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No Additional Benefit Of Foam Rolling Or Dynamic Stretching To Vertical Jump Performance Beyond A General Aerobic Warm-Up In Collegiate Athletes

Benjamin Saaribovre

No additional benefit of foam rolling or dynamic stretching to vertical jump performance beyond a general aerobic warm-up in collegiate athletes

by

Benjamin David SaariBovre
Bachelor of Science, Concordia College, 2011
Master of Science, University of North Dakota, 2018

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This thesis, submitted by Benjamin David SaariBovre in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

Dr. John Fitzgerald, Committee Chairperson

Dr. Grant Tomkinson, Committee Member

Dr. Jesse Rhodes, Committee Member

This thesis (or dissertation) is being submitted by the appointed advisory committee as having met all of the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.

Dr. Grant McGimpsey
Dean of the School of Graduate Studies

May 4, 2018
Date

PERMISSION

Title: No additional benefit of foam rolling or dynamic stretching to vertical jump performance beyond a general aerobic warm-up in collegiate athletes

Department: Kinesiology and Public Health Education

Degree: Master of Science

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Benjamin SaariBovre

Date

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I would also like to thank Dr. Grant Tomkinson and Dr. Jesse Rhodes for their much valued patience and valuable input.

6 years was a long time. Jim you're the best.

ABSTRACT

ABSTRACT

This study aimed to examine the effectiveness of four warm-up protocols on explosive strength in a vertical jump performance in collegiate athletes. Fifty-two NCAA Division 1 athletes (aged 20.3 ± 1.53 years, range: 18-23 years, Height 183.83 cm. ± 11.49 cm., Weight 81.85 kg. ± 17.56 kg., BMI 24.18 ± 3.64) performed each of the four randomly ordered warm-up protocols prior to performing both the squat jump (SJ) and countermovement jump (CMJ) tests, with each warm-up and subsequent jump tests performed at the same time of day spaced 1-week apart. The four warm-up protocols were: (a) general aerobic (run/walk) (AERO); (b) AERO plus foam rolling (FR); (c) AERO plus dynamic stretching (DS); and (d) AERO plus foam rolling and dynamic stretching (FR+DS). Jump test measures included the primary outcome measure of jump height (JH), and secondary measures of peak force, average and peak rate of force development, and starting gradient. A repeated measures ANOVA with covariates of sport and class. Analysis of variance on jump height for both SJ and CMJ showed no significant differences (Partial Eta-sqaured: 0.008-0.01) among the four warm-up protocols ($p \geq 0.05$). There were main effects for the control variable of sport ($F = 9.67$, $p = 0.01$; $F = 13.31$, $P = 0.01$) but not class ($P > 0.05$). There was no interaction between control variables and protocols ($P > 0.05$). This study showed that the addition of foam rolling, dynamic stretching, or foam rolling + dynamic stretching to a general aerobic warm-up did not significantly affect vertical jump performance beyond that of a general aerobic warm-up. Sports coaches and trainers should consider these results when prescribing or programming exercise with athletes, especially in situations when training time is limited.

CHAPTER 1

INTRODUCTION

While many athletes tend to focus on improving their competition results through training, the importance of a warm-up to the optimization of training outcomes cannot be overlooked. A proper warm-up prepares the body to increase mobility and optimize force production for athletic activity (1). Taking this into account, the length and type of movement during a warm-up is very important to an athlete and performance outcomes. Too long of a warm-up could result in fatigue and potential injury before sport or weight room activity, while a limited warm-up could result in being unprepared for force production at the start of training or competition (2). In many NCAA-sanctioned workouts, the use of Foam Rolling (FR) (3,4,5), as well as a Dynamic Stretching (DS) (6,7) is being currently prescribed for the athletes in preparation to help optimize force production in training and/or competition. When both protocols are used, a strength coach can spend up to 20 minutes (5) simply preparing athletes for training. An NCAA Division I athlete can partake in 8 hours of actual coaching instruction per week in the offseason and 20 hours per week during the season, with the strength and conditioning coach being allotted only a fraction of those hours. Such constraints require strength coaches to be proactive in ensuring that they are prescribing the most time effective warm-up, not only to account for NCAA hourly guidelines, but also to maximize time in the training period to improve performance.

The influence of warm-up on subsequent performance has been investigated since the 1930s (8), with the investigation of dynamic stretching ongoing for 60 plus years (9). A meta-analysis of warm-up protocols, including combinations of aerobic, static and proprioceptive neuromuscular facilitation stretching and dynamic components, found that physical performance was improved after a warm-up in 79% of the combinations, with 3% showing no change, and 17% finding that the warm-up had a negative impact (1). A systematic review of healthy and active adults by Behm et al., (10) concluded that dynamic stretching leads to a moderate (2.1%) mean improvement in jump performance and a small (1.4%) mean improvement in repetitive actions such as sprinting. However, non-statistically significant or trivial changes occurred when dynamic stretching duration exceeded 10 minutes or was shorter than 150 seconds.

In recent years, foam rolling has been gaining in popularity for use as a warm-up. The small yet unclear amount of evidence on foam rolling in advance of subsequent athletic performance leaves a practitioner with questions as to whether to include foam rolling in the warmup. Two systematic reviews (11, 12) looked at 9 studies and found that most studies (n=7) pertaining to performance show foam rolling does not appear to impede or improve athletic performance acutely. Behara et al. (16) used current NCAA Division 1 athletes (n=14) and found no difference when comparing foam rolling to dynamic stretching while measuring jump height. However, both increased and decreased explosive performance after foam rolling have been documented. In regards to the contradicting evidence, Janot et al. (27) found a decrease in peak power during a Wingate test, while Peacock et al. (13) and Lanigan et al. (14) found improvements in explosive performance. The majority of these studies do not investigate competitive athletes and may not be generalizable to athletes. The lack of athletes involved in the studies calls for the need to study the athlete population more narrowly, as nonathlete-based results may not transfer over.

The variety of warm-up protocols currently in use with NCAA Division 1 athletes, e.g. foam rolling and then dynamic stretching, and the lack of evidence for the combination of said protocols, calls for the need to examine effectiveness of those warm-up routines. To our knowledge, no study has looked at an aerobic warmup in comparison to foam rolling, dynamic stretching, or the combination of both foam rolling and dynamic stretching in a large sample size of collegiate athletes participating in multiple sports. Published studies (13, 16) using athletes and both foam rolling and dynamic stretching have had small sample sizes with mixed findings. Determining the effect of currently used warmups on ballistic task performance will allow coaches and athletes to make more informed decisions when structuring warmups for training sessions, thereby ensuring that athletes are optimally prepared for training or competition while considering the restricted time available for training. That being said, we realize there will be debate surrounding the results of this study as there are many advocates of the various warmup protocols in the strength and conditioning community. Some might question the methodology or the need for the study due to the current popularity of both protocols in the strength and conditioning community. We feel that providing some evidence to support the informed use of warmup protocols in an efficient and timely manner will be a valuable resource for all.

This study aimed to compare the effects of four warm-up protocols on explosive strength with the use of two vertical jump performance tests in college athletes. The four warm-up protocols were: (a) general aerobic (run/walk) (AERO); (b) AERO plus foam rolling (FR); (c) AERO plus dynamic stretching (DS); and (d) AERO plus foam rolling and dynamic stretching

(FR+DS). After consulting the existing literature documenting both Aerobic and Dynamic Stretching resulting in performance improvement, we hypothesized that AERO plus dynamic stretching would have the greatest impact on jumping performance and that foam rolling or foam rolling + dynamic stretching would not provide an additional benefit.

CHAPTER 2

METHODS

Experimental Approach to the Problem

A single-blind, randomized, repeated measures crossover design study was carried out to examine the effectiveness of four warm-up protocols on vertical jump performance in collegiate athletes. The four warm-up protocols were: (a) general aerobic (run/walk) (AERO); (b) AERO plus foam rolling (FR); (c) AERO plus dynamic stretching (DS); and (d) AERO plus foam rolling and dynamic Stretching (FR+DS). Vertical jump performance was assessed by the squat and countermovement jumps using a force platform within 3 minutes of each warm-up protocol. Jump test measures included the primary outcome measure of jump height (JH), and secondary measures of peak force, average and peak rate of force development, and starting gradient. Each group started with the AERO protocol and were then randomly assigned to the remaining three protocols over the next three weeks, with each warm-up protocol and subsequent jump testing performed at the same time of day 1-week apart. A repeated measures ANOVA with covariates of sport and class was used to measure differences in mean vertical jump performance between warm-up protocols.

Subjects

Fifty-two Division I collegiate (aged 20.3 ± 1.53 years, range: 18-23 years, Height 183.83 cm. ± 11.49 cm., Weight 81.85 kg. ± 17.56 kg., BMI 24.18 ± 3.64) participated in all four testing sessions within a three-week period. The sample comprised 26 men who competed in football (*n*=13) and basketball (*n*=13), and 26 women who competed in volleyball (*n*=16) and softball (*n*=10), at a single, midsized university in the US Midwest. All student-athlete classes were represented, with 22 freshman, 11 sophomores, 11 juniors and 8 seniors.

Participants were well-trained athletes who had been competitive in organized sports for at least the past 6 years. The study took place in an indoor athletic training facility and Biomechanics laboratory during the off-season (summer), with all athletes currently in an 8-hour per week strength and conditioning training cycle. Athletes were recruited from sports that exposed them to many ballistic tasks such as maximal vertical jumping during sport as well as training. The athlete's height and mass were obtained using official roster data and force platform (Bertec Corp., Columbus, OH, USA). The athletes were informed of potential risks and benefits as well as the study procedures during an initial team meeting. Athletes were excluded if they were not currently training or had a recent (past six months) lower-body injury. Participation was voluntary with signed informed consent obtained before participation. Approval to conduct the study was granted by the Institutional Review Board of the University of North Dakota.

Procedures

For the first of four visits, athletes reported to the Biomechanics laboratory wearing the same athletic shorts, shoes and t-shirt for each test. Upon arrival, athletes first completed the AERO warm-up protocol (see below for details) and then rested for 3 minutes prior to jump testing. After the first testing session, athletes reported back at the same time of day for three consecutive weeks and were randomly assigned a different warm-up protocol each session

(**Figure 2**). The foam rolling + dynamic stretching protocol involved completing the foam rolling warm-up followed immediately by the dynamic warm-up.

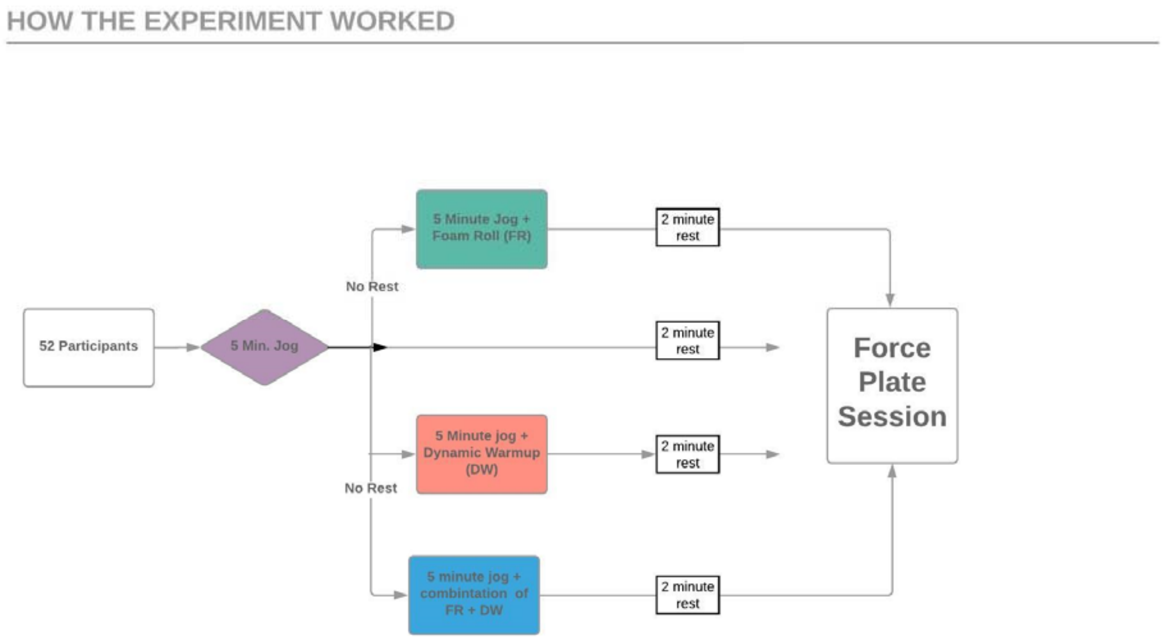

Figure 2: Flow chart showing how the experiment was conducted.

Warm-up protocols

AERO: Participants jogged at a self-selected pace for 5 minutes around a synthetic indoor running track.

FR: Immediately following the AERO warm-up, participants used a 90 cm, high-density foam roller to roll their lower limb musculature in the following sequence: knee extensors and hip flexors, hip adductors and extensors, ankle plantar flexors and iliotibial band. Athletes foam rolled the muscle group of each limb (right before left) for 30 seconds in a controlled manner, rolling distally and proximally in 10 seconds (1 repetition) before repeating.

For the knee extensors, participants assumed a prone plank position, with the roller positioned under their thighs and their elbows on the floor in support. Participants rolled the anterior thigh from the bottom of the hip (near the pubis) to just above the patella knee for two repetitions, followed by the lateral thigh for one repetition. For the hip flexors, athletes rolled the lateral hip from top (near the anterior superior iliac spine) to bottom for one repetition followed by two repetitions on the anterior hip.

For the iliotibial band, participants assumed a lateral plank position, with the roller positioned under the side of their thighs and their elbows on the floor in support. Participants rolled the lateral thigh from the top (near the greater trochanter) to the bottom (near the lateral femoral condyle) for three repetitions.

For the hip adductors, hip extensors and ankle plantar flexors, participants sat on the floor with the roller positioned under their thighs and their hands on the floor in support. Participants then rolled their posterior thigh and calf from the bottom of the hip (near the ischium) to the top of the heel (near the calcaneus). Then participants rolled proximally to distally from the bottom of the greater trochanter to just proximal to the knee, or from just distal to the knee to just proximal to the ankle, while supporting some of their body weight with their hands.
One repetition of ten seconds was devoted to the semitendinosus and semimembranosus and then the biceps femoris. The gastrocnemius and soleus were completed last with the

aforementioned protocol of being done. 120 seconds to complete the hamstring, adductor and calve. 240 seconds for each limb.

DS: The dynamic stretching protocol consisted of displaying a full range of motion movement, stretching the same muscles as those involved in the foam rolling protocol. Dynamic stretching was coordinated to reflect equal time (8 min. total) as the foam rolling protocol. The order of the dynamic stretching was designed with organizing and emphasizing the same muscle groups as the foam rolling group, as well as the sequential order of the foam rolling group, in order to account for fatigue and recovery time when jump testing. Inch worms (gluteals and hamstrings), knee hug lunge (quadriceps), alternating side lunge (adductors), A skips (hip flexors, gluteals, hamstrings, and quadriceps) and straight leg skipping (gastrocnemii and solei) were performed with 20 repetitions on each leg independently, with a walk-back recovery.

Jumping Mechanography

All jump testing was performed on a force platform (Bertec Corp., Columbus, OH, USA) and occurred after each warm-up protocol. The researchers collecting jump test data was blinded to the warm-up condition the athletes performed. Athletes performed three squat jumps (SJ) with their hands on their hips with 30 seconds of rest in between jumps. A 2-minute rest was implemented to ensure adequate phosphagen recovery between the jump types. Following the rest period, three countermovement jumps (CMJ) with hands upon hips were performed with 30 seconds of recovery between successive jumps. Variable calculation was performed using a macro program created in Visual Basic (Microsoft Corp., Redmond, WA, USA). The procedure used has been described in detail by Fitzgerald et al. (17). Jump height was evaluated during both the CMJ and SJ. The vertical velocity of the athletes' center of mass at takeoff was squared and divided by 2 multiplied acceleration due to gravity (9.81 m/s), described in detail by Moir et al. (28). Jump execution variables were calculated for only the SJ and included peak force (highest vertical force trace before takeoff), peak (peak time derivative of vertical force trace) and average rate of force development (peak force/time to peak force) along with starting gradient (half peak force/time to half peak force). Jump height obtained using mechanography demonstrates good reliability during the CMJ and SJ (17,18). Jump execution variables tend to exhibit more variability with coefficients of variation ranging from (7–23%) described by Fitzgerald et al. (17). All variables were reported as the average of three jumps.

Statistical analysis

A repeated measures analysis of variance on jump height for both SJ and CMJ Data were analyzed using SPSS version 23.0 (IBM, Armonk, NY, USA). Descriptive statistics are expressed as mean values ± SDs. Data was examined to see if it met the assumptions for ANOVA. A repeated measures ANOVA was used to determine changes in JH and execution variables among sessions, and the models were adjusted for sport and class. With 52 athletes, this investigation was powered to detect small to moderate effect sizes. Statistical significance was set at $p <= 0.05$ using 2-tailed p-values.

CHAPTER 3

RESULTS

This intent of this study was to examine the comparative effects of four warm-up protocols on jump performance in Division 1 athletes. At the completion of the CMJ and SJ trials, there were main effects for the control variable of sport (F= 9.67, p = 0.01; F = 13.31, P = 0.01), but not class (P > 0.05). There was no interaction between control variables and protocols (P > 0.05). CMJ and SJ height by protocol are displayed in (**Figure 1)**.

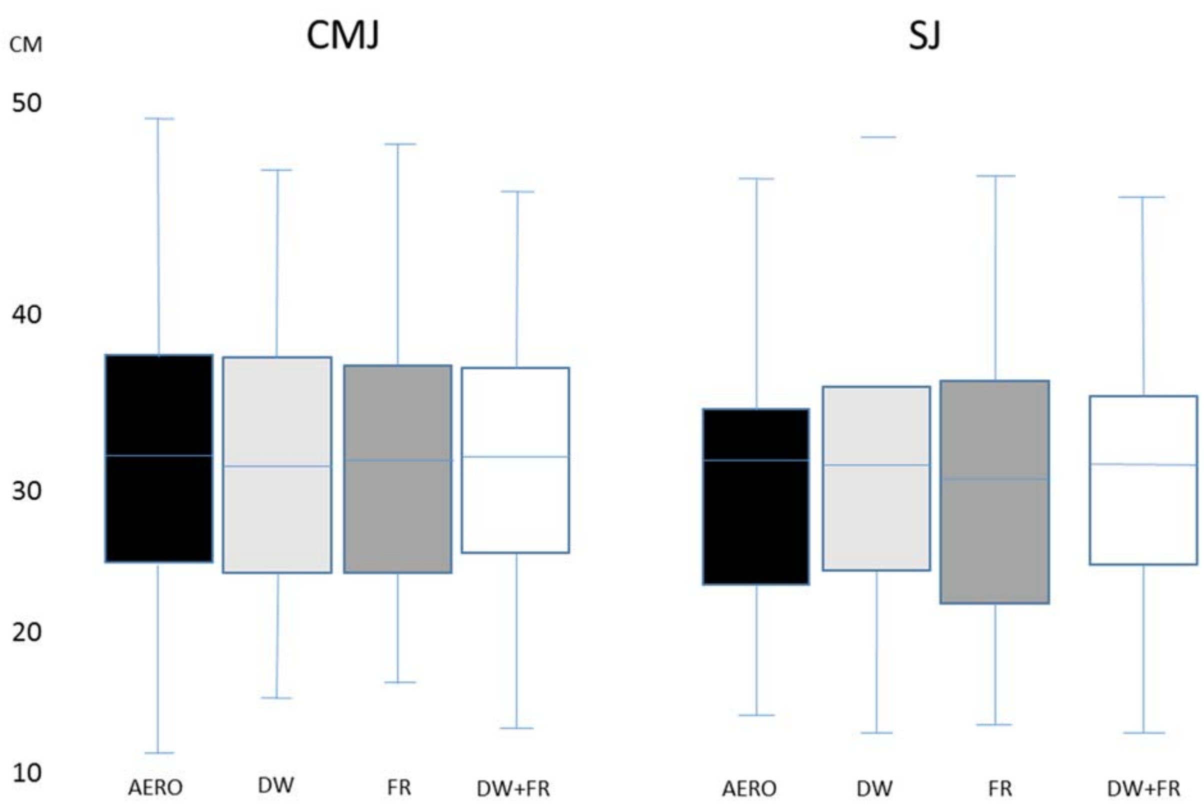

Figure 1: Box Plots of CMJ and SJ height by protocol and JH.

The lack of interaction indicates no statistical performance improvement when adding foam rolling, dynamic stretching, or foam rolling plus dynamic stretching to a general aerobic warm-up activity (Partial Eta-sqaured: 0.008-0.01). Jump height descriptive by sport are presented (**Table 1 and 2**). In line with our jump height results, no statistical differences were found in Peak Force, Peak RFD, Average RFD and Starting gradient amongst the four conditions.

Table 1. CMJ height Dynamic Stretching by Sport

	AERO CMJ	DW CMJ	FR CMJ	DW+FR CMJ
Protocol	Mean	Mean	Mean	Mean
Basketball (13)	38.6 ± 6.71	36.2 ± 5.85	37.7 ± 6.16	36.5 ± 6.16
Football (13)	37.2 ± 9.39	37.5 ± 10.3	36.6 ± 9.17	37.2 ± 9.97
Volleyball (18)	29.0 ± 5.10	27.7 ± 3.20	28.3 ± 3.62	29.0 ± 4.45
Softball (8)	24.1 ± 3.12	25.1 ± 2.50	23.4 ± 2.37	24.4 ± 2.65

Table 2. SJ Height Dynamic Stretching by Sport

	AERO SJ	DW SJ	FR SJ	DW+FR SJ
Protocol	Mean	Mean	Mean	Mean
Basketball (13)	37.2 ± 6.30	36.2 ± 5.45	37.0 ± 6.20	35.4 ± 5.80
Football (13)	36.0 ± 8.71	36.9 ± 8.47	33.9 ± 8.60	35.3 ± 9.59
Volleyball (18)	28.3 ± 3.54	27.8 ± 3.25	27.3 ± 3.60	29.4 ± 4.13
Softball (8)	22.6 ± 2.50	23.1 ± 2.77	23.3 ± 2.88	24.0 ± 2.65

CHAPTER 4

DISCUSSION

The Primary aim of this study was to determine whether foam rolling, dynamic stretching or the combination of both modalities improved vertical jump in comparison to a general 5-minute aerobic jog. Interestingly, we found neither dynamic stretching nor foam rolling influenced vertical jump height or jump execution characteristics above that of a 5-minute jog. The findings supported, in part, our hypothesis that foam rolling or foam rolling + dynamic stretching would not provide any additional performance benefit over a general aerobic warmup. We also hypothesized that aero + dynamic stretching would yield the greatest performance benefit, an outcome that was not supported by the study results.

Previous findings regarding the effectiveness of foam rolling and dynamic stretching protocols have yielded differing results between general and athlete-specific populations. The investigation of the use of foam rolling for performance is quite limited and the results are contradicting. Decreases in performance output were found in Janot's et al. (27) study, which used 23 college-aged individuals and found that peak power output during a 30-second, Wingate test decreased in females, but not males, when following a foam rolling intervention of twenty minutes. Conversely Lanigan et al. (14), in a small sample of healthy active adults (n=14), used foam rolling on the subjects' dominant leg, allowing the non-dominant to act as a control. The study found foam rolling had a positive effect on Jump Height at an improved percentage of 12.8, but did not reach significance. Overall, 12 out of 14 subjects either maintained or improved performance after foam rolling. No statistical differences were found in Healey's et al. study (15), also using non- athletes (n=26), indicating foam rolling was no more effective than a planking warmup in improving performance in tests of vertical jump height and power, isometric force, speed and agility. These results run counter to what Peacock et al. (13) found. In a small, hybrid sample of current and former athletic males (n=11), Peacock et al. (13) reported 4-7% improvements in multiple performance outcomes (vertical jump, pro agility, Sprint, bench, long jump) when foam rolling was performed in addition to a 5-minute general aerobic warmup and a 5-minute dynamic stretch. Other studies involving Division 1 athletes have been of minimal number, but one study done by Behara et al. (16), in a small sample size of 14 offensive linemen, found that the implementation of foam rolling when compared to a standard 8-minute dynamic stretching was no more effective in subsequent vertical force production.

Our study's findings are in line with Healey et al. (15) and Behara et al. (16), showing that foam rolling had no meaningful impact on performance during the vertical jump test. While Healey et al. compared 26 non-athletes, and Behara et al. used 14 linemen, our study extends these results to male and female athletes (n=52) competing in multiple sports at the Division 1 level. The results of Peacock's study differ from the results of our study. Protocol design and sample size may account for the differences. The small sample (n=11) in Peacock's study reduces the confidence in the precision of the results. Another reason for the differences could be that the protocol design, e.g. the addition of roughly 6 minutes of foam rolling in between the general warmup and the dynamic stretching, reduced fatigue associated with the warmup in the current and former athletes in the Peacock study. Too intense of a warmup can rapidly decrease short-term performance by reducing phosphagen stores (20) and this effect can occur in as few as 3-6 minutes of workloads greater than 60 percent VO^2 max (21).

The investigation of the use of dynamic stretching for performance is much more extensive and chronicled over decades, with the results being more consistent in finding that dynamic stretching has a small but positive influence on subsequent force production. A recent systematic review by Behm et al. (10), evaluating 48 studies in healthy adults, concluded dynamic stretching leads to a moderate (2.1%) mean improvement in jump and a small (1.4%) mean improvement in rapid movement performance such as sprinting. However, our study and others in athlete populations do not consistently support the notion that dynamic stretching augments performance, especially in comparison to a general aerobic jog (23, 24, 25). One explanation for this may be that the small performance improvement found in nonathlete populations may not transfer over to athlete populations due to training history and status of said athletes. Another explanation for the statistical variance of dynamic stretching on performance in athletes could be the inability of small sample sizes in the aforementioned studies (23, 25) to accurately detect small effects. However, our study and Holt et al. (24) were designed to detect small-to-moderate effects and still failed to find improved performance when compared to general aerobic jog.

Time will always be a major constraint for strength and conditioning professionals when programming for athletes. The use of time needs to be consistently re-evaluated with efforts of improving subsequent performance, especially when considering the NCAA time restrictions, with a minimum of coaching time given to strength and conditioning coaches. Recent evidence, including ours, suggest no benefit of additional warmup modalities beyond a general aerobic warmup for performance enhancement in athletes. If a positive effect exists, it is likely small. Due to this evidence, practitioners should be inclined to re-evaluate time spent during warmup procedures, especially time spent on dynamic stretching and foam rolling, since the current inclusion of these modalities has been justified by their ability to enhance subsequent performance and reduce injury. Evidence for the effectiveness of dynamic stretching and foam rolling to reduce injury in athletes is lacking according to Thacker et al. (26) systematic review.

One limitation of our study was that the athletes, comprising participants in four different Division 1 sports, were all at different training statuses. The intensity of the exercise and or volume prescribed in the protocols may have influenced athletes differently due to training status, which varies with respective competitive seasons. We only evaluated explosive strength (jump height), therefore our results are not generalizable to low velocity movements and sustained high velocity movement performance. A strength of our study was the diversity of athletes included in the study (males and female from 4 sports) extended our results to these populations. Future studies should account for training status when assessing the effectiveness of warmup protocols on outcomes of interest.

In conclusion, we found that foam rolling, dynamic stretching, or a combination of foam rolling and dynamic stretching, did not enhance jump height in both men and women division 1 athletes (n=52) any more than a general aerobic warmup. Practitioners should question all warmup modalities being prescribed in their efforts for subsequent performance in the weight room. The development of other movement qualities should be considered if foam rolling or dynamic stretching do not enhance force production prior to strength training.

Practical application

These findings suggest that five minutes of jogging at a self-selected pace may be just as effective as a comprehensive foam rolling and dynamic stretching protocol. Coaches and trainers should consider this when preparing athletes with limited time restrictions available to them. Coaches and trainers should also take care to avoid fatiguing athletes through warm-up protocols, as overly exhaustive preparation has shown minimal influence on performance above and beyond those gained through general preparation.

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Institutional Review Board
Twamley Hall, Room 106
264 Centennial Dr Stop 7134
Grand Forks, ND 58202-7134
Phone: 701.777.4279
Fax: 701.777.6708
Email: UND.irb@research.UND.edu

June 7, 2017

Principal Investigator:	Benjamin SaariBovre
Project Title:	The Effect of Warmup Protocols on Jump Mechanography in NCAA Division I Athletes
IRB Project Number:	IRB-201706-364
Project Review Level:	Expedited 4, 7
Date of IRB Approval:	06/06/2017
Expiration Date of This Approval:	06/05/2018
Consent Form Approval Date:	06/06/2017

The application form and all included documentation for the above-referenced project have been reviewed and approved via the procedures of the University of North Dakota Institutional Review Board.

Attached is your original consent form that has been stamped with the UND IRB approval and expiration dates. Please maintain this original on file. ***You must use this original, stamped consent form to make copies for participant enrollment. No other consent form should be used.*** It must be signed by each participant prior to initiation of any research procedures. In addition, each participant must be given a copy of the consent form.

Prior to implementation, submit any changes to or departures from the protocol or consent form to the IRB for approval. No changes to approved research may take place without prior IRB approval.

You have approval for this project through the above-listed expiration date. When this research is completed, please submit a termination form to the IRB. If the research will last longer than one year, an annual review and progress report must be submitted to the IRB prior to the submission deadline to ensure adequate time for IRB review.

The forms to assist you in filing your project termination, annual review and progress report, adverse event/unanticipated problem, protocol change, etc. may be accessed on the IRB website: http://und.edu/research/resources/human-subjects/

Sincerely,

Michelle L. Bowles

Michelle L. Bowles, M.P.A., CIP
IRB Coordinator

MLB/sb
Enclosures

Cc: John Fitzgerald, Ph.D.

The University of North Dakota is an equal opportunity / affirmative action institution.

THE UNIVERSITY OF NORTH DAKOTA
CONSENT TO PARTICIPATE IN RESEARCH

TITLE: *The Effects of Foam Rolling and Dynamic Warmup on Vertical Jump Performance*

PROJECT DIRECTOR: *Ben SaariBovre, B.S.*

PHONE # *320-491-8922*

DEPARTMENT: *Kinesiology*

STATEMENT OF RESEARCH

A person who is to participate in the research must give his or her informed consent to such participation. The consent must be based on an understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

WHAT IS THE PURPOSE OF THIS STUDY?

You are invited to be in a research study about the effects of foam rolling and dynamic warmup on vertical jump height and maximal force production gathered from a force platform because you are a healthy adult, aged 18-25 years, participating in a collegiate sport.

HOW MANY PEOPLE WILL PARTICIPATE?

Approximately 40 people will take part in this study at the University of North Dakota.

HOW LONG WILL I BE IN THIS STUDY?

Your participation in the study will last 4 weeks. You will need to visit the Biomechanics laboratory in the Hyslop Sports Center 4 times. Each visit will take about 20-30 minutes.

WHAT WILL HAPPEN IN DURING THIS STUDY?

If you agree to participate in this study, we would ask you to participate in 4 visits to the Biomechanics laboratory. The familiarization session, as well as the 3 testing sessions would include the following:

Familiarization (approximately 20-30 minutes)

- Your height and weight would be determined.
- You will jog 5 minutes at a self-selected pace.
- You will be asked to jump as high as possible using a squat jump technique and a

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Expiration Date: JUN 5 2018
University of North Dakota IRB

countermovement jump technique on a force platform. You will jump three trials with the squat jump technique and three trials with the countermovement jump technique. You will jump a total of six times.

Session 1 (approximately 20-30 minutes)

- You will jog 5 minutes at a self-selected pace.
- You will perform a 8-16 minute warm-up directed by the investigator.
- You will be asked to jump as high as possible using a squat jump technique and a countermovement jump technique on a force platform. You will jump three trials with the squat jump technique and three trials with the countermovement jump technique. You will jump a total of six times.

Session 2 (approximately 20-30 minutes)

- You will jog 5 minutes at a self-selected pace.
- You will perform a 8-16 minute warm-up directed by the investigator.
- You will be asked to jump as high as possible using a squat jump technique and a countermovement jump technique on a force platform. You will jump three trials with the squat jump technique and three trials with the countermovement jump technique. You will jump a total of six times.

Session 3 (approximately 20-30 minutes)

- You will jog 5 minutes at a self-selected pace.
- You will perform a 8-16 minute warm-up directed by the investigator.
- You will be asked to jump as high as possible using a squat jump technique and a countermovement jump technique on a force platform. You will jump three trials with the squat jump technique and three trials with the countermovement jump technique. You will jump a total of six times.

WHAT ARE THE RISKS OF THE STUDY?

There may be some risk from being in this study. Jumping is a maximal exertion activity and may cause soreness of the knee and thigh. Although rare, there is risk of losing balance during the landing phase of a jump that may result in ankle sprain and/or falling. Every effort will be made to minimize these risks by evaluation of preliminary information related to your health and fitness and by careful observation during testing. It is important for you to realize that you may stop when you wish because of feelings of fatigue or any other discomfort. All personal information will be kept confidential. Participant data will be stored according to an unidentifiable participant number.

WHAT ARE THE BENEFITS OF THIS STUDY?

You may not benefit personally from being in this study. However, we hope that, in the future, other people might benefit from this study because the data may help to understand how foam rolling and dynamic warmup affects components of vertical jump in college athletes.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

Approval Date: JUN 6 2017
Expiration Date: JUN 5 2018
University of North Dakota IRB

You may have costs for being in this research study. The cost of travel will vary depending on the distance you live from the Biomechanics laboratory in the Hyslop Sports Center.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for participation in this research study.

WHO IS FUNDING THE STUDY?

The University of North Dakota and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research study.

CONFIDENTIALITY

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. Your study record may be reviewed by Government agencies, the UND Research Development and Compliance office, and the University of North Dakota Institutional Review Board.

Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. You should know, however, that there are some circumstances in which we may have to show your information to other people. For example the law may require us to show your information to a court or to tell authorities if we believe you have abused a child, or you pose a danger to yourself or someone else. Confidentiality will be maintained by means of data encryption according to current University policy. The data will be destroyed after a three year period.

If we write a report or article about this study, we will describe the study results in a summarized manner so that you cannot be identified.

COMPENSATION FOR INJURY

In the event that this research activity results in an injury, treatment will be available including first aid, emergency treatment and follow-up care as needed. Payment for any such treatment is to be provided by you (you will be billed) or your third-party payer, if any (such as health insurance, Medicare, etc.) No funds have been set aside to compensate you in the event of injury. Also, the study staff cannot be responsible if you knowingly and willingly disregard the directions they give you.

IS THIS STUDY VOLUNTARY?

Your participation is voluntary. You may choose to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota. If you decide to participate, you are free to withdraw at any time without affecting those relationships.

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CONTACTS AND QUESTIONS?

The researcher conducting this study is Ben SaariBovre, B.S. You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact Ben SaariBovre at 320-491-8922.

If you have questions regarding your rights as a research subject, you may contact The University of North Dakota Institutional Review Board at (701) 777-4279.

- You may also call this number about any problems, complaints, or concerns you may have about this research study.
- You may also call this number if you cannot reach research staff, or you wish to talk with someone who is independent of the research team.
- General information about being a research subject can be found by clicking "Information for Research Participants" on the website: http://und.edu/research/resources/human-subjects/research-participants.cfm

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Subjects name:____

__________________________ __________________

Signature of Subject Date

I have discussed the above points with the subject or, where appropriate, with the subject's legally authorized representative.

__________________________ __________________

Signature of Person Who Obtained Consent Date

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PRETEST QUESTIONNAIRE

Personal

Name: ____ Test Date: ________________________

Date of Birth: _____________________

Diet

1. Evaluate your diet over the last 2 days. ☐ Poor ☐ OK ☐ Good ☐Excellent

2. How many hours ago did you eat your last meal? _____________

3. Have you consumed alcohol in the past 12 hours?________________ 24 hours?_________________

4. Have you consumed caffeine in the past 12 hours?_______________

Environment

1. Have you been training in hot conditions over the last two weeks? ☐ No ☐ Yes

If yes, please provide details: ____

____

____

Illness

1. Are you currently suffering from any type of illness? ☐ No ☐Yes

If yes, please provide details (type, severity): ____

____

____

2. Have you ever had any type of illness or health problem for the last two weeks? ☐ No ☐ Yes

If yes, please provide details (type, severity): ____

____

____

Injury

1. Do you currently have any injuries? ☐ No ☐ Yes

If yes, please provide details (type, severity): ______________________________

____

____

2. Have you had any injuries for the last two weeks? ☐ No ☐ Yes

If yes, please provide details (type, severity): ______________________________

____

____

Medication/Supplements

1. Are you currently taking any medication? ☐ No ☐ Yes

If yes, please provide details (type, severity): ______________________________

____

____

Motivation

1. Evaluate your motivation for training today. ☐ Poor ☐ OK ☐ Good ☐Excellent

2. Evaluate your motivation for testing today. ☐ Poor ☐ OK ☐ Good ☐Excellent

Training

1. Evaluate your last week of physical training. ☐ Easy ☐ Moderate ☐ Hard ☐ Very Hard

2. How fatigued are you today? (0 = not at all; 5 = extremely) 1 2 3 4 5

3 How many hours ago did you last exercise? ________________

Tobacco

1. Are you a smoker? ☐ No ☐ Yes

2. Have you used tobacco in the past 12 hours? ☐ No ☐ Yes

Miscellaneous

Please provide any additional information that you believe may influence your fitness test results. _____

____

____

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