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The Effects of Different Warm-Up Methods on Anaerobic Power

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THE EFFECTS OF DIFFERENT WARM-UP METHODS ON ANAEROBIC POWER

by

Bradley Kendall

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THE EFFECTS OF DIFFERENT WARM-UP METHODS ON ANAEROBIC POWER

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Western Michigan University 2014

The purpose of this study was to investigate the effects of various warm-up methods on Wingate Anaerobic Test (WAnT) performance. The goal of this study was to investigate how a general cycling warm-up, a dynamic stretching routine, a static stretching routine, and the combination of both static stretching followed by cycling and dynamic stretching followed by cycling affect WAnT performance. Ten recreationally active subjects (5 males, 5 females), completed five WAnT on a Monark Ergomedic 984E cycle separated by at least 48 hours. Subjects were randomly assigned to an order of conditions and performed a different condition prior to each WAnT. The warm-up protocols consisted of static stretching protocol, dynamic stretching protocol, a cycling protocol, and the combination of both static stretching followed by cycling and dynamic stretching followed by cycling. Peak anaerobic power, mean anaerobic power, power drop, and percent fatigue were calculated following the completion of all five conditions. No significant ($p > 0.05$) statistical differences were found among the five conditions for any of the four measurements. In conclusion, various stretching and active warm-up methods prior to the WAnT did not increase or inhibit performance.

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I would like to thank my family for their continued love, support, and encouragement as I continue to pursue my life-long goals. I would like to give a special thank you to my father for giving me his undivided attention whenever I had any questions and helping me pursue a career in academia. Thank you for pushing me to keep going all the times I was frustrated.

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To my committee, Dr. Michael Miller and Dr. Carol Weideman, thank you for giving your time and energy to help me complete this project.

Finally, I would like to thank my wife Allie. Thank you for helping and encouraging me to complete this task. Thank you for allowing me to pursue my goals of a career in academia. I am so thankful for you and everything you do. I love you.

Bradley Kendall

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INTRODUCTION

It is a common practice for athletes to warm-up before a practice or an athletic competition. The desired effect of a warm-up is to increase flexibility, range of motion, blood flow, and elevate body temperature, all of which are widely accepted as important factors that can improve performance (Ce et al., 2008; Curry et al., 2009; Faulkner et al., 2013). Athletes will usually follow a standardized warm-up routine designed by their coach prior to competition. It is common to see a team line up and perform both dynamic and static stretching routines prior to a competition. In more individual sports such as track, some athletes choose to perform a general warm-up followed by a stretching routine while other athletes simply perform a stretching routine. Since athletes and teams commonly warm-up before competition in order to improve performance, it is vital to understand if one warm-up method is superior to another.

Although athletes warm-up prior to competition, it is important to clarify that one warm-up method will not be the most beneficial for all athletes. For example, the warm-up designed for an endurance athlete (e.g., a marathon runner) should be different from a warm-up designed for a power athlete (e.g., a sprinter). An endurance athlete will require a warm-up that promotes muscular endurance while a power athlete requires a warm-up that promotes maximal power production from the skeletal muscles. Stretching is especially encouraged as an essential part of a warm-up since it tends to increase performance while reducing the potential for injury (Nelson et al, 2005).

In recent literature, there are differing opinions on which type of warm-up is optimal for performance and power output. More specifically, which type of stretching should be incorporated prior to competition, as well as whether a stretching routine should be included within a general warm-up. Bishop (2003) stated that there is little evidence supporting the effectiveness of various warm-up methods and, typically, warm-up procedures end up being based on trial and error rather than scientific study.

Stretching type (dynamic or static) is of popular interest since there are varying thoughts on the effects it has on performance. Fowles, Sale, and MacDougall (2000) reported that prolonged passive stretching reduced strength up to one hour after stretching, as well as lowered contractile force of the muscle. Yamaguchi and Ishii (2005) reported that dynamic stretching increased muscular performance while static stretching neither increased nor reduced muscular performance. Similarly, other researchers promote dynamic stretching before competition since static stretching has been reported to decrease power production. Researchers (Manoel et al., 2008; Marek et al., 2005) stated that reduction in power output is primarily due to the decrease in muscular force-producing capacity. However, not all researchers agree static stretching negatively affects power output and performance.

Samson et al. (2012) encouraged the use of static stretching in a warm-up routine. The researchers concluded that static stretching (in warm-up) leads to maximal range of motion and enhanced sprint performance. Likewise, O'Connor, Crowe, and Spinks (2006) suggested that a warm-up should include static stretching because it has beneficial effects on anaerobic power events. The researchers stated that earlier studies suggested stretching negatively affected force production due to an increase in tendon slack and musculotendinous compliance. However, they concluded that a 15-minute warm-up including static stretching improved anaerobic performance greater than just a submaximal cycling warm-up alone. Additionally, Christensen and Nordstrom (2008) observed the effects of a general running warm-up, a general running warm-up with a dynamic stretching routine, and a general running warm-up with proprioceptive neuromuscular facilitation stretching routine on vertical jump performance. They measured vertical jump following each warm-up and concluded that all three warm-up methods produced similar results and neither positively or negatively affected performance.

Along with what type of stretching promotes the greatest increase in performance, some researchers also have observed that the inclusion of stretching within a general warm-up routine increased performance. Several studies (Dabbs et al., 2011; O'Connor et al., 2006) suggest the combination of an active general warm-up and a stretching routine tends to increase flexibility as well as increase blood flow and body temperature. Jogging or cycling prior to performance has been shown to increase muscle temperature and core temperature, which led to improvements in short-term performance (lasting <10 seconds) (Bishop, 2003). These improvements in short-term performance were suggested to derive from decreased muscle and joint stiffness (Wright and Johns, 1961). Furthermore, Ce et al. (2008) stated that if an active warm-up is performed, it should not be so intense that it causes a decrease in power output due to fatigue.

As mentioned in an article by Bishop (2003), many warm-ups are developed by trial and error. In team settings, coaches often use tests such as the vertical jump, standing long jump, or 40-yard dash in order to evaluate a player's power output. One test that is not used very often in a team setting, but is used frequently in research studies is the Wingate Anaerobic Test (WAnT). This test is used to measure peak anaerobic power and anaerobic capacity. The WAnT is a 30-second test designed to measure the degree of anaerobic performance in participants (Bell & Cobner, 2010). During the early stages of the test, energy supply is primarily anaerobic. As the test progresses, the aerobic energy system begins to provide more energy, while the anaerobic system decreases (Masayoshi & Hiroaki, 1995). Although the WAnT is performed on a cycle ergometer, the results on this test relate well to sports that rely on maximal anaerobic power and anaerobic capacity including sprinting and hockey (Franco et al., 2012).

The WAnT has been used in many studies (Popadic et al., 2009; Hoffman et al., 2007; Bell et al., 2010) to determine power production and anaerobic capacity, there has been very few studies that have observed the effects of different warm-up methods on WAnT performance. One study that did observe stretching and WAnT performance compared dynamic stretching, static stretching, proprioceptive neuromuscular facilitation, and no stretching. Specifically, Franco et al. (2012) noted that there are few WAnT stretching studies in the literature so they had to compare their results with stretching studies performed with other anaerobic power tests (e.g., vertical jump). They suggested that there is a need for additional research to observe warm-up techniques and their effects on WAnT performance. The researchers concluded there was no significant difference in performance between the no stretch and dynamic stretch groups. They suggested that performance was impacted more by the active warm-up instead of the stretching routine. However, they could not conclude this with certainty since all groups performed the active warm-up before the stretching routine.

Since Franco et al. (2012) had all the subjects in their study perform an active warm-up, it is possible that any negative or positive benefits from the stretching protocols were affected by the active warm-up. The purpose of this study was to investigate how a general cycling warm-up, a dynamic stretching routine, and a static stretching routine affect WAnT performance. Specifically, this study examined the combination of a general cycling warm-up (followed by a dynamic stretching routine) and the combination of a general cycling warm-up (followed by a static stretching routine) to determine if the combination of an active warm-up and stretching routine produced a greater effect on WAnT performance than stretching alone.

METHODS

Subjects

Ten recreationally active subjects (5 males, 5 females) participated in this study, which was approved by the Human Subjects Institutional Review Board at Western Michigan University. Characteristics of subjects are provided in Table 1. All subjects signed an informed consent document and completed a health and injury questionnaire. The subjects included in this study were considered low risk according to risk classifications of the American College of Sports Medicine (Manning, 1999). Additionally, all subjects were between the ages of 18-45, exercised 3-5 days per week for at least 30 minutes, and were free of any known disease or injury that would inhibit WAnT performance.

Table 1. Descriptive Characteristics of Subjects

Age (yr)	23.3 ± 0.70
Height (cm)	158.0 ± 2.75
Weight (kg)	49.0 ± 4.97
BMI	24.5 ± 1.13

(n = 10), (mean ± S.D.)

Procedures

Testing took place in the Human Performance Research Laboratory at Western Michigan University. Before testing began, subjects completed an orientation session demonstrating the proper warm-up exercises and use of the cycle ergometer for the WAnT. Subjects were randomly assigned to an order of conditions. On the first test day, the investigator recorded subjects' height and weight, followed by performance of one of five testing conditions in a counterbalanced design (Table 2):

Table 2. Descriptions of Conditions

Condition 1	Subject performed a standardized cycling warm-up and then performed a WAnT immediately after
Condition 2	Subject performed a standardized dynamic stretching warm-up and then performed a WAnT immediately after
Condition 3	Subject performed a standardized static stretching warm-up and then performed a WAnT immediately after

Table 2. - Continued

Condition 4	Subject first performed a standardized dynamic stretching warm-up, then a standardized cycling warm-up, and then performed a WAnT immediately after
Condition 5	Subject first performed a standardized static stretching warm-up, then a standardized cycling warm-up, and then performed a WAnT immediately after

Cycling Protocol

For the standardized cycling warm-up, the subject cycled at a low-moderate intensity (between 70-75 RPM) for five minutes, with a sprint done at maximal force for five seconds at the end of each minute. After the fifth sprint was completed, the participant cycled at low intensity for an additional minute before performing the WAnT (Beam and Adams, 2011).

Dynamic Stretching Protocol

The dynamic stretching warm-up consisted of military march, walking lunge drill, side step hurdle drill, superman drill, A-skips drill, C-skips drill, high knee walk drill, lateral high knee drill, skips for height drill, toe touch drill, and bounding drill. Each exercise was done for 20 meters, with the exception of the bounding drill, which was performed for 50 meters. This dynamic warm-up was developed by Leon et al. (2012)

and is described as a purposeful dynamic stretching routine. This warm-up is beneficial since it increases body core temperature, increases nerve impulse transmission, increases metabolic activity, and decreases joint and muscle stiffness. A more detailed explanation of each exercise can be found in Leon et al. (2012).

Static Stretching Protocol

The static stretching warm-up consisted of (1) standing calf stretch, (2) kneeling Achilles tendon stretch, (3) seated hamstring stretch, (4) seated gluteus maximus stretch leaning forward with one foot over the leg, (5) standing quadriceps stretch, (6) lying lower back stretch, (7) seated groin stretch, and (8) kneeling hip flexor stretch. All stretches were held for 30 seconds each, with stretches 1–6 repeated twice for each limb. Stretches 7–8 only were performed once on each limb. Taylor et al. (2009) used this stretching routine to observe the combination of static stretching and an active warm-up: see the article for a detailed explanation of each stretch.

Wingate Anaerobic Test

Following each of the 5 warm-up conditions, the participants performed a WAnT. The WAnT consisted of subjects pedaling at their highest revolutions per minute (RPM) against 7.5% of their body weight in resistance force for 30 seconds which is similar to other studies on recreationally-active individuals (Arslan, 2005; Franco et al., 2012; McLester et al., 2004). This study used the Monark Anaerobic Test software (V.3.3.0.0) from Vansbro, Sweden and tests were performed on a Monark Ergomedic 984E cycle. The WAnT test was used to measure peak anaerobic power, mean anaerobic power, and percent fatigue. Each test was separated by at least 48 hours to provide each participant with sufficient time to recover. Also, participants were asked to maintain regular exercise activity, but to avoid maximal exercise for at least one day prior to testing.

Statistical Analysis

Data on peak power, mean anaerobic power, power drop, and percent fatigue were analyzed using a repeated measures ANOVA to determine differences ($p \leq 0.05$) among conditions. Post-hoc analysis was done using t-tests with Bonferroni adjustments ($p \leq 0.05$). The level of significance was established *a priori* as $p \leq 0.05$. The SPSS statistical package (V. 19.0.0) was used for data analysis.

RESULTS

Peak Anaerobic Power

The greatest power output for peak anaerobic power was seen in condition two (Fig. 1). However, there was no significant difference for peak anaerobic power among any of the five conditions.

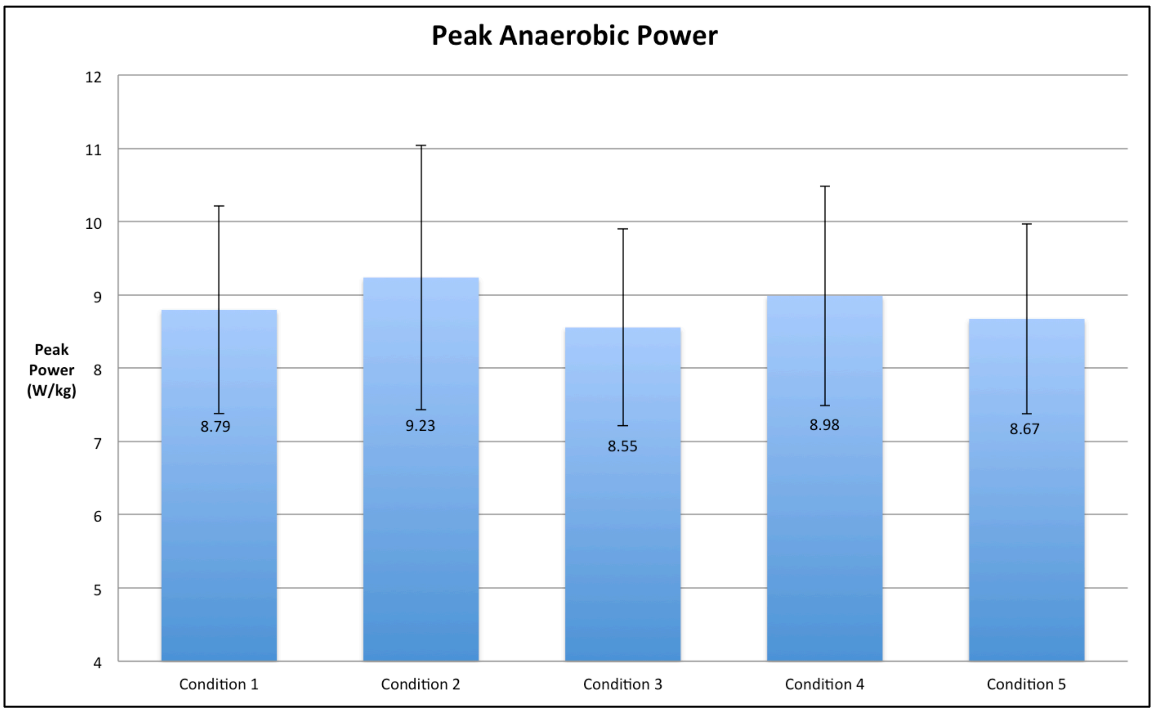

Figure 1. Peak Anaerobic Power (means ± S.D.)

Mean Anaerobic Power

Condition two and four produced the greatest mean anaerobic power among the conditions (Fig. 2). However, there was no significant difference ($p > 0.05$) among any of the five conditions.

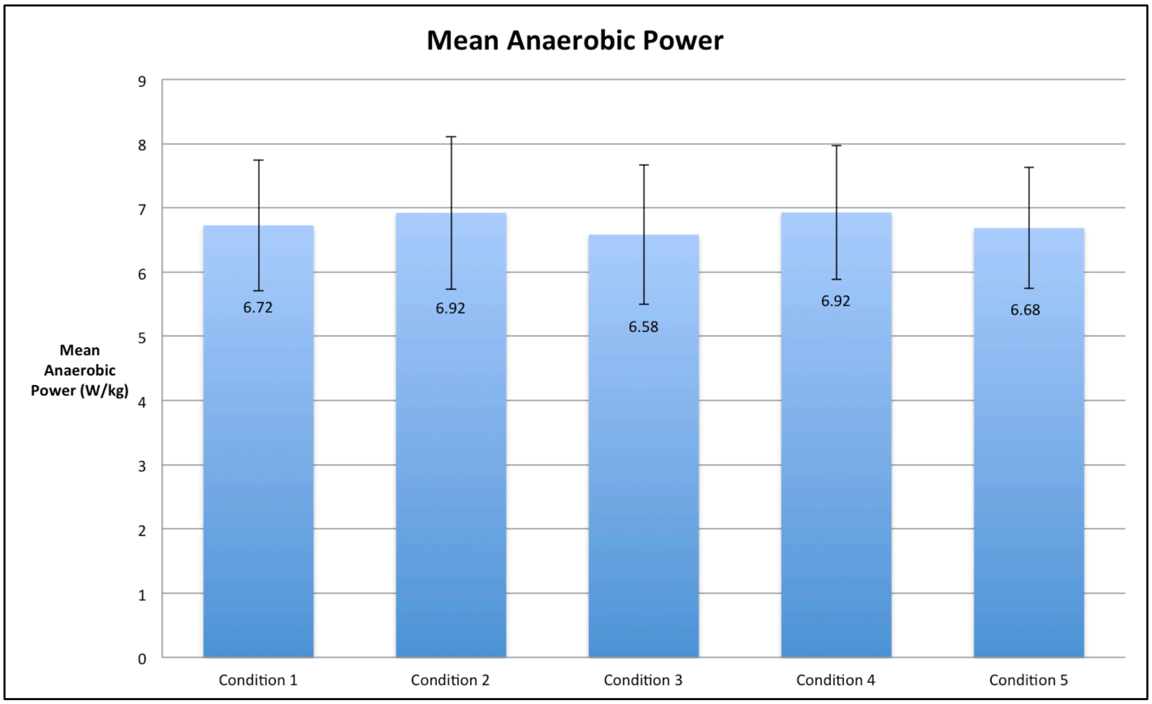

Figure 2. Mean Anaerobic Power (means ± S.D.)

Power Drop

The greatest power drop between the conditions was seen in condition two (Fig. 3). However, similar to peak anaerobic power and mean anaerobic power there was no significant differences ($p > 0.05$) among any of the conditions.

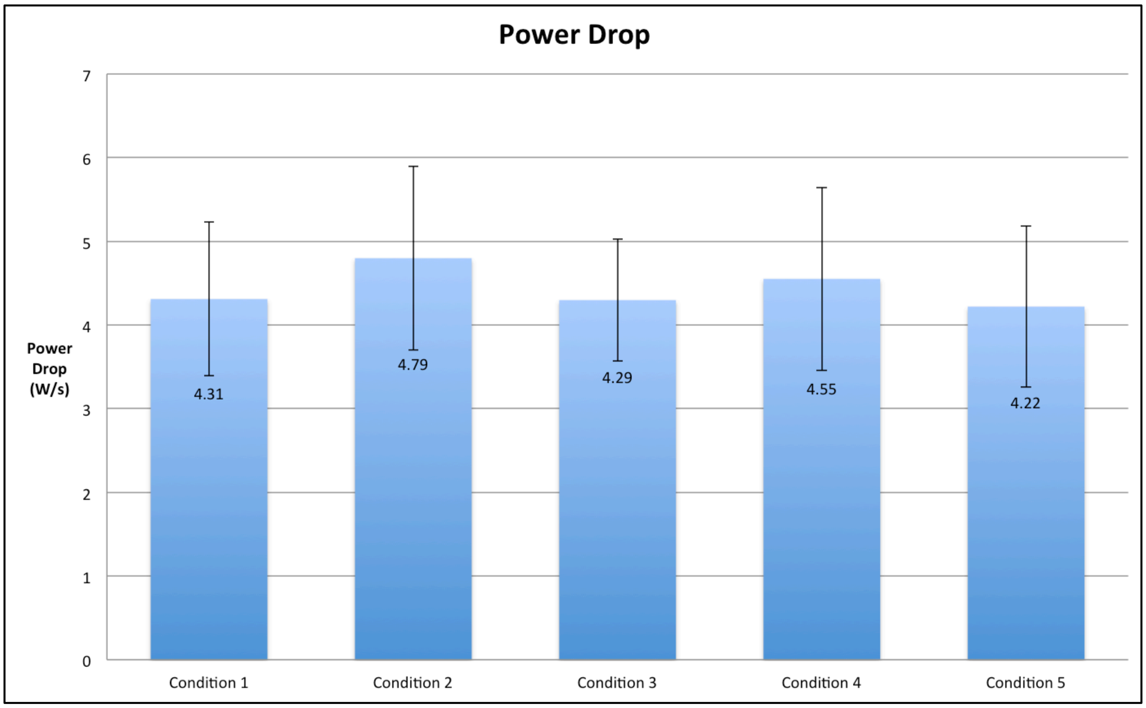

Figure 3. Power Drop (means ± S.D.)

Percent Fatigue

There was no statistical difference (p > 0.05) in percent fatigue among any of the five conditions (Fig. 4).

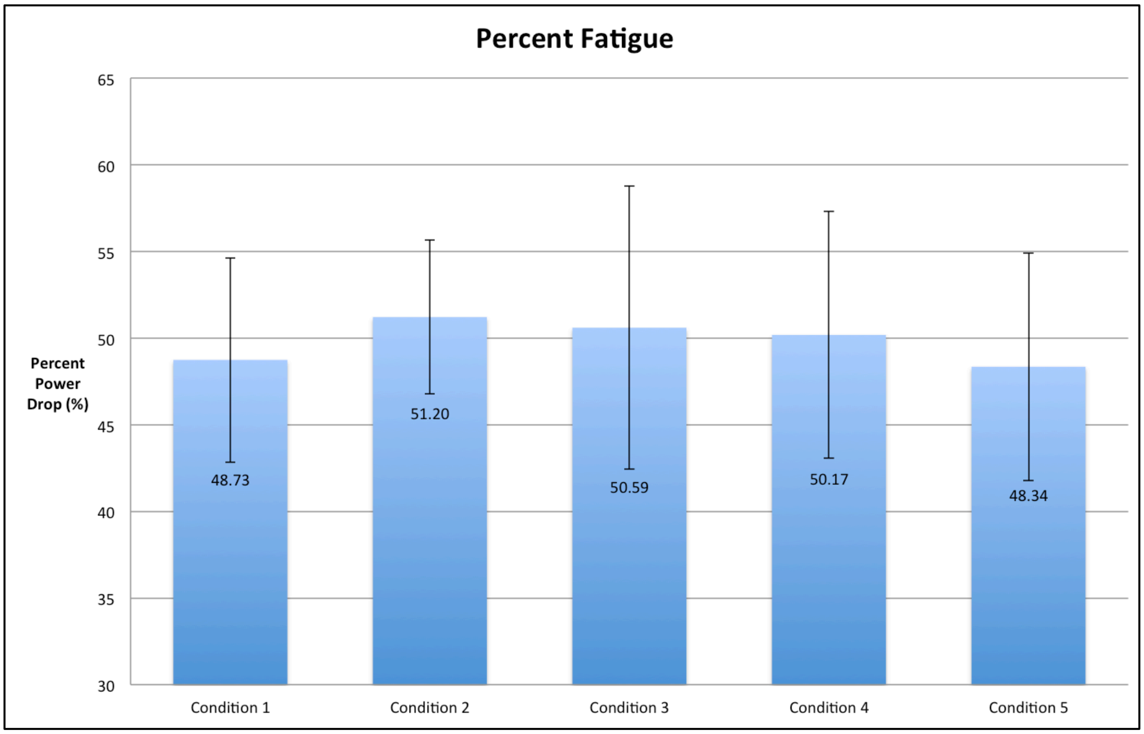

Figure 4. Percent Fatigue (means ± S.D.)

DISCUSSION

The purpose of this study was to investigate the effects of various warm-up methods on WAnT performance. The study compared a standardized cycling warm-up, a static stretching warm-up, a dynamic stretching warm-up, and the combination of static stretching followed by cycling and dynamic stretching followed by cycling. Prior to the commencement of this study, it was hypothesized that the combination of the cycling warm-up and the dynamic stretching warm-up would be most beneficial on WAnT performance. Past studies have concluded that a proper warm-up, one that increases flexibility and range of motion while elevating body temperature and blood flow, will improve performance, specifically maximal anaerobic power (Ce et al., 2008; Curry et al., 2009; Nelson et al., 2005). Therefore we hypothesized that our study would yield similar results.

Upon completing the study, we did not find significant differences among any of the conditions. However, for the dependent variable measured, there was a slight difference ($p = 0.065$) in peak anaerobic power between conditions two and three. This is similar to studies that have concluded dynamic stretching to be more beneficial then static stretching prior to anaerobic performance output (Curry et al., 2009; Christenson et al., 2008; Yamaguchi and Ishii, 2005; Yamaguchi et al., 2007). However, the differences found in this study were not significant ($p > 0.05$) so therefore we cannot conclude this with certainty. We would suggest the need for further research to observe the effects of static and dynamic stretching on WAnT performance.

Another area of concern in recent literature is that an excessively long active warm-up could reduce performance due to muscle fatigue. In our study, we kept all warm-up protocols under 15 minutes, similar to suggestions made by Bishop (2003) who recommended a limited active warm-up due to increase risk of fatigue A study by as and Macintosh (1985) concluded that too intense of a cycling warm-up would negatively affect WAnT performance. However, based on the findings in this study, it does not appear that an active warm-up either positively or negatively affects WAnT performance. Dotan and Bar-Or (1983) stated that a specific fatigue rate (around 46.6%) is associated with optimal resistance or maximized performance. In our study, each condition had a mean percent fatigue close to fifty percent with no significant differences among any of the conditions, leading us to conclude that each subject maximized performance and was not hindered by the warm-up prior to testing. Nevertheless, Franco et al. (2012) stated there are very few studies that investigate warm-up effects on WAnT performance, which leads us to agree that more research should take place before any conclusions are made in regards to warm-up prior to WAnT.

While this study was focused on the effects of various warm-up methods on power output, we specifically wanted to observe effects of warm-up routines on WAnT performance. Franco et al. (2012) compared static stretching, dynamic stretching, proprioceptive neuromuscular facilitation, and no stretching. They concluded that there was a consistent increase in total power after all stretching exercises compared to the no stretching condition. However, they did not find a significant difference among any of the three stretching protocols – findings supported in our study. Franco et al. (2012) stated that their findings could not be concluded with certainty because all their subjects performed an active warm-up prior to the stretching routine. Yet, in our study we compared stretching protocols with and without an active warm-up and still found no significant differences among the various stretching methods. It is important to note that although we did not see an improvement in performance following a warm-up, a warm-up did not have a negative or diminishing effect on performance. This finding is consistent with other studies (Franco et al., 2012; Yamaguchi et al., 2007) that observed the effects of various warm-ups on power output and related activities. Since we did not observe a negative or positive effect on performance, we would suggest that a warm-up is still important prior to performance due to the injury reducing potential that was noted in previous studies (Ce et al., 2008; Curry et al., 2009; Faulkner et al., 2013; Nelson et al., 2005).

CONCLUSION

In conclusion, we saw a slight increase in peak anaerobic power following the dynamic stretching routine compared to static stretching, however, this was not significant (p = 0.065). Since there are few studies that investigate specific warm-up methods for WAnT performance, we suggest that further research should take place investigating various warm-up methods on WAnT performance. Given that the WAnT is a commonly used laboratory test to measure peak power, mean anaerobic power, and fatigue, we think it would be beneficial to standardize the warm-up in order to promote optimal performance. Therefore, further research is needed to determine the most beneficial warm-up protocol.

Finally, since performance on the WAnT seems to relate to sports that rely on maximal anaerobic power we suggest, along with other researchers (Franco et al. 2012), that athletes and coaches should use this data to choose the most appropriate warm-up to meet their specific needs. In this study, we did not see a negative effect on performance for any of the five warm-up protocols. We conclude that a warm-up (as presented in this study) is not detrimental to anaerobic performance and simply acts as a method of preparation for performance while possibly reducing injuries.

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APPENDIX A

Human Subjects Institutional Review Board Approval Letter

Date: January 13, 2014

To: Timothy Michael, Principal Investigator
Bradley Kendall, Student Investigator for thesis
Michael Miller, Co-Principal Investigator
Carol Weideman, Co-Principal Investigator

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 13-12-09

This letter will serve as confirmation that your research project titled "The Effect of Different Warm Up Methods on Anaerobic Power" has been **approved** under the **full** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., ***you must request a post approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study***)." Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: December 18, 2014

APPENDIX B
Human Subjects Institutional Review Board Informed Consent

Western Michigan University
Human Performance and Health Education Department

Principal Investigator: Timothy Michael, PhD
Co-Principal Investigator: Michael G. Miller, PhD, Carol Weideman, PhD
Student Investigator: Brad Kendall
Title of Study: The effect of different warm up methods on anaerobic power

You have been invited to participate in a research project titled "The effect of different warm up methods on anaerobic power." This project will serve as Brad Kendall's thesis project for the requirements of the Master of Science in Exercise and Sports Medicine/Exercise Physiology. This consent document will explain the purpose of this research project and will go over all of the time commitments, the procedures used in the study, and the risks and benefits of participating in this research project. Please read this consent form carefully and completely and please ask any questions if you need more clarification.

What are we trying to find out in this study?
The purpose of this study is to determine if variations of stretching and warm up methods effect performance differently during a maximal sprint on a stationary cycle.

Who can participate in this study?
You must be between 18 and 40 years old and be considered low-risk. Your risk will be determined by your answers to a Screening Questionnaire developed by the American Heart Association and the American College of Sports Medicine. You must currently be exercising 30 minutes a day for at least three days a week and be able to perform a variety of exercises and cycling. Also, you must be free from any lower leg injuries. We will determine this by asking you to fill out the Lower Leg Injury Questionnaire.

Where will this study take place?
This study will take place on the first floor of the Student Recreation Center in room 1055 on the Western Michigan University campus.

What is the time commitment for participating in this study?
You will first complete a one-hour orientation session in order to learning about participating in the study. Secondly, if you choose to participate, you will complete 5 exercise sessions within a 3-4week period. To familiarize you with the equipment, the first session will include an explanation of how the equipment works. Each session will last about 30 minutes. Total time commitment will be about 3.5 hours.

What will you be asked to do if you choose to participate in this study?
At orientation, you will be asked to complete the Screening Questionnaire and Lower Leg Injury Questionnaire. If we determine you can do the study, you will then be scheduled

for the first exercise visit. Additionally, you will be notified during the orientation session to bring comfortable clothing to exercise in. When you arrive at the testing facility, you will be shown the equipment that will be used and instructed on how to properly perform the cycle test. Immediately following this you will be asked to change into comfortable exercise clothing and belt on a heart rate monitor to the chest area. You will then be asked to complete each of the 5 conditions in a random order (each on a separate day) over a 3-4 week period.

Condition 1
You will perform a standardized cycling warm up and then perform a cylce test immediately after.
Condition 2
You will perform a standardized dynamic stretching warm up and then perform a cycle test immediately after.
Condition 3
You will perform a standardized static stretching warm up and then perform a cycle test immediately after.
Condition 4
You will first perform a standardized dynamic stretching warm up, then a standardized cycling warm up, and then perform a cycle test immediately after.
Condition 5
You will first perform a standardized static stretching warm up, then a standardized cycling warm up, and then perform a cycle test immediately after.
What information is being measured during the study?
The information being measured during the study is heart rate, peak anaerobic power (peak effort), mean anaerobic power (average effort), and fatigue index (how much you tire during the test). In addition, your height, weight and age will be recorded.

What are the risks of participating in this study and how will these risks be minimized?
Risks of participating in this study include those associated with light aerobic exercise, as well as the risks associated with performing a maximal cycling test against resistance. These may include dizziness and muscle soreness. By reviewing your answers to the screening questions and by watching you closely throughout the study we will minimize these risks. You reserve the right to stop the test if you feel any of these symptoms at any time. As in all research, there may be unforeseen risks to you. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to you except as otherwise stated in this consent form. Additionally, all data that is collected during this study will be locked in a filing cabinet to help prevent the possibility of a breach of confidentiality.

What are the benefits of participating in this study?
There is no direct benefit to you, however you will learn about your performance on a cycle test. Written results of your performance will be given to you after the last exercise session. The results of this research project may benefit the field of exercise physiology and sports performance by increasing the understanding of how to properly develop a warm up protocol for athletes, specifically for those involved in power related sports (e.g., sprinters, football players, long jumpers).

Are there any costs associated with participating in this study?
There are no monetary costs associated with participating in this study. However, it will require a time commitment of approximately five hours that will take place over three to four weeks.

Is there any compensation for participating in this study?
There is no compensation or extra credit for participating in this study.

Who will have access to the information collected during this study?
All data will be confidential and only made available to the investigators named in the consent document.

Confidentiality of Data
You will be assigned a code number that will be separated from your name once all the data is collected. Only the code numbers will be used in evaluating and describing subjects.

All data will be stored in Dr. Michael's office, in a locked file cabinet, and retained for three years.

What if you want to stop participating in this study?
You can choose to stop participating in the study at anytime for any reason. You will not suffer any prejudice or penalty by your decision to stop your participation. You will experience no consequences either academically or personally if you choose to withdraw from this study.

The investigator can also decide to stop your participation in the study without your consent.

Should you have any questions prior to or during the study, you can contact the primary investigator, Dr. Timothy Michael at 269-387-2691 or tim.michael@wmich.edu. You may also contact the Chair, Human Subjects Institutional Review Board at 269-387-8293 or the Vice President for Research at 269-387-8298 if questions arise during the course of the study.

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.

I have read this informed consent document. The risks and benefits have been explained to me. I agree to take part in this study.

____

Please Print Your Name

__________________________ __________________________

Participant's signature Date

APPENDIX C

ACSM/AHA Preparticipation Screening Questionnaire

Assess your health needs by marking any statements that are true.

History

You have had:

___ A heart attack
___ Heart surgery
___ Cardiac catheterization
___ Coronary angioplasty (PTCA)
___ Pacemaker/implantable cardiac defibrillator/rhythm disturbance
___ Heart valve disease
___Heart Failure
___ Heart transplantation
___ Congenital heart disease

Symptoms

___ You experience chest discomfort with exertion.
___ You experience unreasonable breathlessness.
___ You experience dizziness, fainting, blackouts.
___ You take heart medications.

Other health issues

___ You have diabetes
___ You have or asthma other lung disease.
___ You have burning or cramping in your lower legs when walking short distances.
___ You have musculoskeletal problems that limit your physical activity
—– You have concerns about the safety of exercise.
—-- You take prescription medication(s)
—-- You are pregnant

Cardiovascular risk factors

___ You are a man older than 45 years.
___ You are a woman older than 55 years, you have had a hysterectomy, or you are postmenopausal.
___ You smoke, or quit within the previous 6 mo.
___ Your blood pressure is greater than 140/90.
___ You don't know your blood pressure.
___ You take blood pressure medication.
___ Your blood cholesterol level is >200 mg/dL.
___ You don't know your cholesterol level.
___ You have a close blood relative who had a heart attack before age 55 (father or brother) or age 65 (mother or sister).
___ You are physically inactive (i.e., you get less than 30 min. of physical activity on at least 3 days per week).
___ You are more than 20 pounds overweight

___ None of the above is true.

APPENDIX D
Lower Leg Injury Questionnaire

Lower Limb injury Questionnaire

__ Yes __ No Have you had any lower leg injuries in the last 6 months? (Explain below)
__ Yes __ No If you answered yes to the above question, is the injury currently limiting your physical activity?
__ Yes __ No Have you experienced any pain, numbness, or tingling in the lower leg after exercise?

Explain:
____
____
____
____

I, the undersigned, hereby acknowledge, affirm, and represent that all above statements are true and accurate to the best of my knowledge; and that no answers or information have been withheld.

____ ____________________
Signature Date