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Preference of Dynamic Stretching and Static Stretching Among Division I Athletes from Southern Illinois University of Carbondale

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PREFERENCES OF DYNAMIC STRETCHING AND STATIC STRETCHING AMONG
DIVISION I ATHLETES FROM SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

by

Emma Baalman

B.S., Southern Illinois University, 2020

A Research Paper

Submitted in Partial Fulfillment of the Requirements for the
Master of Science in Education

School of Human Sciences
in the Graduate School
Southern Illinois University Carbondale
May 2021

RESEARCH PAPER APPROVAL

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Fulfillment of the Requirements

for the Degree of

Master of Science in Education

in the field of Kinesiology

Approved by:

Dr. Philip Anton, Chair

Graduate School
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April 1, 2021

AN ABSTRACT OF THE RESEARCH PAPER OF

Emma Baalman, for the Master of Science in Education degree in Kinesiology, presented on April 1, 2021, at Southern Illinois University Carbondale.

TITLE: PREFERENCES OF DYNAMIC STRETCHING AND STATIC STRETCHING AMONG DIVISION I ATHLETES FROM SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

MAJOR PROFESSOR: Dr. Philip Anton

Researchers have long debated the question of proper warm-up protocol; however, research concerning the preference of athletes is scarce. Dynamic and static stretching both have positive and negative aspects and many of these features are influenced heavily by the time point during exercise in which they are executed. The purpose of this paper is to determine the preferences of either static stretching or dynamic stretching as a part of warm-up routine. Division I collegiate athletes from Southern Illinois University Carbondale answered survey questions regarding the type of stretching techniques they use and why they utilize them. Upon completion of the survey, a small portion of the participants were randomly selected to participate in an interview designed to elicit greater detail about their specific warm-up protocols. In addition, this investigation was designed to determine the relationships between anaerobic or aerobic sport, sex of athlete, and team-based or individual-based sport, regarding stretching techniques.

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CHAPTER 1

INTRODUCTION

All sports use flexibility techniques (stretching) in some capacity, whether it is prior to competition/practice sessions or after. Individuals use stretching for a large variety of reasons, but the three main reasons are: 1) to reduce injuries 2) prepare the body for more intense activity 3) ease the transition from exercise to rest. This investigation focused on two main types of flexibility technique: dynamic stretching and static stretching.

Dynamic stretching is more of an active technique compared to static. It helps increase heart rate/stroke volume, blood flow to active muscle, nerve conduction velocity, metabolic rate, muscle and connective tissue temperature and pliability. Dynamic stretching is frequently completed by using sport-specific movements, working muscles, connective tissue, and joints through their complete range of motion, allowing for a transient increase in flexibility and range of motion.

Static stretching is more of a passive activity when compared to dynamic stretching. Static stretching focuses on the use of one muscle at time and is used mainly to elicit permanent increases in flexibility and range of motion. It is based on the use of a slow stretch of a body area to the point of discomfort, followed by a static hold of that stretch at the point of discomfort for a period of 10-30 seconds.

Based on the literature regarding dynamic stretching and static stretching, there is not a clear consensus on which technique is more beneficial for a warm-up protocol. The purpose of this investigation was to determine which type of stretching is preferred by athletes in different sports for a pre-performance warm-up. The athletes' views will be measured through a survey of multiple choice and open-ended questions and an interview to gain deeper knowledge of the

participants specific warm-up routines. It is hoped that this study will lead to more extensive experimental trials of athletes attempting both dynamic and static stretching prior to performance.

Research Questions

Increased research into warm-up protocols could increase the performance of athletes in their perspective sport. In this study, the purpose is to determine whether dynamic or static stretching is preferred as warm-up amongst various SIU athletes of different teams.

Hypothesis 1: Participants from different sports will have varying preferences of dynamic stretching and static stretching.

Hypothesis 2: Participants who are members of more anaerobic sports will prefer dynamic stretching more often than static stretching in a warm-up.

Hypothesis 3: Participants who are members of aerobic sports will prefer static stretching more often than dynamic stretching in a warm-up.

CHAPTER 2

LITERATURE REVIEW

Dynamic Stretching

Dynamic stretching increases heart rate and blood flow to muscle, while working large muscle groups. A study by Chaouchi et al. (2010) researched elite athletes, to test their performance on sprint, agility and jump tests. They compared 1) the effects of prior static and dynamic warm-ups 2) looked at the effects of different sequencing of dynamic and static warm-ups 3) compared the effects of stretching maximally and submaximal stretching. They hypothesized that the dynamic stretching alone warm-up would result in the largest enhancement of performance, but the results did not show any significance in dynamic stretching alone over the other warm-ups used. This may have been due to the participants training level. Previous research is not completely for or against static stretching, so caution should be used with static stretching.

A review by Behm & Chauachi (2011), described how to use dynamic stretching and static stretching for optimal performance. A smaller duration of static stretching should be used if completed prior to performance. Dynamic stretching should last for longer duration and can be paired with short durations of static stretching for sports specific needs. Although the optimal warm-up should consist of sub-maximal aerobic activity followed by a large number of dynamic movements and ended with sport specific dynamic movements, Behm and Chauachi also noted that static stretching should be implemented in overall fitness routine.

Static Stretching

Dynamic and static stretching are used in all sports. Static stretching is used to mainly increase flexibility and range of motion of specific muscles and joints. The joints and muscle

being stretched can depend on what activities will be performed.

Effects of Dynamic Stretching on Performance

Acute Effects

A study by Fletcher & Monte-Colombo (2010) used well-trained semi-professional male soccer players. The athletes were tested on their vertical jump, sprint time, and agility time. The athletes underwent three different warm-ups: active warm-up, active warm-up with sport specific dynamic, and active warm-up with static stretching. The researchers hypothesized that the active with dynamic would have the greatest positive effects on the three soccer specific tests compared to active alone and active with static stretching. The researchers found that the jump height was significantly increase with the active and dynamic compared to the active and static, and when active alone was compared to active and static. The active and dynamic showed a faster time during the sprint and agility times compared to the other two warm-ups. This study also examined the differences in heart levels for each warm-up. They discussed that the active alone and active and dynamic warm-ups had higher heart rates than the active stretching. The increase in heart rate can increase the blood flow and have positive metabolic effects, which could increase performance.

Zmijewski et al. (2020) examined the effects of static vs. dynamic warm-ups on repeated sprint ability on a cycle ergometer. They hypothesized that the static stretching would impair sprint performance. The participants were well-trained female handball players. The participants did an aerobic warm-up on the cycle ergometer and completed one of the three different warm-ups: static, dynamic, and control. After they completed the warm-up, participants were tested on their repeated sprint ability. Dynamic stretching produced the highest average power over static stretching and control group, and the static stretching had negative effects for the maximal sprint

performance.

Researchers are not in agreement about the proper stretching for sport. Other studies found that a dynamic warm-up did not have any positive effects on sprint performance which contradicts most studies. Kyranoudis et al. (2018) believed that the dynamic warm-up did not have any effect because the participants had little experience with dynamic stretching.

Lastly, male collegiate athletes were used to test the effects of four different warm-up protocols on vertical testing. This study had four different conditions: general warm-up, static stretching, dynamic warm-up, and dynamic flexibility. This is one of the few studies that have tested two different types of dynamic warm-ups. All four conditions had increases in vertical jump, but the static stretching condition had the least improvement from the pre-test. Dynamic warm-up and dynamic flexibility had greater effects size over the general warm-up (Holt & Lambourne, 2008).

Chronic Effects

Most of the research mentioned to this point has been about acute effects, but this study conducted by Herman & Smith (2008) focused on the long-term effects that dynamic stretching and static stretching can have on power, agility, speed, endurance flexibility and strength. 25 collegiate wrestlers underwent a four-week study either in the dynamic condition or the static condition. The improvements seen in the dynamic group were not as dramatic as in the static group. Even though the static condition also showed decreases in the push-up and 600-m tests. This is one of the few studies that have shown long-term effects of dynamic and static stretching compared to the acute effects.

Effects of Static Stretching on Performance

Acute Effects

Young & Behm (2003) tested the effects of submaximal running, static stretching, and practice jumps had on jump performance. The participants used were an average of 26 years of age and reported having some experience with jump testing. There were five different warm-ups tested: control, run, static, run + static, and run + static + jump. Researchers found that the run and the run + stretch + jump had the greatest positive effects on performance, whereas stretch alone had the greatest negative effects on jump performance. They also noted that the submaximal run included an increase in muscle temperature to increase performance and the practice jumps may have increased the neural pathways used for the jump testing.

Hough et al. (2009) used vertical jump testing and electromyography to examine the effects of dynamic and static stretching. They used male athletes who participate in recreational sports. They were three different groups: a no stretching group, dynamic stretching, and a static stretching group. The largest reduction in the vertical jump was between the dynamic condition and the static condition. There was also a significant increase in EMG activity between the dynamic and static stretching protocols. The significant difference in EMG activity could be the reason for the decrease in vertical jump performance.

Military cadets were studied to test the difference between dynamic stretching warm-up, static stretching warm-up, and no stretching warm-up. The cadets were tested on five-step jumps, medicine ball throws, and the T-agility test. Overall dynamic stretching showed the best outcomes, but static stretching showed improved scores for the five-step jumps. Dynamic stretching should be used in every warm-up, and static stretching can be used with dynamic, but static stretching should not be used alone for a warm-up (McMillian et al, 2006).

Untrained males were used to test the acute effects of muscle stretching on one-rep max knee flexion and extension. The two conditions were either quite resting for 10 minutes or static

stretching for 20 minutes. They found the static stretching group had significantly more flexibility on the sit and reach exercise, but the resting groups performed significantly better on the one-rep max knee flexion and extension tests. Static stretching of primary muscle should be done prior to flexibility testing, but static stretching might inhibit maximal strength performance (Kokkonen et al., 1998).

Wong et al. (2011) found results that conflict with the previous research mentioned. In this study 25 post-graduate male students were used to test the effects of static stretching durations on repeated sprint performance and change of direction. There was a significant change in the flexibility after the static stretching, but there was no impairment to the performances due to the change I duration of static stretching. Researchers noted that the limited of change between duration of static stretching could have been because of the dynamic stretching that followed. It would be interesting to conduct this study again without the dynamic stretching following the static stretching.

Muscle Strength Endurance

Most of the researcher regarding the effects of dynamic and static stretching are related to muscle power performance. Nelson et al. (2005) studied the acute effect of static stretching on muscle strength endurance. They found that static stretching can reduce stiffness and blood flow in the muscle which can decrease the transfer of power, decreasing the muscle strength endurance. Static stretching significantly decreased muscle strength endurance in this experimental procedure.

Running Endurance

Up to this point in this paper, there has not been any regarding running endurance. Some research suggests that static stretching may decrease strength and power performance. In a study

conducted by Mojok et al. (2011), they examined the acute effects of static stretching on running economy and endurance performance of trained female runners. Their research concluded that static stretching has no adverse effects on trained female runners. Once again, there might not have been in effect because of the participants' level of training.

Chronic Effects

Most studies have assessed the acute effects of static stretching on muscle performance. The study conducted by Kokkonen et al. (2007) studied the chronic effects of static stretching on muscle performance on untrained individuals. The participants were instructed to maintain their current exercise habits, so they could study the static stretching effects specifically. After a 10-week static stretching regimen they found that static stretching alone can improve flexibility, strength, endurance, and power.

One of the main reasons why people believe in static stretching prior to performance is to reduce injuries. This article studied the effects of static stretching on low-limb injuries. After a 12-week training program, they did not find any significant data to support that static stretching can decrease low-limb injuries for army recruits. This may have been due to fitness levels of the recruits before entering the 12-week program. Static stretching can change in value for different population of people (Pope et al., 2000).

Sport Specific Movements

Many studies discuss the effects of dynamic and static stretching on performance. A 2012 article by Samson et al. examined the effects of sport specific warm-ups paired with dynamic and static stretching. They found that there when sport specific movements were paired with general aerobic warm-up there was a .94% increase in performance, but there was no significant difference when specific movements were either paired with static or dynamic stretching. They

also noted static stretching increased performance on the sit and reach test; therefore, because there were no significant differences between dynamic and static stretching on performance, static stretching should be used to increase range of motion before performance.

Kyranoudis et al. (2018) studied amateur soccer players to test the effects on sprint performance with static stretching and dynamic stretching when paired with a general warm-up and a soccer specific warm-up. They found that the soccer specific warm-up did not have negative or positive effects on sprint performance. This may have been due the experience level of the participants.

Multiple studies have been used to test dynamic stretching and static stretching on general power performance, but Moran et al. (2009) examined the effects of dynamic stretching on the golf swing performance. When dynamic stretching was implemented into the general warm-up there was a significant increase in ball speed and club head speed. Not only did the dynamic stretching increase the ball swing speed, but accuracy was improved; therefore, improving the golfer short game and long game.

Many strongman athletes were surveyed on their pre-competition routines. Several areas were analysis such as: nutrition, duration, passive versus active, and rest period. Most athletes reported that they used self-directed warm-ups for injury prevention, increase muscle activation, and to increase blood circulation. The warm-ups were event-specific, and they used these warm-ups during their everyday training practices (Winwood et al., 2019). This survey showed that athletes prefer their warm-ups used for practice should be the same for their competitions.

Sequencing of Dynamic and Static Stretching

If dynamic and static stretching are done separately following an aerobic warm-up, there is significantly better results on performance for dynamic stretching compared to static

stretching. However, if a sport specific warm-up is completed after either dynamic or static stretching, there is not a significant difference in performance (Taylor et al., 2009). Sequencing can change the adverse effects of a warm-up, but the training level of an athlete can also affect the warm-ups potential.

Trained

Dalrymple et al. (2010) examined the effects of dynamic stretching and static stretching on countermovement jump testing. They tested 12 female collegiate volleyball players, who were familiar with the vertical testing. The testing was conducted five minutes after a five-minute jogging warm-up and an eight-minute session of one of the dynamic or static stretching protocols. They did not find any significant difference between the groups. They noted that the time between the stretching protocol and the testing was too long to show effects because other studies tested the jumping two minutes after the stretching, and they found that dynamic had significant increases in the jump performance.

Untrained

Untrained female athletes were used to study the effects of dynamic, static, aerobic warm-ups on counter movement jumps, peak force leg extension and range of motion. All of the conditions showed same similar results for range of motion, but the dynamic stretching had the greatest improvement in five-minute post-test countermovement jump and static stretching decreased at the five-minute post-test. Dynamic stretching also showed greatest improvement for the time to peak force. Some studies have shown that a five-minute post-test does not show difference between static and dynamic stretching, but this studied has did not find the same results (Curry et al, 2009). This shows that the training levels of athletes can determine how effective the warm-up is.

Most Common Warm-up

There has been limited surveys of how coaches and player use dynamic and static stretching but in research by Takeuchi et al. (2019), they surveyed 138 coaches from the Japan Sport Association. All of coaches combined were involved in 21 different sports and coached for an average of 16 years. The survey assessed how coaches used static stretching and/or dynamic stretching. The survey was split into four parts: demographic, describing how they used static stretching, how they used dynamic stretching, and how they learned about their type of stretching. The survey was not specific to just prior to performance, but included prior, during and after performance. It would be interesting to know how coaches use static and dynamic just prior to performance. Most coaches used static stretching increase flexibility, but the duration at which they performed static stretching would not increase flexibility. This shows that some coaches understand the benefits, but they do not fully understand how to correctly perform the stretching.

Overall, the previous research can be conflicting, but some common themes emerged. First, the duration of any static stretching before performance should be done in small bouts. This allows for the athlete to increase range of motion without decrease muscle activation speed. Second, the warm-ups, whether using static or dynamic, should be specific to the sport or activity that will be performed. The warm-ups should change based on the needs of athlete. A volleyball player might need more upper body dynamic movements, where a figure skater might need more static stretching to increase flexibility. Lastly, the level of athlete can change the usefulness of the warm-up.

CHAPTER 3

METHODS

Participants

206 recruitment emails were sent, and the study surveyed 31 male and female participants and interviewed 4 of those participants (randomly selected), who will be the athletes from various Southern Illinois University Carbondale NCAA Division I collegiate sports. The participants are knowledgeable and trained in their specific sport. The age range varied from 18-23 years.

Measures and Materials

Surveys/questionnaires/measurement tools. The survey used in this study was derived from a previous study conducted by Takeuchi et al. (2019). It was modified to accommodate athletes, unlike the survey by Takeuchi et al. (2019), which only surveyed coaches. The survey included multiple choice, yes or no, and open-ended questions. The link to the survey was sent to the participants via email and Survey Monkey was used as a platform for the collection of the data. The interview questions were created by the researcher to gain more insight into the athletes' specific warm-up protocol choices.

Procedure

Once the survey was created the research obtained the athletes' emails through the People Finder component of the SIUC website. Each participant was sent an email with the cover letter and the link to the survey included. The first page of the survey detailed the Informed Consent Form for the survey section of the research. If the participant did not wish to consent, they were directed to the end of the survey and thanked for their time. For those that did consent, the survey required ~5-10 minutes of their time.

The cover letter included information about the interview portion of the study. If participants were interested in participating in an interview, they were asked to sign and email the interview consent form back to the researcher. Once all of the consent forms were received, the researcher randomly selected 4 of the participants and a phone interview time was scheduled via email. On average the phone interviews took about 10-15 minutes to complete. The interviews were audio recorded with the researcher's phone and then uploaded to a safe confidential drive for later analysis. Once the upload was complete, the interview was deleted from the researcher's phone. The recorded information was then transcribed and analyzed to determine if any consistent themes emerged. The only person with access to the audio recordings was the researcher. Once the analysis was completed, the interview recordings were deleted from the confidential drive.

Analysis

To analyze the data received through the interviews and surveys, the researcher used frequencies, percentages, and correlations. These analyzing tools allowed the researcher to find underlying themes throughout the information provided by the athletes.

CHAPTER 4

RESULTS

Survey Results

Demographics

The survey had a total of 31 participants. Of the 31 participants there were 7 males and 24 females. The average time spent in Division I athletics was 3.5 years. The participants competed in seven different sports [football: 9.68%, volleyball: 48.39%, baseball: 6.45%, swimming and diving: 9.68%, track and field: 12.9%, cross country: 6.45%, other: 12.9% (basketball, softball, golf, soccer)].

Static Stretching

90% of the sample reported using static stretching on a regular basis, with the remaining 10% not using the technique at all. Regarding when static stretching was used, 80% of the sample reported that they use the technique following resistance training, and 66.7% of the sample reported using static stretching prior to practice sessions. When asked for the purpose of their utilization of static stretching, the most common response was the use of the technique as an injury prevention method and a pathway to greater flexibility. One participant mentioned that it helps them prepare mentally before practice and competitions. Another participant specifically noted that they execute static stretching techniques before they engage in any dynamic stretching. Several respondents noted that they engaged in static stretching to help them to decrease stress and relax. 27 of the participants reported that they use static stretching for the lower body: glutes, hamstrings, quadriceps, and hip flexors. Only 11 participants mentioned using static stretching for upper body muscle groups. Only one participant did not have previous knowledge about static stretching.

Dynamic Stretching

100% of the participants reported using dynamic stretching. All participants use dynamic stretching before competitions, 93.1% use it before practice, and 68.97% use it before weight training. Only a total of eight participants utilized dynamic stretching following a practice session, competition, or weight training. The most common purpose for the use of dynamic stretching was to increase blood flow, prevent injuries, and improve performance. Seven participants mentioned increase in heart rate and one participant mentioned increase mobility. One participant reported that dynamic stretching prepares their body for high intensity movements. 29 participants use dynamic stretching for the lower body, specifically their hamstrings and quadriceps. One participant added that they use dynamic stretching mainly for their legs because that is what their sport relies heavily on their legs. 16 of those participants reported also using dynamic stretching for their upper body.

Interview Results

All the interview participants were from team-based sports. Each participant had to follow warm-up protocols provided by a coach, which they all felt adequately ready for their sport following the coach provided warm-ups. The interview section of this study included four interviewees, two females and two males. The female participants indicated that their warm-up period consisted of both dynamic and static stretching, but one of the females reported that their warm-up was about 80% dynamic and 20% static. The male participants reported that their warm-up period consisted of only dynamic stretches. They all felt that at the end of their warm-ups they were physically prepared to participate in their sport. Each participant remarked that they tended to place more value on lower body muscle groups stretching, whether it was dynamic or static. Three of the participants specifically mentioned the targeting of the

hamstrings and quadriceps as being most important. Two of the participants mentioned that they prefer hamstring stretches because that muscle group tends to be “tighter”. Only one of the participants reported preferring static stretching over dynamic stretching, mainly because static stretching provides a “deeper stretch”; however, that participant acknowledged that dynamic stretching was still important. Only one of the participants indicated that they did not recognize warm up as a key component of good performance, even though she mentioned that she would be fine with a few sport-specific drills and maybe a little hamstring static stretching if she was sore. Only two of the participants referred to sport-specific movements and they indicated that the sport-specific movements were only included in the pre-competition warm-up and not in the pre-practice warm-up. One of the two preferred the pre-competition more because of the sport-specific movements.

CHAPTER 5

DISCUSSION

Static Stretching

As stated in the Results section, static stretching was found to be most often used following resistance training and prior to a practice session. In one of the interviews, a participant who played volleyball noted that for their practice warm-up they would often take more time to do preventive rehabilitation, primarily for their backs and shoulders. This fits with previous research by Seminati and Minetti (2013) that indicated shoulder and back injuries are the most common over-use related injury in volleyball. The distributed survey found that athletes mainly use static stretching for injury prevention. These findings indicate that some athletes may use pre-practice warm-up as a time to focus on injury prevention via the use of static stretching. This thought process may support the fact that, when used prior to activity, static stretching is more commonly used prior to practice compared to resistance training or competition.

This contradicts the results of McMillian et al. (2006), which was discussed in the literature review. Static stretching was not found to prevent injuries in trained individuals. Division I athletes' range in trained status due to the age range and different experience levels. A fifth-year student-athlete would have a higher training status than a first year straight from the high school level. Some individuals may notice more injury prevention with static stretching than others due to their training status. This shows that static stretching needs to be implemented on an individual basis.

The survey results showed that 80% of the participants reported using static stretching following resistance training. Static stretching more commonly follows resistance training than practice or competition. This may be because previous research has found that static stretching

following resistance training can significantly increase strength gains. Depending on the sport's strength and power requirements, static stretching following practice and competition could be just as beneficial for strength gains as following resistance training (Kokkonen et al., 2010).

A large theme amongst the surveys and interviews was that static stretching was used over twice as much on the lower body compared to the upper body. This could have been because almost half of the participants played volleyball, which is a sport that relies heavily on the lower body. The other sports that were included in the survey were a combination of predominant lower body or whole-body sports. There was not a sport that relied primary on the upper body that was surveyed or interviewed. One participant also noted that they focus mostly on the lower body but if other areas are bothering them, they will do additional static stretching accordingly.

Another participant used static stretching to mentally prepare for their performance. Proper static stretching includes regular breathing. Numerous sport psychology research studies have shown that deep breathing can prepare an athlete for their sport. Static stretching could be used in a warm-up as a mental preparation process effective at reducing pre-competition anxiety.

Dynamic Stretching

All participants reported that they use dynamic stretching before competition, and all but two reported using dynamic stretching before practice. This is congruent with the findings from McMillian et al. (2006), where they concluded that dynamic stretching should be a part of every warm-up and static stretching should not be used alone but as a lead-in into dynamic stretches.

10.34% of our participants used dynamic stretching following competition and practice. To the researcher's knowledge there is little research into dynamic stretching following exercise, but a proper cool-down can improve the recovery processes. A cool-down is used to gradually

transition the body from an active state to a resting state. Cooling-down helps to decrease venous blood pooling by increase venous return. In addition, it may decrease muscle soreness and stiffness. Depending on the intensity level of practice, competition, or resistance training it may be beneficial to transition into dynamic stretching before moving into static stretching. Higher intensity sports, such as sprinting, may benefit from including a dynamic stretching protocol in a cool-down protocol. At the end of a high intensity practice the body in an excited state, and immediately moving on to static stretching with no movement, may not allow the athletes to benefit from the positive effects of a proper cool-down. When a dynamic stretching protocol is included between a high intensity practice and a static stretching protocol, it will allow for a gradual change in the physiological process. This may increase the efficiency of a cool-down protocol. If a gradual transition from high intensity to static stretching is implemented, athletes may see a reduction in muscle soreness. For the athletes that mention doing more static stretching when their muscles are “tight”, they may also be able to prevent such “tightness” by included dynamic stretching post-high intensity exercises. (Costa et al., 2011).

Previous research has shown that increased blood flow, enhanced performance, and injury prevention can be effects to dynamic stretching, these were also common responses to purposes of uses dynamic stretching. An interesting finding was that only three participants use dynamic stretching specifically to increase flexibility/mobility. Mann and Jones (1999) implemented a dynamic flexibility program as part of softball players’ warm-up and found that there was a significant increase in range of motion in the hamstrings and quadriceps for both the dynamic and static stretching groups, but the dynamic stretching group had significantly fewer injuries. The hamstrings and quadriceps muscle groups were repeatedly stated as the main muscle groups that the participants focused on. In the interviews, three participants mentioned

that if they are sore in their hamstrings or quadriceps, they will do more static stretching. Dynamic stretching might be more beneficial because of the increased injury prevention. Injury prevention was mentioned multiple times as a purpose for using both dynamic and static stretching. Due to the limited responses for dynamic stretching to increase flexibility, it may suggest that it is not common knowledge amongst the participants that dynamic stretching can increase flexibility as effectively as static stretching.

Limitations

One limitation to this study was that the survey had a limited number of survey responses. Within the limited responses there was a small variety of sports. The study included mainly team-based sports and almost half of the responses came from volleyball athletes. It would be interesting to investigate more individual-based sports. The survey should have been distributed more widely across the entire NCAA Division I level to access larger populations.

Having interviewees that were all from one athletic program might have affected the results of the study as well. All the warm-ups were likely to have been conducted under the direction of the same strength and conditioning coach. Having responses from multiple athletic programs could change the general design of warm-up protocols used.

Another limitation was that the participants might not have fully understood the definition of dynamic stretching or static stretching. In the interviews, there seemed to be confusion about what could be included in a warm-up. For instance, one participant mentioned in the interview that she does not need a warm-up and would be fine with a few short specific movements. The sport-specific movements would be considered a type of dynamic warm-up. If further research is done with this study, it will be important to give in-depth explanations of both dynamic and static stretching.

Conclusion

Static stretching should never be done alone in a warm-up. Static stretching should be implemented into a warm-up with dynamic individually based on the training level of the athlete and their muscle-specific needs. Depending on the strength and power requirements of the sport, athletes might find static stretching just as rewarding with muscle recovery following practice and competition, as they do following resistance training. Static stretching could be added to a warm-up as a mental preparedness technique. Changing the focus of static stretching from a “deep stretch” to deep breathing may increase the mental preparedness of some athletes. Again, it may not be effective for each athlete.

The responses in the surveys and interviews may suggest that not all athletes fully understand the effects of dynamic and static stretching. Dynamic stretching should be a part of every warm-up and may be beneficial in recovery following high intensity events. A dynamic stretching protocol can be just as effective in increasing flexibility compared to static stretching.

All the interviewees were required to follow a warm-up protocol provided by a coach, and this might be a reason why some athletes are unsure about the effect of specific warm-up protocols. The athletes have not developed their own protocol; therefore, have not learned from their different experiences on what they personally need. Coaches should take more time to explain the reasonings for different types of stretching. Since most of the interviewees were required to follow a coach’s warm-up it is hard to determine whether static stretching or dynamic stretching is preferred overall by the participants.

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APPENDICES

APPENDIX A

Survey Consent Form

Dear Participant,

My name is Emma Baalman and I am a graduate student at Southern Illinois University. The goal of this project is to understand the preferences of static stretching and dynamic stretching amongst division I student athletes from Southern Illinois University.

This section of the research will include a survey. The survey will take 5-10 minutes to complete. At the end of the survey, you will be notified that survey is complete. The risks of this survey are minimal, and if you feel uncomfortable answering a question, they may be skipped if you choose not to answer. A mental risk may include being influenced towards a specific stretch. A benefit of doing this survey may include gaining knowledge towards different types of stretching.

Your responses will be kept confidential. Your participation is voluntary, and you may refuse to participate.

You can withdraw your participation at any time. You can withdraw by closing the browser. If you choose to withdraw, the responses given up to that point will be used. After the research is concluded your email will be deleted.

If you have any questions or concerns, please contact me or my advisor using the information below.

Emma Baalman, BS
Department of Kinesiology, Southern Illinois University Carbondale
emma.baalman@siu.edu
(618)-535-4357

Philip Anton, Ph.D.,
Department of Kinesiology, Southern Illinois University Carbondale
panton@siu.edu
(618)-453-3116

This project has been reviewed and approved by the SIUC Institutional Review Board. Questions concerning your rights as a participant in this research may be addressed to the committee chairperson, Office of Research Compliance, SIUC, Carbondale, IL 62901-4344. Phone (618) 453-4534. Email siuhsc@siu.edu

By clicking "Yes, I consent" below you certify that you are at least 18 years of age and consent to participate in this research.

APPENDIX B

Interview Consent Form

Dear Participant,

My name is Emma Baalman and I am a graduate student at Southern Illinois University. The goal of this study is to understand the preferences of static stretching and dynamic stretching amongst division I student athletes from Southern Illinois University.

This section of the research will only include an interview. If chosen for an interview, the research will follow-up with you to determine a time for the interview. The interview will take 10-15 minutes. You will be answering questions regarding your specific warm-up routine. You will be audio recorded with the researcher's phone. After the interview, the recording will be uploaded to a safe and confidential drive, then deleted from the researcher's phone. Next, information from the interview will be transcribed to find themes. Only people directly involved in this research will have access to the tapes. After the research is concluded all contact information (emails/phone numbers) and recordings will be deleted.

The risks in the interview are slightly greater than the survey, but still minimal. If you feel uncomfortable answering any questions, they may be skipped by telling the research you prefer not answer. A risk of participating the interview is that you may feel the questions are too personal. You may also gain knowledge about your specific warm-up routine, which would be a benefit to participating in the interview.

Your responses will be logged, but your information will be kept confidential. Quotes from this interview may be used. Your participation is voluntary, and you may refuse to participate. You can withdraw your participation at any time. You can withdrawal by telling the researcher you do not wish to participate further in the interview. If you choose to withdraw, the responses given up to that point will be used.

If you have any questions or concerns, please contact me or my advisor using the information below.

Emma Baalman, BS
Department of Kinesiology, Southern Illinois University
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By signing below, you certify that you are at least 18 years of age and consent to participate in this research. Put your initials in the space to indicate that you either agree or disagree to be recorded and quoted. Once completed and signed, please email this consent form back to emma.baalman@siu.edu.

I agree ____/disagree____ to have my interview recorded. I agree____/disagree____ to be quoted with a pseudonym by Emma Baalman.

Signature:_____

APPENDIX C

Cover Letter/Email Solicitation for Participation in Research

Southern Illinois University Carbondale

Dear Participant:

My name is Emma Baalman and I am a graduate student at Southern Illinois University. I am conducting a study to investigate the preferences of either static stretching or dynamic stretching as a warm-up. To learn more about this, I will be recruiting various athletes from the athletic department at Southern Illinois University to participate in a survey and interview.

This research will include a survey and an interview. The survey will take 5-10 minutes to complete. During the survey portion you will be answering questions about dynamic and static stretching. If you are willing to participate in the interview, it will take 10-15 minutes. You will be answering questions about your specific warm-up protocol. All responses will be kept confidential within reasonable limits. Only people directly involved with this project will have access to the surveys and interviews. Your participation is voluntary; you do not have to participate if you do not want to and you may withdraw at any time, without penalty.

You will not be harmed or involved in any risk. If, at any point and for any reason, you want to stop participating in the study, you are free to do that. Even after permission has been given, you can tell the researcher that you have changed your mind and would rather not participate. There is no penalty for withdrawing from the study. If you choose to withdraw, the responses given up to that point will be used.

If you are interested in the survey, you can follow the link at the bottom of this email. Once the survey is opened an Informed Consent Form will appear.

If you are interested in the interview, please see the attachment. The attachment is the consent form for the interview. Please sign the form and email it to emma.baalman@siu.edu. Once the consent form is received, the research will contact you to set up a time for the interview. A reminder email will be sent in one week to all participants.

If you have any questions about this research, please contact:

Emma Baalman, BS
Department of Kinesiology, Southern Illinois University
emma.baalman@siu.edu
(618)-535-4357

Philip Anton, Ph.D.,
Department of Kinesiology, Southern Illinois University Carbondale
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This project has been reviewed and approved by the SIUC Institutional Review Board. Questions concerning your rights as a participant in this research may be addressed to the committee chairperson, Office of Research Compliance, SIUC, Carbondale, IL 62901-4344. Phone (618) 453-4534. Email siuhsc@siu.edu

Link to survey on Survey Monkey: <https://www.surveymonkey.com/r/QSX6DNS>

APPENDIX D

Survey Questions

Section 1

1. Are you Male/Female/Non-Binary?
2. What collegiate sport(s) do you participate in?
3. How long have you participated in collegiate sports?

Section 2 (Static Stretching)

1. Do you use static stretching?
2. When do you use static stretching?
3. What is your purpose for using static stretching? (Increase blood flow, increase flexibility, improve performance, prevent injuries, relaxation, etc.)
4. Which body part(s) do you target with static stretching?
5. How did you learn about static stretching?

Section 3 (Dynamic Stretching)

1. Do you use dynamic stretching?
2. When do you use dynamic stretching?
3. What is your purpose for using dynamic stretching? (Increase blood flow, increase flexibility, improve performance, prevent injuries, relaxation, etc.)
4. Which body part(s) do you target with dynamic stretching?
5. How did you learn about dynamic stretching?

APPENDIX E

Interview Questions

1. Do you have to follow a specific warm-up protocol provided by a coach?
 - a. If yes:
 - i. Does it focus more on dynamic or static movements?
 - ii. Are there specific movements that your preferred over others? Why?
 - b. If no:
 - i. Do create your own warm-up protocol before practice and competitions?
 1. Is it more dynamic or static movements?
 2. Do you do the same things every time? Why or why not?
2. Is your practice warm-up different from your pre-competition warm-up?
 - a. If yes:
 - i. What is different between the two warm-ups?
 - ii. Which do you prefer and why?
3. After your warm-up protocol, do you feel adequately ready or “warm” for participation in your sport?
 - a. How do you measure your physical preparedness? (heart rate, range of motion, body temp, general feeling)
4. Do you think warming-up is an important component in preparing your body to perform at its best? Why or why not?

APPENDIX F

Interview Transcriptions

Participant 1 Interview (Football):

Researcher: Do you have a specific warm-up protocol that is proved by a coach or do you kind of do your own thing?

Participant: Its provided by a coach

Researcher: Do you know if it focuses more on dynamic or static movements

Participant: Could explain the differences between the two?

Researcher: Yeah, of course. A dynamic stretch is move of your high knees, butt kicks, and carioca. Static stretching is more of toe touches, quad pulls, and hamstring stretch. Does that make sense.

Participant: Yeah we do more dynamic stuff. Like we do, a skips, walking quad stretches.

Whatever do is we are moving. We don't do anything still.

Researcher: Okay thank you. Is there a specific movement of those dynamic stretches that you use, prefer as an individual?

Participant: Yeah, I really, like the walking quad stretch.

Researcher: You stretch your quad and then reach out in front.

Participant: Yeah you reach out in front while holding the other back.

Researcher: Do you know why you prefer that one over another stretch?

Participant: I feel like it warms your muscle while stretch them because you also have to balance.

Researcher: After you finish your warm-up do feel as if you are adequately ready or do you feel that you need to do more individually?

Participant: Yeah, I feel like I am adequately ready. If anything, I feel like our warm-up is a workout.

Researcher: Are your practice warm-ups different from your game warm-ups?

Participant: Yeah, they are.

Researcher: Okay. In what way are they different?

Participant: We try you put the ball more in a game warm-up, we catch more footballs. We usually don't catch before practice. We do more football related warm-ups.

Researcher: Like more sport-specific?

Participant: Yeah, like dropping into zones.

Researcher: Do you prefer a game warm-up versus a practice warm-up?

Participant: Ummm.... Yeah, I actually would say yes. We do a little bit of both, like the weightlifting coach stretches us out kind a like practice in the beginning, and then we get into football specific. So, I think the football game ones are a little bit more tiring.

Researcher: So, do you prefer that?

Participant: Yeah, I do, because I feel like I get to work on my football skills more often.

Researcher: As an athlete do you believe that warming-up is an important part of being able to perform at your best?

Participant: Definitely, I do.

Researcher: Why is that?

Participant: Umm... well starting cold can cause injuries, I has for me before. Just the ability to get back in motion can prevent injuries as well. At the same time, I like to already have a broken sweat by the time its game time.

Participant 2 Interview (Volleyball):

Researcher: Do you have to follow specific warm-up protocols provided by a coach?

Participant: Yes, I do.

Researcher: Does the warm-up focus more on dynamic or static stretching?

Participant: Ohh its kind of half and half.

Researcher: Are there specific movements that you prefer over others?

Participant: I like static stretching more because I feel like I get a deeper stretch. I also know that dynamic stretching will increase my blood flow and help me warm-up faster.

Researcher: After your warm-up protocol do you feel adequate ready or “warm” for participation in your sport?

Participant: Yes, I would say I do feel ready after our warm-up.

Researcher: Is your practice warm-up different from your pre-competition warm-up?

Participant: It is a slight variation. The practice warm-up is longer than the pre-competition warm-up. We do less running before games than practice. We also do arm bands and abs before practice.

Researcher: Do you prefer your practice warm-up over your competition warm-up?

Participant: I prefer the competition warm-up

Researcher: Do you think that warming up is a key component to allow you to perform at your best?

Participant: I do. I think that if I didn’t warm up, my shoulder problems would be worse. I defiantly need to warm-up for my lower body as well

Researcher: So you feel that if you did not warm-up, you would be more sustainable to injuries?

Participant: Yes, yes I would definitely be more susceptible to injuries. In fact, one time I did not warm-up and I pulled my hamstring.

Participant 3 (Women's Basketball):

Researcher: Do you have to follow a specific warm-up provided by a coach or do you warm-up on your own.

Participant: We have to follow a warm-up that is given to us by our strength coach.

Researcher: Does the warm-up focus more on dynamic or static movement?

Participant: For competition and practice it is a dynamic.

Researcher: Is weight training warm-up different?

Participant: It is a little different, but still mostly dynamic.

Researcher: Do you mix in static stretching?

Participant: Yeah, a little. Like we do stand quad pull for about 5 secs and then switch.

Researcher: Is there any specific movement you like over other movements?

Participant: I like hamstring kicks. Mainly because I need those to get moving and they get pretty tight sometimes.

Researcher: Once you are done with the warm-up provided by your coach, do you feel like you are ready to go or do you need to do more stuff on your own?

Participant: Yeah, I am ready to go.

Researcher: Is your practice warm-up different from your game warm-up?

Participant: They are in a different order. Before games we do a little more static, like trunk rolls.

Researcher: For example, I have done game warm-ups that are about 45 minutes long and then are practice warm-up is maybe 15 mins. What is your situation?

Participant: For pre-game stuff we do RPR and hip and back stretches in the locker before we go out on the floor. Then we will come out to the floor and do the trunk rolls and golf swings. And

then we have a full hour warm-up of just basketball specific stuff. The stretching stuff is about 20 mins.

Researcher: As an athlete do you think that warming up is a key part of allowing you to perform at your best?

Participant: Honestly, no. If I just had... like warming up for practice yeah but stretching I don't think it helps me too much.

Researcher: So, you prefer dynamic rather than straight static stretching?

Participant: Yeah, or I could just go out there and do a couple basketball drills. And if I didn't stretch, I probably would be able to notice unless I was sore.

Participant 4 (Baseball):

Researcher: First question, do you have to follow a specific warm-up provided by a coach or do you warm-up individually?

Participant: By a coach.

Researcher: Umm... does it focus on more on dynamic movements or static movements, or like a combination of both?

Participant: Its dynamic for the most part there is not much static stretching in there (the warm-up)?

Researcher: Do you like that it is mostly dynamic, or do you wish there was more static stretching?

Participant: Just dynamic is good with me.

Researcher: Are there certain movements that you prefer over others?

Participant: I prefer a lot more of the hamstring movements. My hamstrings tend to get a lot tighter.

Researcher: After the warm-up do you feel like you are ready to go or do you need to do more on your own?

Participant: After the warm-up I usually feel like I am ready to do what they need me to do.

Researcher: Okay. I know some people think that their warm-up is almost like a separate workout. Do you feel like that is the same for you?

Participant: Not for me, but I have heard that from other people.

Researcher: Is your practice warm-up different from your game warm-up?

Participant: No, it's the same.

Researcher: Do you think that... as an athlete do you think that warming-up is a key component to allowing you to perform at your best?

Participant: Yes, I do believe it is a key component.

Researcher: Why do you think that?

Participant: I think it primes your body and gets you ready to actually perform at the level it needs too.

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Publications:

Rogers, L.Q., Courneya, K.S., Anton, P.M., Verhulst, S., Vicari, S.K., Robbs, R.S., McAuley, E. (2016 - in press). Effects of a multicomponent physical activity behavior change intervention on fatigue, anxiety, and depressive symptomatology in breast cancer survivors: Randomized trial. *Psycho-Oncology*.

Rogers, L.Q., Courneya, K.S., Carter, S.J. Anton, P.M., Verhulst, S., Vicari, S.K., Robbs, R.S., & McAuley, E. (2016, in press). Effects of a multicomponent physical activity behavior change intervention on breast cancer survivor health status outcomes in a randomized controlled trial. *Breast Cancer Research and Treatment*.

Carter, S. J., Hunter, G. R., McAuley, E., Courneya, K. S., Anton, P. M., and Rogers, L. Q. (2016). Lower rate-pressure product during submaximal walking: a link to fatigue improvement following a physical activity intervention among breast cancer survivors. *Journal of Cancer Survivorship*. 1-8

Rogers, L.Q., Courneya, K.S., Anton, P.M., Hopkins-Price, P., et al. (2015) Effects of the BEAT Cancer physical activity behavior change intervention on physical activity, aerobic fitness, and quality of life in breast cancer survivors: a multicenter randomized controlled trial. *Breast Cancer Research and Treatment*, 149(1), 109-119

Anton, P. M., Partridge, J. A., & Morrissy, M. (2013). Cancer caregivers' perceptions of an exercise and nutrition program. *Supportive Care in Cancer*, 21(3), 803-810