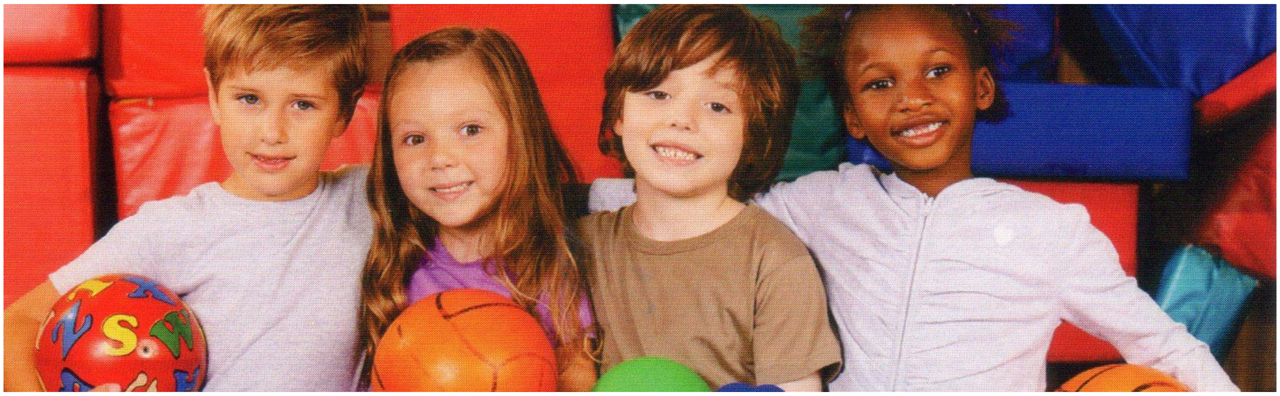
2024 Fall

# Kentucky SHAPE Journal



teaching students to thrive for life

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**TABLE OF CONTENT**

**(Peer Reviewed Article)**



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## A Message from the Kentucky SHAPE President

Hey KYSHAPE family and journal readers!

First off, a huge shoutout to Dr. Steve Chen and his awesome team! They keep delivering a fantastic journal full of submissions that push our thinking and help strengthen the profession.
It's been quite a year for KYSHAPE—two SHAPE America Teachers of the Year, a wildly successful #MoveThrive24 event in July, and a future professional event last month that provided HETE and PETE students an opportunity to learn best practices in instruction, professional growth, and finding future employment!
Looking ahead to the end of the school year, it's the perfect time to recharge and focus on our own professional growth. And luckily for us, KYSHAPE's got our backs! Our summer conference is coming up June 23-25 at Tates Creek High School in Lexington, and I couldn't be more excited. We're going all-in with the #MoveThrive25 theme, and once again, we plan to showcase not only the professional excellence of Kentucky health and physical educators but also host sessions by HPE leaders across the country. It's going to be packed with learning, networking, and inspiration—you won't want to miss it!
Be on the lookout for information on Speak Out! Day, #SHAPEBaltimore, and #MoveThrive25, and reach out to me or any KYSHAPE Board member if you need anything—we're here to help.
Thanks for everything you do for Kentucky's students, and thanks for letting me serve as your KYSHAPE President!

MeMe Ratliff
President, KYSHAPE
SHAPE America Education Trainer
@meme3rat
502-724-8464
Book a meeting with me

## Acknowledgement

As the Editors of the Kentucky SHAPE Journal, we would like to show our appreciation to the following guest reviewers for their assistance in reviewing this current issue.
*Dr. A. J. Morata and Dr. Michelle Thornton-Adler of Berea College.
*A special thanks to Dr. Tricia Jordan's service during the last four years (wish her the best for a new career pursue).

Sincerely,

Dr. Tricia Jordan, Kentucky SHAPE Co-Editor
Dr. Gina Blunt Gonzalez, Kentucky SHAPE Journal Co-Editor
Dr. Steve Chen, Kentucky SHAPE Journal Managing Editor

## Kentucky SHAPE Journal Submission Guideline

### SUBMISSION OF A PAPER

The *Kentucky SHAPE Journal* (formerly *KAHPERD Journal*) is published twice yearly (spring and fall) by the Kentucky SHAPE. The journal welcomes the submission of empirical research papers, articles/commentaries, best practices/strategies, interviews, research abstracts (spring issue only) and book reviews from academics and practitioners. Please read the information below about the aims and scope of the journal, the format and style for submitted material, and the submissions protocol. Your work will be more likely to be published if you follow the guidelines thoroughly.

Articles are accepted via an electronic attachment (must be in Microsoft Word format, doc or docx) through e-mail to the editor before the deadline dates. Submissions should be sent to one of the co-editors below based on the topic (nature) and discipline of the study:

- For an article related to health promotion, exercise science and exercise physiology, please email the submission to Gina Gonzalez: ggonzalez2@saybrook.edu
- For an article related to physical education, recreation and sport management/administration, sport sociology, and sport coaching, please email the submission to Jean Yu-chun Chen (yuchun.chen@wku.edu) (starting January 2025)
- You are more than welcome to contact Steve Chen (s.chen@moreheadstate) for any submission related questions.

**Deadlines:**
Spring issue—March 1
Fall issue—September 1

Estimated publishing time: Spring issue—Mid May & Fall issue—Late November

### AIMS AND SCOPE

The main mission is to bring together academics and practitioners to further the knowledge and understanding of issues and topics related to health, physical education, sport administration and marketing, exercise science, sport coaching, dance, and recreation, etc. We encourage submissions relating to these topics from a variety of perspectives.

### FORMAT AND STYLE

When preparing manuscripts for publication in the *Kentucky SHAPE Journal*, authors should follow the guidelines set forth in the *Publication Manual of the American Psychological Association*, Seventh Edition, 2019. Manuscripts should not be submitted for publication elsewhere at the same time being reviewed by *Kentucky SHAPE Journal*. Authors are advised to proof the typing, and check references for accuracy. Articles should include an abstract of approximately 150-200 words including the rationale for the study, methods used, key findings

and conclusions. Manuscripts should not exceed 20 double-spaced pages (not including references, tables, and figures).
The manuscript must be typed double-spaced, including the abstracts and references; please number each line. Tables, charts, pictures, diagrams, drawings and figures should be in black and white, placed on separate pages at the end of the manuscript. They must be submitted photo-ready and reproduced to fit into a standard print column of 3.5 inches. Only one copy of each illustration is required, and captions and proper citations should be typed on the bottom of the table and diagrams; please clearly mark where the tables/figures belong in the text. Jargon should be reduced to a minimum, with technical language and acronyms clearly defined. The accuracy of any citations is the responsibility of the author(s). Please try to follow the APA 7th edition to document your citations and the reference lists.

For more specific style questions, please consult a recent edition of the journal.

## CONTENT

All submissions should be written primarily to inform senior practitioners and academics involved in areas of health, physical education, recreation, and dance.

**Research Manuscripts**
Research articles should be well-grounded conceptually and theoretically, and be methodologically sound. Qualitative and quantitative pieces of research are equally appropriate. Formatting suggestion: Introduction, Literature Review, Methodology, Results, & Discussion, Conclusion, and Implication.

**Commentary Articles or Teaching Lesson Plans**
Articles related to literature review, opinion analyses, and discussions of trending topics for various sport-related disciplines, law reviews, and teaching lessons (or pedagogies) and activity plans in physical education are all welcome (limited to 5000 words including references).

**Book Reviews**
Reviews of books and/or reports are welcome (around 1000-2000 words). Information concerning the book/report must be sent to the editor. Interviews (it would be nice to discuss with the editor beforehand) and best practice/strategy papers of 1,500-3,000 words should be objective and informative rather than promotional and should follow the following format: Objective/Background/Discussion and Practical Implication.

**Research Abstracts**
Research abstracts (300 words or less) are welcome. The submitted abstracts should have been presented (either an oral or a poster presentation) in the KAHPERD annual conference in the previous year.
*The editors are keen to discuss and advise on proposed research projects, but this is no guarantee of publication.

**Case Studies**

The purpose of using case studies in learning environments is to stimulate critical thinking. Such thinking skills as problem-solving, decision-making, creative thinking, visualizing, knowing how to learn, and reasoning should be stimulated as your case is discussed in learning environments. The guidelines found below provide authors guidance in writing case studies for publication in the *KAHPERD Journal*:

1. Use narrative form when writing your case(s). Consider telling a brief story about a controversial or problematic issue or incident in the field of discipline selected from the list of suggested subject areas, competencies, and educational levels. The story could, for example, illustrate principles or theories, describe events, and/or address problems or situations related to the topic(s) you choose. You may include data to be analyzed or illustrated. Include a key character with a problem or dilemma to solve. Within the case, the key character may or may not attempt to solve the issue within the case.
   For Example:

| **Suggested Subject Area** | **Competencies** | **Focus** | **Educational Level** |
|---|---|---|---|
| Alcohol sponsorship and sales at collegiate venues | Diversity, ethics, decision making, social responsibility | Sport Management | Undergraduate, Graduate, or both |
| Class management | Leadership, strategic planning, communication | PE | Undergraduate, Graduate, or both |
| Design of fitness programs | Scientific training, First Aid training, sport psychology | Exercise science | Undergraduate, Graduate, or both |
| Tourism economic impact study | Economy, analytic skills, event planning | Recreation | Undergraduate, Graduate, or both |
| Developing a weight watching program | Nutrition, exercise knowledge, motivation…. | Health, and health promotion | Undergraduate, Graduate, or both |
| Preparing a dance gala | Strategic planning, event management, dance performance | Dance | Undergraduate, Graduate, or both |

2. The case can be based on reality or fictional scenario. It can also evolve from one’s own or others’ actual experience. It can be deeply personal and reflective, yet it should be written objectively. The case is intended to simulate real life; therefore, the case does not have to be unrealistically neat. Rather, the issue can be messy and complex.
3. Case authors should provide questions and solution ideas. Often, when writing and discussing case(s), it is advised to allow readers to discuss analyses and compromise, make their own interpretations, and draw their own inferences regarding solutions. Although solutions may not always extensively included, case authors are encouraged to cover detailed solutions that helps educators discuss the cases in a more informed and insightful way with students.

4. To provide an optimal learning opportunity through the case(s), four elements should be included in the case study submission:
    a. Abstract and learning objectives: a summary of case and its purpose, learning outcomes and applications (75-150 words)

Fill in the following boxes

| **Suggested Subject Area** | **Competencies** | **Focus** | **Educational Level** |
|---|---|---|---|
| | | | |

    b. Introduction of case: presentation of issues, challenges, problems, and various thoughts
    c. Teaching notes: addressing discussion questions, guidelines for discussions, and pros and cons of different solutions
    d. References

## SUBMISSIONS AND REVIEW PROTOCOL

Submission of a paper to the publication implies agreement of the author(s) that copyright rests with *Kentucky SHAPE Journal* when the paper is published. *Kentucky SHAPE Journal* will not accept any submissions that are under review with other publications. All manuscripts submitted will be peer-reviewed by 2 to 3 professionals/experts. Authors will normally receive a decision regarding publication within six to eight weeks. Rejected manuscripts will not be returned.

**(Peer Reviewed Article)**

# Effect of Exaggerated Hip Rotation on Anaerobic Power During Sprint Cycling

*Manuel Probst, Morehead State University*
*Gina Gonzalez, Saybrook University*
*Jarrod Plank, Morehead State University*

## Abstract

The purpose of this study was to examine the effects of exaggerated hip (femoral-acetabular) rotation on anaerobic power during sprint cycling. Twenty-six subjects (15 males and 11 females, 21.8 ± 2.0 years) performed a 30-sec Wingate Anaerobic Test (WAnT) twice on non-consecutive days on a Monark 873E cycle ergometer using a cross- over, counter-balanced experimental design. Following a 2-min warm-up and a 10-second unloaded countdown, subjects pedaled as fast as possible at a set load. During one trial, subjects pedaled for 30 seconds using a standard cycling technique (ST). During a different trial, subjects pedaled using ST for the first 15 seconds and then switched to a rotation technique (RT) for the remaining 15 seconds. The two-way mixed ANOVA showed a statistically significant interaction ($p < 0.05$) between the intervention (RT and ST) and time for anaerobic power for the final 15 seconds. Paired t-test analysis showed a significantly lower ($p < 0.05$) fatigue index (-4.33 ± 8.15) and mean anaerobic power (15.33 ± 36.09) for RT during the final 10 seconds, but not during the final 15 seconds of the test. Paired t-test analysis also showed significantly higher anaerobic power for RT than ST at 23 sec (20.81 ± 39.18), 24 sec (18.08 ± 39.35), 25 sec (18.81 ± 39.35), 26 sec (19.81 ± 43.67) and 30 sec (25.85 ± 49.37). The data suggest that increased hip rotation can help sustain anaerobic power during sprint cycling for brief periods.

## Introduction

Anaerobic power is an important component in many kinds of athletic performances, including cycling. Cyclists often require a "boost" of power during sprinting, passing or when climbing a hill for instance. One common and popular way to measure anaerobic power is via the Wingate Anaerobic Test (WAnT). The test has been used for decades and is typically performed on a stationary cycle with the subject pedaling as fast as possible for 15 to 30 seconds against a pre-determined resistance or load [1,2,6]. The WAnT is considered supramaximal in that it is a short duration, high-intensity activity. Common measures obtained include peak power, mean power, minimum power, and fatigue index (percentage of power loss); with power typically expressed as Watts. Peak power during the test is usually achieved within the first 10 seconds [25] with up to 43% of the ATP coming from the phosphagen system [3], whereas mean power is more related to anaerobic capacity with ATP coming mainly from glycolytic ATP sources followed by aerobic sources and finally by the phosphagen system [14]. Reliability for peak power has been reported as high as 0.95 to 0.98 [12] and up to 0.73 for fatigue index [27]. Mean power losses during a 30-second WAnT range from 30% to 40% [19]. Information on an individual's power output including deficits in peak or mean power can be addressed during athletic conditioning.

As the test is typically performed on a cycle ergometer, the joint movements are hip extension, knee extension and ankle plantar flexion during the push phase and hip flexion, knee flexion and ankle dorsiflexion during the pull phase. Moreover, hip and knee extension moments have been shown to both increase with increasing power output, with the hip providing the most power during submaximal and supramaximal cycling [8]. An increase in power output also appears to be related to increased activation of the knee and hip flexors [16,20] when the feet are secured to the pedals [17]. Although, the basic movements of cycling are in the sagittal plane, the hip can move in multiple planes, and therefore, it might be possible that adding additional muscular activity in these planes may create additional power.

Increased hip movement also occurs during standing cycling [5,12] and is typically used by cyclists when more speed is needed, or to offset reductions in pedal frequency and therefore, loss of momentum. The hip movement during standing causes a shift in body weight [5], an increased knee moment through a larger range of motion, and an increased length of the concentric phase of contraction for the single joint extensors, gluteus maximus, quadriceps and soleus muscles [4]. It also allows arm moments to be used to produce force in the legs; however, it is not necessarily an efficient mode of cycling [5,24] and it may cause damage to the bicycle. A similar action may be created during seated cycling if the cyclist were to exaggerate hip rotation to create additional power from the hips and torso both during the push and pull phases.

There are two primary variables to be considered when referring to “exaggerated hip rotation” which may contribute to increased power output. From a biomechanical perspective, the act of performing excessive, lateral pelvic tilt ipsilaterally to the side of the lower extremity which is performing the push phase of cycling (i.e., ipsilateral hip drop toward downstroke) is occurring. To put this exaggerated movement into perspective, normal frontal plane motion of the pelvis during gait is 5 degrees while normal cycling projects pelvic frontal plane motion of up to 11 degrees [15,29]. The second variable to consider in this exaggerated hip motion is the muscular adaptation component associated with each femoral-acetabular position (i.e. external rotation and internal rotation).

As stated above, positioning the hip in external rotation (ER) and internal rotation (IR) throughout different phases of cycling may facilitate increased contraction of various muscles. For instance, while the push phase of cycling is predominantly executed and completed by contraction of the gluteus maximus, hamstrings, quadriceps, and triceps surae, perhaps maintaining hip IR (and inevitably hip adduction) throughout this phase would enact a muscular response increasing the number cross-bridges of muscles responsible for hip extension such as the adductor magnus [18]. Additionally, perhaps by eliciting hip ER during the pull phase of cycling would increase the concentric capability of the iliopsoas muscle group (psoas major and iliacus) by increasing the number of cross-bridges as these hip flexors also aid in hip ER [22]. While these variables require further investigation to assess greatest contribution, each should be acknowledged as potential contributors to increased power output.

In an unpublished study conducted in our lab, anaerobic power was measured during a 30-second Wingate Power test (WAnT) using a standard (ST) and a rotation technique (RT). Subjects completed the entire test using both ST and RT. Although statistical analysis found no significant differences in anaerobic power in ST and RT for the entire 30-second test, there appeared to be a trend toward a reduced power loss following an initial power loss early in the test in the RT group as the resistance load was added. The early power loss in the RT group may have been related to the awkwardness of the rotation cycling at the beginning, but once the subjects "got used" to the motion, some recovery appeared to have occurred. It could have been difficult to overcome the initial inertia of the load, resulting in an inability to produce a certain amount of momentum. Allowing subjects to begin the rotation trial using standard form initially, and then switching, might have allowed the subjects to use some of the momentum before switching to rotation. This may also more closely mimic a more "normal" condition experienced by the cyclist.

Therefore, the purpose of this study was to determine the effects of exaggerated hip rotation on anaerobic power during the final 15 seconds of the 30-second WAnT following an initial period of cycling using a standard technique.

## Methods

*Experimental Approach to the Problem*

To determine differences in power output for standard technique (ST) cycling and rotation techniques (RT) cycling, subjects were asked, in a counter-balanced, cross-over design, to cycle for 30 seconds using ST and then on a separate day switch to RT after the initial 15 seconds of ST cycling.

*Participants*

Twenty-six subjects (15 males and 11 females, 21.8 ± 2.0 years, height (m) = 1.7 ± 0.1, weight (kg) = 72.3 ± 16.0; mean ± SD) participated in this study and were recruited from a regional university student body. General training status was mixed; however, no subjects were trained cyclists. Each subject completed a consent form and completed a Par-Q questionnaire for determining any health conditions that might preclude them from participating. The study was approved by the Morehead State University Institutional Review Board (Protocol # 15-03-82) and subjects were informed of the benefits and risks of the investigation prior to signing an IRB approved informed consent document to participate in the study.

*Procedures*

Each subject performed the Wingate Anaerobic Test (WAnT) twice on non-consecutive days to ensure full recovery. On each testing day, subjects were weighed prior to testing to determine the proper resistance (load) to be added (7.5% of the subject's weight in kg). Seat height was adjusted for each subject, initially bringing the seat to the top of the hip allowing for knee flexion between 7% and 10% during extension at the bottom of the down stroke. The seat position was noted for the second test. A Monark Ergomedic 874E Ergometer with foot straps was used for all cycle tests. Each subject then performed a two-minute warm-up at no-load. Following the warm-up, each subject performed a 10-second countdown at no-load while gradually increasing pedaling speed to maximum by the last 2-3 seconds of the countdown. Once the 10-second countdown was complete, the load was applied quickly by lowering a weight tray loaded with the pre-determined amount of weight plates, thereby applying tension to the flywheel. Each subject then pedaled all-out in a seated position using either a standard technique (ST) or a rotation technique (RT) for a total of 30 seconds. A 2 to 5-minute low-load cool-down was performed following the test. The SMI Power System was used to measure the ergometer cycle flywheel rotation and perform the power calculations. The SMI hardware consists of reflective markers placed on the Monark flywheel. A small laser mounted to the ergometer sensed the movement of the markers thereby, allowing measurement of the number of flywheel revolutions. The SMI Power software calculated peak power, minimum power, and mean power as well as fatigue index from the flywheel revolutions and the applied force.

*(a) Traditional Cycling*

Each subject performed the WAnT for 30 seconds using traditional cycling technique in the sagittal plane.

*(b) Rotation Cycling*

On a different day, each subject performed the WAnT using traditional cycling technique for the first 15 seconds and then, when directed, switched to exaggerated hip rotation during the final 15 seconds of the 30-second test. Subjects were instructed to practice hip rotation during the warm-up phase. Consistency of rotation was maintained by having each subject point the knee at a mark on the center bar of the bike handles.

*Statistical Analysis*

Corrected versus standard power was used for all data analysis. A two-way mixed ANOVA was used to determine interactions between the groups (RT and ST) and time for anaerobic power during the final 15 seconds of the test. Paired t-test analysis was used to compare the means for fatigue index (FI) and mean power (MP) for RT and ST power and each second during the final 15 seconds. In addition, since there was an initial drop in RT power after switching from ST (figure 1), a paired t-test was also run to compare means for FI and MP for RT and ST for the final 10 seconds only. An alpha level of significance was set at $p < .05$. SPSS software version 26 was used for all statistical analyses.

## Results

The two-way mixed ANOVA showed a statistically significant interaction between the intervention (RT and ST) and time for anaerobic power (W), $F(14, 118.32)=3.79$, $p < 0.05$. Paired t-test analysis did not show a significant difference in FI during the final 15 seconds of the test for RT and ST (table 1); however, analysis of the final 10 seconds of the test showed a significantly lower Fatigue Index (FI), a higher mean power, and a higher minimum power ($p < 0.05$) for RT (table 2).

*Table 1. Descriptive Data for Rotation Technique and Standard Technique for Final 15 (Means ± SD)*

| | Rotation | | | Standard | | |
|---|---|---|---|---|---|---|
| Fatigue Index (%) | 22.29 | ± | 7.33 | 28.25 | ± | 8.69 |
| Mean Power (Watts) | 392.02 | ± | 135.63 | 383.84 | ± | 132.40 |
| Minimum Power (Watts) | 345.27 | ± | 127.86 | 319.42 | ± | 111.86 |

*Significantly different, $p < 0.05$

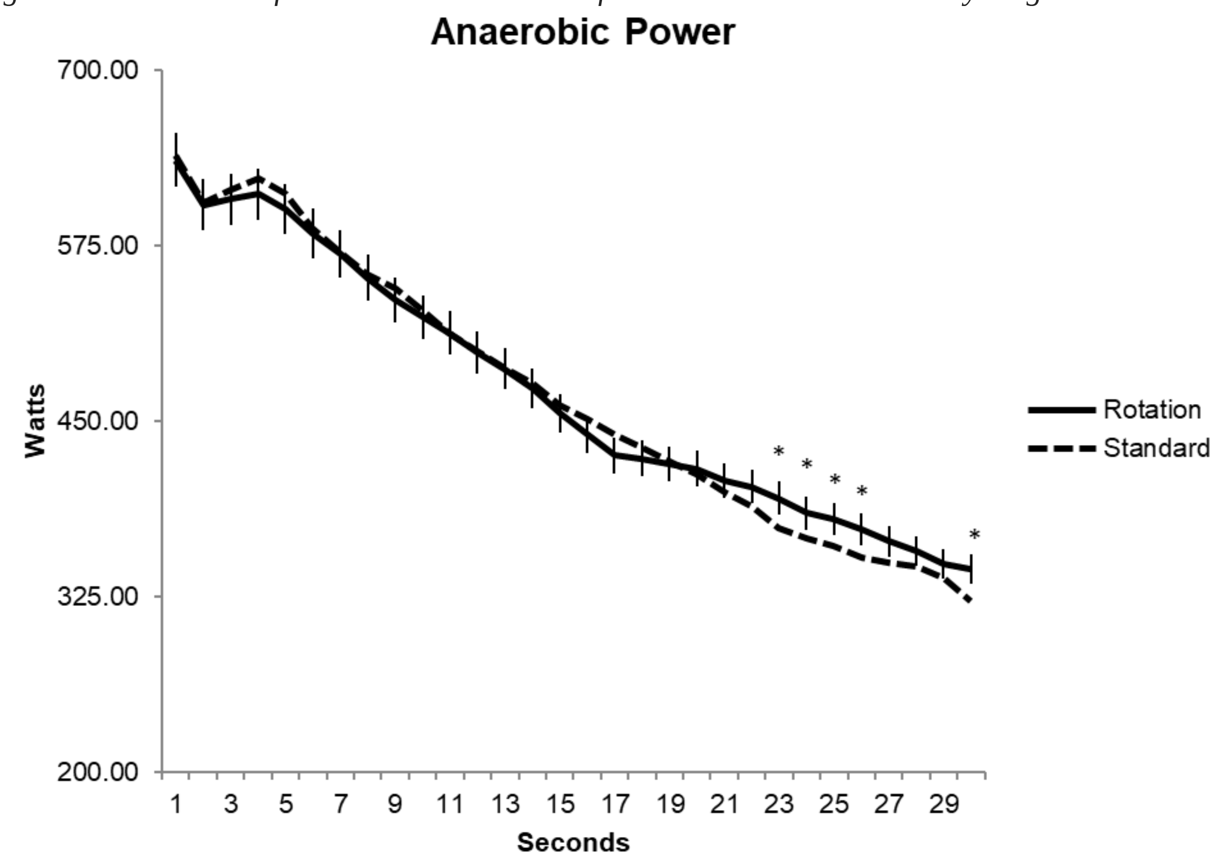
*Table 2. Descriptive Data for Rotation Technique and Standard Technique for Final 10 seconds (Means ± SD)*

| | Rotation | | | Standard | | |
|---|---|---|---|---|---|---|
| Fatigue Index (%)* | 17.47 | ± | 6.75 | 21.81 | ± | 8.12 |
| Mean Power (Watts)* | 379.45 | ± | 131.60 | 364.12 | ± | 126.54 |
| Minimum Power (Watts)* | 345.27 | ± | 127.86 | 319.42 | ± | 111.86 |

*Significantly different, $p < 0.05$

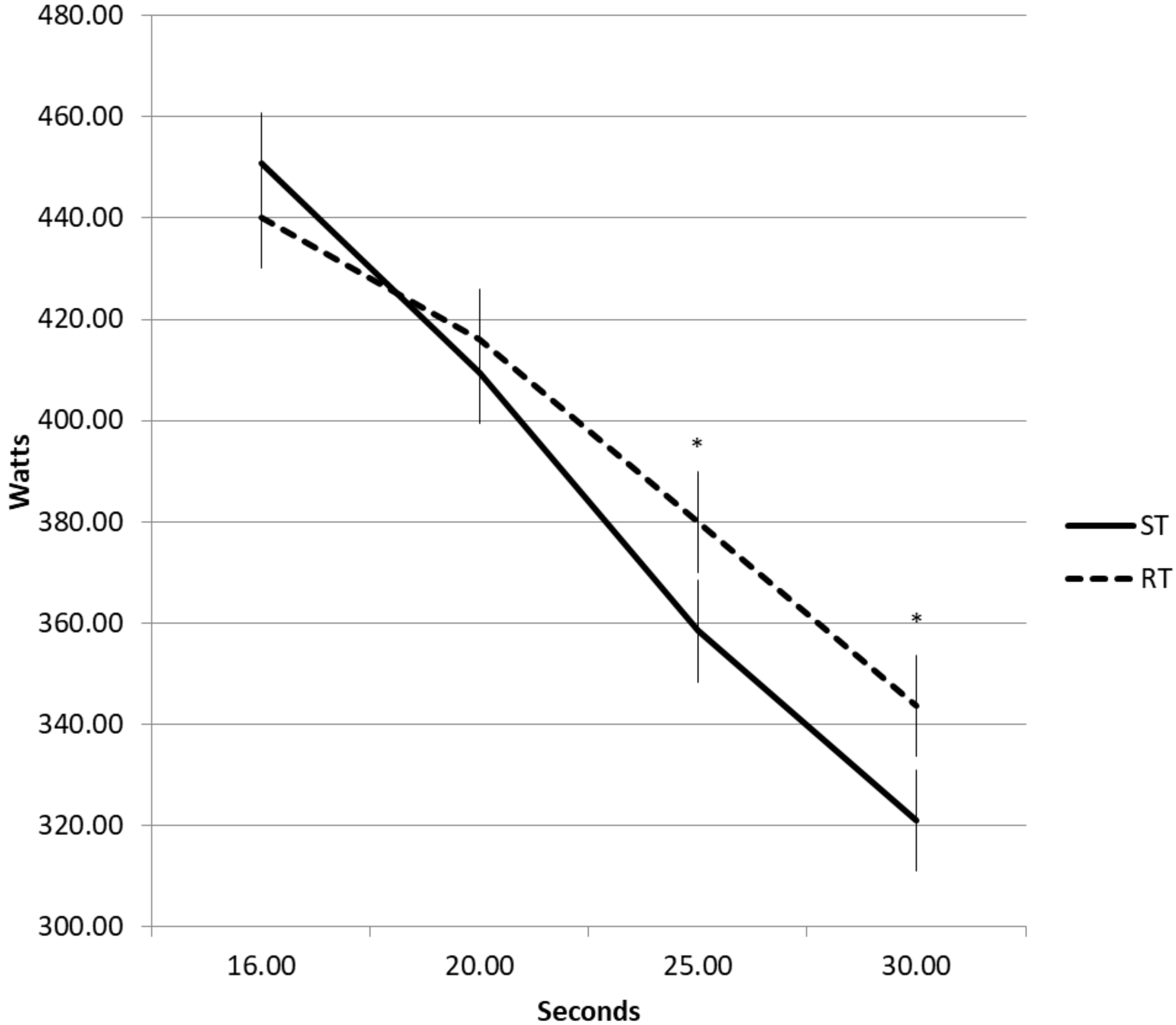
Paired t-test analysis also showed a significantly higher anaerobic power (W) for RT than ST at 23 sec, 24 sec, 25 sec, 26 sec and 30 sec, $p < 0.5$, figure 1.

*Figure 1. Mean Power for the 30-Second WAnT for Rotation and Standard Cycling.*




Estimated marginal means at 5 second intervals for the final 15 seconds showed significant power differences for ST and RT at 25 and 30 seconds (figure 2).

*Figure 2. Estimated Marginal Means for RT and ST for the final 15 seconds of Sprint Cycling*




*Significantly different $p < 0.05$

## Discussion

The results of the data analysis show additional power can be generated by increasing hip rotation, thus reducing the loss in power during sprint cycling. This is reflected by the lower fatigue index and the higher minimum power for RT than ST during the final 15 seconds of the WAnT. The difference in the fatigue index is clearly related to the differences in minimum power. Why the mean power for RT was not significantly greater than ST is unclear, however, it was most likely due to adjustments to the rotation technique causing an initial drop in power, which then recovered during the final 15 seconds. The data appear to show a non-significant 10 Watt higher mean power for ST at the 16-second mark ($p > 0.05$). If RT began the final 15 seconds slightly lower and finished significantly higher, then that probably accounts for the significant difference between RT and ST fatigue index and a non-significant difference in mean power. Finally, there appears to have been a slight “bump” in power around seconds 26-28 just before the final drop in power for the last 2 seconds in the ST group. There may have been a brief increase in motivation and thus, power in this group. It is not clear why this was seen in the ST group and not the RT group.

The improvement in anaerobic power could have come from several sources including an added force production from hip rotators during push and pull phases, added rotation from the torso, with help from the arms to create moments that are transferred to the pedals through the legs and possibly a greater amount of hip extension and flexion. Numerous muscles can move the hip joint in several directions.

The muscles typically involved in cycling include the gluteal group, hamstrings, quadriceps, and anterior and posterior compartments of the lower leg [11]. During standard cycling, the main muscles involved during the push phase are the gluteus maximus and hamstrings group at the hip, the quadriceps at the knee and gastrocnemius and soleus at the ankle, while the primary muscles involved during the pull phase are the iliopsoas, rectus femoris at hip flexion, the hamstrings at the knee and the tibialis anterior at the ankle dorsiflexion [26]; although, the degree to which these muscles are activated remains controversial [16,20]. The semimembranosus and semitendinosus have been shown to act more as knee flexors while the biceps femoris acts more as a hip extensor during cycling [10]. Several studies have shown that other muscles not normally associated with cycling such as the adductor magnus and adductor longus [21,28], gluteus medius [9] can assist the primary muscles. And since high-intensity cycling seems to preferentially recruit hip muscles during pushing and pulling [7,8] it stands to follow that the hip musculature can supplement power during different hip movements. Since no other study has demonstrated hip musculature involvement during rotation cycling, it is obvious that more research must be done in this area.

## Practical Application

Most, if not all, cyclist will require a boost of power at some point during training or competition. The study showed that it is possible to generate more power during exaggerated hip rotation in a seated position than during standard cycling. The exaggerated rotation could be viewed as another way to get that extra amount of power during passing or hill climbing for instance.

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