2001). When conducting performance testing on athletes, it is essential to make the test specific to the energy metabolism; duration; intensity; mode of exercise; activity patterns; muscle mechanics and muscle recruitment employed in their sport. The intensity and duration of the work effort determines the relative contribution of the energy systems (Gastin, 2001). Selecting an appropriate test that maximises the contribution of the measured energy system, and minimises the contribution of the others is important, as the energy potential of muscle is evaluated by the power and capacity of each energy system (Gastin, 2001).

Vandewalle *et al* (1987), compiled a comprehensive list of standard tests to measure anaerobic performance, including the Staircase Test (Margaria *et al*, 1966), the Vertical Jump Test (Sargent, 1921), and the Short Sprint Runs of which the 40 metre sprint appears to be the most popular. The most frequently used method of measuring anaerobic power though is using ergometric assessments of mechanical work. These have proved popular because they are non-invasive, indirect performance based measures of the power and capacity of the body's three energy systems (Gastin, 2001).

The Wingate Anaerobic Test (WAnT) uses a cycle ergometer. The test has been described as the most popular anaerobic test to assess muscle power, muscle endurance and fatigue ability. Bar-Or an Inbar (1978), stated that such a test may be useful for the evaluation of athletes and others who perform tasks of very high intensity and for short periods of time. Therefore, the test is suitable to measure the anaerobic power and capacity of sprinters.

The following investigation has been conduced based upon recommendations by Bar-Or (1987), stating that research using this test on athletes of various metabolic specialities is needed.

1.1 Definition of Terms

Bar-Or (1987), stated that three parameters of performance are measured during the Wingate test. These are defined as Peak Power (a); Mean Power (b); and Rate of Fatigue (c) as described below:

(a) Peak Power is measured in Watts (W), and is described as the highest mechanical power elicited during the test and is normally measured during the initial few seconds. This parameter is calculated as the highest average power of any 5 second interval.

(b) Mean power is measured in Watts (W), and described as the average power that is sustained during the 30 second duration.

(c) Rate of Fatigue (Fatigue Index) is described as the degree of power drop off or power decrease during the test. This is calculated as a percentage (%) of peak power. Minimum power normally occurs during the last few seconds of the test and it is the lowest power recorded during the test. This is calculated against the peak power output to produce a power decrease percentage.

1.2 Purpose of the Investigation and Hypotheses

This investigation therefore intends to use under 23 age-grouped, country level, male, sub-elite, sprint trained athletes in the 100m and 400m sprint disciplines. The investigation aims to quantify the individual and collective anaerobic power and capacity of these athletes. The data will then be statistically analysed, to yield valuable information which, can be used by coaches and athletes as a valid measure of performance and determine the suitability of WAnT use on this athletic population.

The objective of the study was to accept or reject the following hypotheses.

H_0 Null Hypothesis:

There will be no significant difference between the measured parameters of Maximal Power Output (W), Average Power Output (W) and Fatigue Index (%) using a standard WAnT test protocol developed by Ayalon (1974) on a cycle ergometer under laboratory conditions of Under 23 age group, male, county level 100m and 400m sprint trained athletes.

H_A Research Hypothesis:

There will be a significant difference between the measured parameters of Maximal Power Output (W), Average Power Output (W) and Fatigue Index (%) using a standard Wingate Protocol developed by Ayalon (1974) on a cycle ergometer under laboratory conditions of Under 23 age group, male, county level 100m and 400m sprint trained athletes.

Chapter III

3.0 Methodology

Subjects were informed to arrive to the testing laboratory 15 minutes prior to the start of testing. This time was used to brief subjects on the forthcoming exercise, answer any questions they had regarding the test to make them fully aware of the test protocol and to assist them in equipment familiarisation.

3.1 Physical Activity Readiness Questionnaire, Informed Subject Consent and Risk Assessment.

A Physical Activity Readiness Questionnaire (PAR-Q), and an Informed Consent Form were completed, (please refer to appendix A and B respectively for an example of these). A PAR-Q was completed to identify if subjects had any previous health problems or current health issues to determine if they were physically fit to take part in the study. Subjects were asked to identify if they had completed a Wingate test previously to help determine their level of experience of physiological testing. Written voluntary informed consent was obtained to proceed with exercise testing to inform subjects of the risks associated with taking part, and provide information about the purpose and procedures of the study. A full risk assessment was completed to identify, and reduce potential risks to ensure the health and safety of the participants at all times.

3.2 Subjects

Once the initial paperwork was completed and signed, the physical characteristics of the subjects were measured; height (cm) and body mass (Kg). Subjects were advised to prepare for the test by ensuring they were hydrated, had not eaten or consumed caffeinated drinks 90 minutes prior to testing, and had not undertaken strenuous training or competition in the previous 24 hours. This study involved 15 male sprint trained athletes. Subjects were recruited from the Under 23 athletics age group category, and attended the University of Wales Institute, Cardiff.

Based upon the events that they competed in, the subjects were classified as 100m or 400m sprinters. Each subject voluntary participated and they were healthy, well trained and motivated and met the selection criteria of country representation to take part. Each subject was assigned a number and identifiable subject characteristics have been omitted from the results section to maintain subject confidentiality, which complies with the data protection act (1998).

The mean age (*S*) of the 100m and 400m samples were 22 (± 0.53) and 21 (± 0.75) years old respectively. The mean height (*S*) of the 100m and 400m samples were 180.1 (± 7) and 177.8 (± 8.04) cm respectively. The mean Body Mass (*S*) of the 100m and 400m samples were 83.6 (± 7.6) and 76.4 (± 8.8) Kg respectively.

3.3 Test Overview

This test has been chosen as the method of choice because as previously stated by Bar-Or (1987) "the test should qualify as objective, reliable, valid, sensitive to improvement or deterioration in anaerobic performance; and specific in reflecting anaerobic performance rather than fitness in general". The test measures the parameters of Peak Power Output, Mean Power Output and Fatigue Index. This investigation was conducted at the Physiology laboratories in the University of Wales Institute, Cardiff (UWIC), on the Cyncoed Campus. Testing took place over a two day period, the 100m athletes attended the first period, the 400m athletes attended the second. The procedure involved a single stage requiring the subject to pedal maximally for 30 seconds on a cycle ergometer against a constant force (Bar-Or, 1987).

3.4 Load Determination

This constant force is known as the 'test weight' or more specifically the 'Wingate Load', and it is relative to 7.5% body mass of the subject and it is added to the basket (the basket weighs 1KG). This was the load proposed initially by Ayalon *et al,* in 1974.

3.5 Equipment

The test can be administered simply by using only a mechanical ergometer (based on hanging weights) such as Monark or bodyguard and a stop watch, and pedal revolutions counted by visual observation (Bar-Or, 1987). However, due to advances in technology the sophistication of ergometers has been improved, and this protocol used a more advanced Monark Cycle Ergometer Model Bike, (874), (Monark Exercise AB, Varberg, Sweden) with micro linked data logging facilities (Wingate Software Cranlea, Wingate 4.0, Cranlea, Birmingham, UK). This software increased the precision of data collection, and was used to record movements on the flywheel which automatically calculated the test parameter scores. A separate ergometer was used for the next test subject to warm up on. Subjects were instructed to wear gym clothes (t-shirt & shorts) and suitable footwear to participate.

Prior to testing the subjects body mass was measured in metric units, barefoot using digital scales, (SECA- Model 770, Vogel & Halke, Hamburg, Germany) and height was measured using a standard Stadiometer (Holtain Fixed Stadiometer. Holtain LTD. Crosswell. Crymych, Pembs). All testing was conducted using the same ergometer to ensure reliability of measures under identical laboratory conditions.

3.6 Warm Up

A warm up is important to physically and psychologically prepare the body for exercise. Inbar and Bar-Or (1975), have previously suggested that prior to any physical exertion, a warm up should be conducted for the improvement of athletic performance, and for the prevention of sports injuries. Prior to the start of the warm up, the seat height was adjusted to allow for near full extension of the leg, so that the angle of application was correct whilst pedalling for optimal performance. Subjects cycled at 60 repetitions per minute (RPM) against a resistance of 1.5Kg for 5 Minutes (Mins). The warm up was conducted at a resistance of 90 Watts (W) for each participant, irrespective of body weight. This is the standard protocol proposed by Ayalon *et al* (1974).

After 2 minutes in to the warm up, the subject was instructed to stop pedalling, the test weight was added and the basket was raised above the flywheel, the subject continued to pedal against no resistance at 60rpm. A count down was begun by the administrator, "3 – 2 – 1 – GO!!!" On "Go" the basket is lowered onto the flywheel, and the subject cycled maximally for 3 seconds until a "Stop" command was used and the basket lifted, the subject continued to cycle at 60rpm for a further 2 minutes. Subjects then rested for a period of 3 minutes prior to performing the full test procedure.

3.7 Full Test Procedure

The subject and test variable data was input into the computer. Prior to the start of the test, the seat height was checked to allow for near full extension of the leg whilst pedalling for optimal performance. The subject was instructed to cycle maximally throughout the test and told to avoid pacing. The predetermined test weight was positioned above the flywheel. Toe stirrups were securely fastened. The single stage test began at a rolling speed of 60rpm without resistance, the test was initiated by a countdown by the test administrator, 3 – 2 – 1 – GO!!!". On "Go" the basket was lowered onto the flywheel and the subject cycled maximally for the 30 second duration, until a "Stop" command was issued. After this stop command was given, the test was finished. Strong verbal encouragement was given throughout the test to aid subject motivation to provide a maximal effort.

3.8 Warm Down

Post testing, the test weight was immediately raised above the flywheel and subjects were advised to remain on the ergometer, and continue to cycle at 60rpm without resistance for a period of 3 minutes to facilitate recovery of the lower limbs. General static stretching was advised to stretch the active muscles when the subjects dismounted. After the cool down period, it was essential that the participants were observed, they were advised to elevate the legs above the heart by resting them on a chair to aid blood flow to the legs. If the subject felt ill or went quiet or pale, they would have been assisted to get off the bike to lie down with their feet elevated on a chair.

3.9 Statistical Analysis

The variables of both sample populations were measured on a ratio scale, the sample populations were randomly selected from an athletic population. Simple descriptive statistics (Means ± SD) were calculated to make a basic comparison between each data set. Statistical analysis was conducted using the SPSS Statistic software 17.0 package.

Many of the classical statistical tests depend on normality assumptions. Significant Skewness (a measure of the vertical deviation from normality) and Kurtosis (a measure of the lateral deviation from normality) clearly indicate that data are not normal. Therefore, the data was tested by creating a histogram for each of the three parameters measured to test for both Kurtosis and Skewness to determine if they affected the data. Significance was tested at a 95% level of confidence ($p<0.05$).

A normal distribution of data about the mean (Gaussian distribution) was generated for each parameter measured for both sets of data; there was non-significant Kurtosis or Skewness, all variables were not significant ($p>0.05$). The data was therefore compiled with the assumption of normality, qualifying it for parametric statistical analysis. These tests are used to specify certain conditions about the measured parameters (PPO, MPO and FI) of the populations from which the samples were drawn.

The Levene's Test for Equality of Variances was used for each individual parameter to determine if the two independent samples have approximately equal variance on the dependent variable. This therefore determines the T-test employed for statistical analysis. The value of the Levene's Test is not significant ($p>0.05$), the two variances were not significantly different because the two variances are approximately equal and a two tailed Independent T-test was conducted. This test was used to examine if there were significant differences between the means of each parameter measured between both the data sets. If a P value of >0.05 was generated then the null hypothesis would have been accepted and the research hypothesis rejected.

However, if the P value was <0.05 then the null hypothesis would have been rejected and the research hypothesis accepted. This would therefore determine if the results of the investigation were due to physiological differences between samples or merely down to chance.

Chapter IV

4.0 Results

The physical characteristics of the subjects that participated in the study and the Wingate test weight ratio used are presented in Table 4.0, subjects were grouped by event.

Table 4.0 Mean and standard deviation (SD) of anthropometric data values of subjects and wingate test ratio

Sprinting Event	100m	400m
Number of Participants	8	7
Mean Age (Years)	22 (± 0.5)	21 (± 0.8)
Mean Height (cm)	180.2 (± 7.0)	177.8 (± 8.0)
Mean Body Mass (Kg)	83.7 (± 7.6)	76.4 (± 8.8)
7.5% Test Weight Ratio (Kg)	6.3 (± 0.5)	5.7 (± 0.7)

The difference in the mean body mass between the 100m sample (83.7 ± 7.6Kg) and the 400m sample (76.4 ± 8.8Kg) was 7.3 Kg; this can be attributed to their increased lean muscle mass. Subjects completed a single test under identical laboratory conditions using the 'Wingate Load' on a Monark Cycle ergometer linked to a computer containing the Cranlea Wingate software (4.0), which automatically calculated the results. Individual subject scores for each parameter measured and test weights used are presented in Table 4.1 for the 100m sample and table 4.2 for the 400m sample.

Table 4.1 Individual test weight (7.5%) and test scores for each measured parameter; Peak Power Output (PPO); Mean Power Output (MPO), and Fatigue Index (FI) for each subject of the 100m sample.

SUBJECT	7.5% ratio (Kg)	PPO (W)	MPO (W)	FI (%)
1	5.2	824	638	44
2	6.8	1057	743	60
3	6.7	1148	808	63
4	6.6	954	755	45
5	6.1	909	686	49
6	6.6	1026	792	46
7	6.2	1020	796	42
8	6.0	990	782	46
Mean	6.3	991	750	49
S.D.	0.5	98	60	8

Table 4.2 Individual test weight (7.5%) and test scores for each measured parameter; Peak Power Output (PPO); Mean Power Output (MPO), and Fatigue Index (FI) for each subject of the 400m sample.

SUBJECT	7.5% ratio (Kg)	PPO (W)	MPO (W)	FI (%)
1	4.7	622	546	29
2	6.4	976	783	36
3	6.5	821	703	37
4	5.2	834	602	51
5	5.7	867	672	40
6	6.2	795	642	31
7	5.4	818	653	58
Mean	5.7	819	657	40
SD	0.6	105	75	10

Mean and standard deviation (SD) of each parameter (PPO, MPO and FI) were calculated to allow a comparison. The 100m sample displayed a greater magnitude in PPO (100m mean = 991 W; 400m mean = 819 W), MPO (100m mean = 750 W; 400 mean = 657 W) and FI (100m mean = 49%; 400 mean = 40%). This information is displayed in table 4.3 below and graphically compared in figure 4.0 and 4.1.

Table 4.3 Results from the single effort WAnT (Mean and SD for PPO, MPO and FI) of both data sets.

Parameter	PPO (W)	MPO (W)	FI (%)
100m Sample Mean (SD)	991 (±98)	750 (±60)	49 (±8)
400m Sample Mean (SD)	819 (±105)	657 (±75)	40 (±10)

.

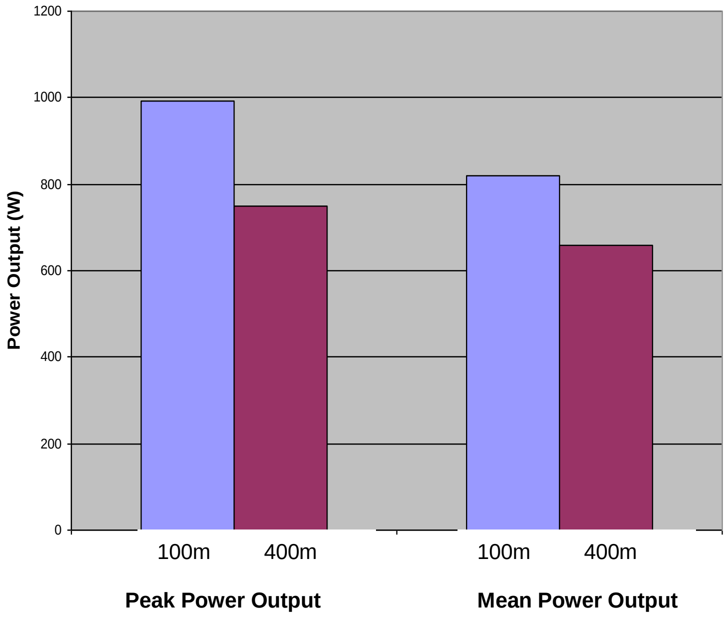

Figure 4.0 Mean PPO (W) and MPO (W) values for the 100m and 400m sample

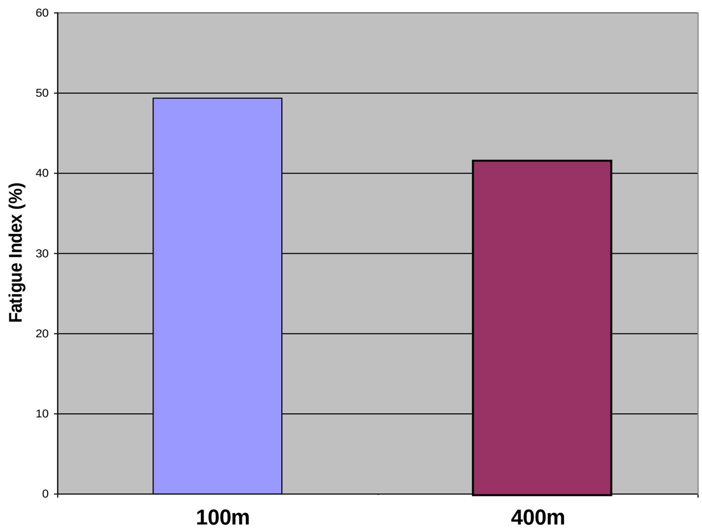

Figure 4.1 Mean Fatigue Index (%) for the 100m and 400m Sample

It has been suggested in the literature that there is an association between body mass and power output, commonly known as power to weight ratio. The scatter diagram in figure 4.2 shows that there is a positive linear relationship between: PPO (W) and Body Mass (Kg) and there is an even spread of values of both data sets.

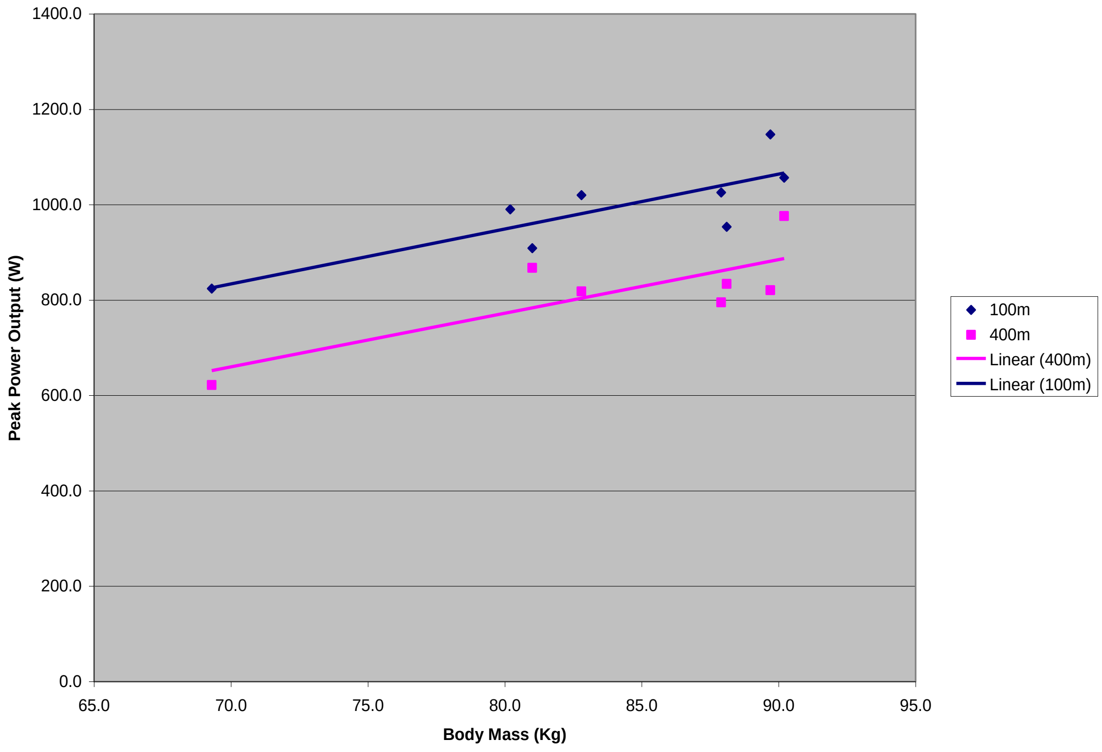

Figure 4.2 – Peak Power Output (W) values plotted against Body mass (Kg) with trend line for both the 100 and 400m sample.

The scatter diagram in figure 4.3 shows that there is a positive linear relationship between: MPO (W) and Body Mass (Kg) again, the results of both data sets are evenly spread.

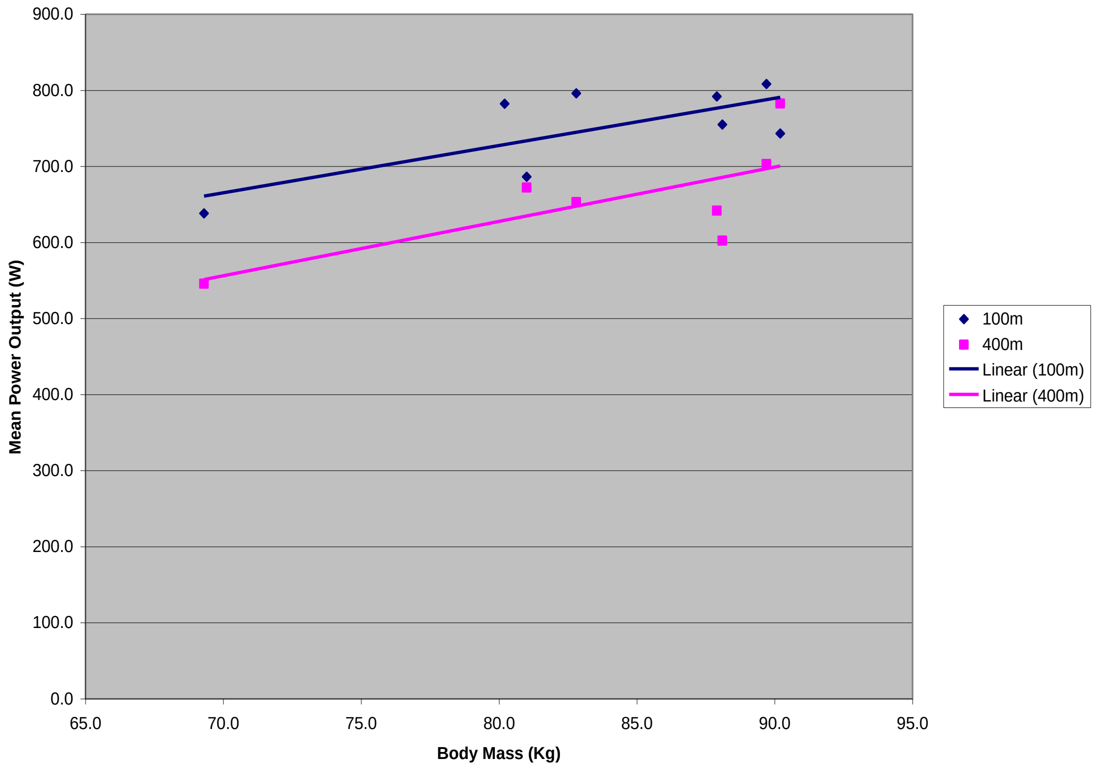

Figure 4.3 – Mean Power Output (W) values plotted against Body mass (Kg) with a trend line for the 100m and 400m sample.

The scatter diagram in figure 4.4 shows that there is a weak positive linear relationship between: FI (%) and Body Mass (Kg) and the data is spread.

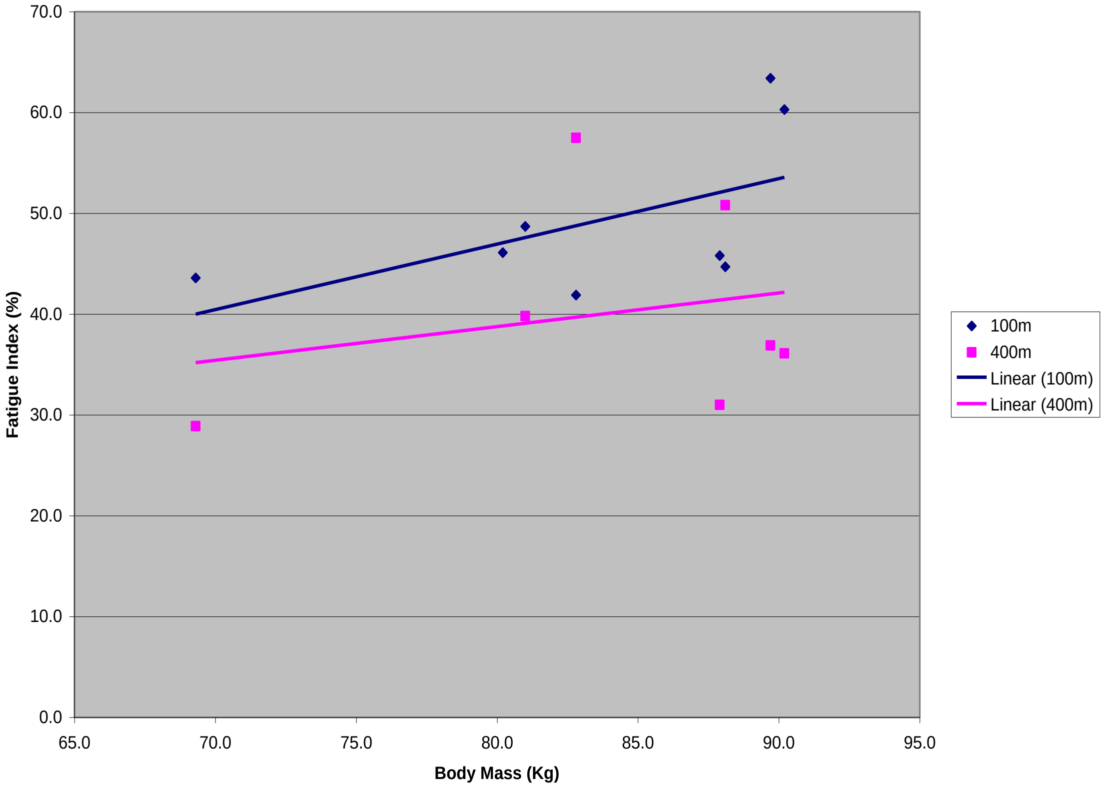

Figure 4.4 – Fatigue Index (%) values plotted against Body mass (Kg) with a trend line for the 100 and 400m sample.

An Independent T-test examined if there were significant differences between the means of each parameter between both data sets. The parameters of PPO and MPO were both significant, however the FI was deemed insignificant. The analysis results are briefly displayed in table 4.4 below. Significance was tested at a 95% level of confidence ($p<0.05$).

Table 4.4 P Values of Independent T-test comparing the means of each parameter of both data sets.

Parameter	PPO (W)	MPO (W)	FI (%)
P Value	0.006	0.019	0.077
Significant	Yes	Yes	No

Chapter VI

6.0 Conclusion

The use of a Wingate test has been able to identify a statistically significant difference between PPO and MPO of the 100m and 400m samples. Therefore, the null hypothesis regarding both these parameters can be rejected and the research hypothesis can be accepted. The results concerning the measurement of the Fatigue Index parameter indicate that there was no significant statistical difference between the means of the two samples so the null hypothesis is accepted and the research hypothesis is rejected. Ergonomic data showed that the mean height and body mass of the 100m sample was greater than the 400m sample. The use of the Wingate test has been able to identify that the PPO and MPO of the 100 sample was 17% and 12.4% greater than the 400m sample respectively and deemed significantly different. The FI results for the 100m and 400m sample were 49% and 40% respectively, a difference of 9%, however there is no significant statistical difference between the FI of these samples using this test. Therefore this investigation concludes that increasing lean body mass through plyometric exercises, nutritional interventions and sprint training focusing upon the development of the phosphagen energy system will positively increase the peak power and average power output of sprint trained athletes.

6.1 Future research

Future research is required to develop a sprint athlete specific protocol for the Wingate Test. This may increase the specificity of the test for use with an athletic population, who produce a greater amount of power than children. The test is suitable to measure anaerobic power. However, the protocol employed cannot produce a valid measure of anaerobic capacity, because the duration of the test is insufficient to deplete the muscle glycogen stores. The test could be manipulated by increasing the test weight ratio to increase the resistance a subject works against, or increase the duration to 40-45 seconds to make the test more specific to a 400m sprinter. Laboratory and field based measures can be used to measure the individual performance parameters of athletes. However, the most appropriate method of measuring athletic performance of a sprinter requires a predetermined length of track, and a stopwatch.

Chapter VII

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APPENDICES

APPENDIX A

Physical Activity Readiness Questionnaire (PAR-Q)

Subject Name: ____________________________

Date of Birth: ____________________________

Please **circle** the answers to the following questions:

1	Do you have asthma or any breathing problems?	Yes / No
2	Has your doctor ever said you have heart trouble?	Yes / No
3	Do you frequently suffer from pains in the chest?	Yes / No
4	Do you often feel faint or have spells of severe dizziness?	Yes / No
5	Has a doctor ever said your blood pressure was too high?	Yes / No
6	Has a doctor ever said that you have a bone or joint problem such as arthritis that has been aggravated by exercise, or might be made worse with exercise ?	Yes / No
7.	Is there a good physical reason not mentioned here why you should not take part in a fitness test?	Yes / No
8.	Are you unaccustomed to vigorous exercise?	Yes / No

If you have answered yes to any of these questions, please add details below. Similarly, if there are any situations which will prevent you from exercising write them here (or let us know if they arise through the experiment).

____
____
____
____

If your situation changes at any time regarding your responses to these questions, please notify the test administrator.

Have you completed a Wingate test previously? Yes / No

Signed (subject): ____________________ Date: _______________

Signed (investigator): ____________________ Date: _______________

APPENDIX B

University of Wales Institute, Cardiff

Cardiff School of Sport

Informed Consent

Subject Name: ____________________

Date of Birth: ____________________

Investigator (Student): Matthew Gibbs

Dissertation Supervisor: Carl Beynon

Ethical Approval Gained? **Yes** / No

Title of the Study:

Use of the Wingate Test in Comparing the Anaerobic Power and Capacity of Sprint Trained 100m & 400m Athletes.

The following investigation has been examined and accepted by the University ethics committee and is suitable for consenting human subjects. Explained below is information regarding exercise tests and measurement techniques.

Objectives

The primary aim of the study is;

1). To assess and compare the anaerobic power (maximal power, average power) and capacity (fatigue index) of 100m and 400m sprint trained athletes and make a scientific comparison.

Exercise protocol

You (the test subject) will be required to visit the laboratory on a single occasion. Before testing commences, you will be introduced to the cycle ergometer to familiarise yourself with the equipment and the test procedure will be explained. The test will involve a maximal sustained effort for 30 seconds against a resistance of 7.5% bodyweight, loaded in the test basket.

The warm up involves cycling at 60rpm repetitions per minute (RPM) against a resistance of 1.5Kg for 5 Minutes. The warm up is conducted at a resistance of 90 Watts (W). After 2 minutes, you will be instructed to stop pedalling, the test weight is added and the basket is raised above the flywheel, you will then continue to pedal against no resistance at 60rpm. A count down is begun by the administrator, “3 – 2 – 1 – GO!!!” On “Go" the basket is lowered onto the flywheel and you will cycle maximally for 3 seconds until a “Stop” command is used and the basket lifted, prior to the test you will continue to cycle at 60rpm for a further 2 minutes. A rest period of 3 minutes is permitted prior to performing the full test procedure.

Full Test Procedure

The test weight is positioned above the flywheel, toe clips are secured and the seat height is adjusted for optimal performance. The single stage test will begin at a rolling speed of 60rpm without resistance, the test is initiated by a countdown by the test administrator, 3 – 2 – 1 – GO!!!”. On “Go" the basket is lowered onto the flywheel and you will cycle maximally for the 30 second duration, until a “Stop” command. Strong verbal encouragement is given throughout the test to aid motivation.

Warm Down

Post testing, the test weight is raised above the flywheel and you will continue to cycle at 60rpm without resistance for a period of 3 minutes to aid lactate removal of the lower limbs. General stretching is advised for the active muscles. After the cool down period you will be observed for a short period of time and it is advised to elevate the legs above the heart by resting them on a chair to aid blood flow to and from the legs.

Potential Risks

The risks involved with this test will be explained fully so that you are aware of the possible outcomes and provide you with the necessary information to give written informed consent to participate in the study.

During Exercise

Risks associated with participating in this study are mentioned to maintain health and safety standards. Due to the maximal effort required of the Wingate test, there is a small injury risk to you the participant; however in any test requiring physical exertion the possibility of injury is always present.

Following Exercise

The physical effort will produce post exercise symptoms such as some light-headedness, disorientation and nausea. The active warm down will help to facilitate recovery and avoid adverse symptoms.

Benefits

Participating in this study will help collect data on the power of sprinters and provide information for a scientific comparison to further understand the role of the energy systems in maximal work. This information can also be of personal use as it provides you with data on your own peak power output, average power and fatigue index.

The Data

All data collected from this study will remain anonymous and privacy will be maintained.

NB - The University and its staff accept no liability for any matters arising, either directly or indirectly, from the information and recommendations given to you as a result of the outcomes of your test. It is the responsibility of the athlete to ensure that the Sport Scientist is aware of any medical conditions or other information that might affect either the test itself or the interpretation of the results and subsequent recommendations.

Statement by the Subject

I have been made fully aware of the risks and benefits involved from partaking in the present study. I understand that I am free to withdraw from the study at any time and that the results of the study will be treated anonymously and with total confidentiality.

I have had my attention drawn to the document produced by the American College of Sports Medicine (1997) entitled "Policy Statement Regarding the use of Human Subjects and Informed Consent". It has been made clear to me that if I feel my rights are being infringed and / or my interests are being ignored, neglected or denied, I should inform the chairman of the Cardiff School of Sport Research Ethics Committee who will undertake to investigate my complaint.

Signed: ________________ (Subject's signature) Date: ____________

I certify that the details of the study have been fully explained and described in writing to ____________________ (Subject's name, printed) and this information has been fully understood by him.

Signed: ________________ (Independent witness' signature) Date: ____________

Subjects contact details:

Address: ____________________

Home telephone number: ____________________

Mobile telephone number: ____________________

E-mail address: ____________________