

AN EXAMINATION OF PRE-ACTIVITY AND POST-ACTIVITY STRETCHING
PRACTICES OF CROSS COUNTRY AND TRACK AND FIELD DISTANCE
COACHES

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MATTHEW BENNER

ADVISER – DR. LAWRENCE JUDGE

SCHOOL OF PHYSICAL EDUCATION, SPORT, & EXERCISE SCIENCE

COORDINATOR, ONLINE COACHING PROGRAM

BALL STATE UNIVERSITY

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ABSTRACT

PAPER TITLE: An Examination of Pre-Activity and Post-Activity Flexibility Practices of Cross Country and Track and Field Distance Throws Coaches

STUDENT: Mathew Benner

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The purpose of this study was to determine whether coaching certification courses in track and field and cross country are effective in promoting proper pre- and post-activity stretching practices in NCAA division I, II, and III cross country and track and field distance programs. Questionnaires were sent to 770 NCAA Division I, Division II, and Division III programs in the United States. 108 coaches (84 males & 24 female) participated in the study. Chi Square analysis ($\chi^2=21.582$, $p=0.0174$) revealed that non-certified coaches reported greater usage of static stretching alone (18.9%, $n=9$) versus their certified counterparts (1.8%, $n=1$). In addition, certified coaches reported higher usage of dynamic flexibility only during the pre-activity period (47.4%, $n=27$) versus non-certified peers (32.4%, $n=16$). Coaches were also asked if they allowed for static stretching between interval work and events in track and field, and as expected ($\chi^2=11.948$, $p=0.0177$), a higher percentage of non-certified coaches (45.5%, $n=23$)

reported allowing athletes to perform static stretches between intervals at practice than certified peers (37.9%, n=22). Results indicate that even though coaching certification courses are an effective tool for communicating current information about stretching practices, there are still many certified coaches who are not implementing the practices into in pre-activity routines.

KEY WORDS: dynamic stretching, static stretching, warm-up, cool-down

Introduction

Many topics in the athletic world will be debated, but the use of a pre-workout warm-up routine is a standard practice used by coaches. Most coaches will agree that a warm-up is essential before any physical activity in order to activate muscles and prevent injuries to the muscle groups being used. An abundant amount of recent research, however, has created a debate regarding the content of warm-up routines because negative effects from the use of static stretching have been proven (Cramer, Housh, Coburn, Beck, & Johnson, 2006; Curry, Chengkalath, Crouch, Romance, & Manns, 2009; Kistler, Walsh, Horn, & Cox, 2010; Marek et al., 2005; Marganato, 2008; Papadopoulos, Siatras, & Kellis, 2005; Torres, Conceição, Sampaio, Dantas, 2009; Yamaguchi, Ishii, Yamanaka, & Yasuda, 2006). In contrast to this research, two more recent studies have found static stretching does not have a negative effect on athletic performance (Unick, Kieffer, Cheesman, & Feeney, 2005; Bazzett-Jones, 2008) but both of these studies claimed that further research must be completed to prove any positive or negative effects of static stretching. As a result of these mixed research results, many coaches who had been promoting the practice of static stretching are now looking towards other forms of stretching to properly activate the muscle groups that are utilized in a given sport. This study will examine the certifications and education of college distance coaches in relation to their current pre- and post activity stretching practices with

the intention of determining whether current education programs are promoting positive stretching practices.

Literature Review

Daniels (2001) stated that endurance training involves seven principles that need to be followed when creating a plan for building endurance. These are a certain set of principles that are easily understood by most distance runners and distance coaches. The body will experience and react to stress (i.e. training). Based on the prescribed training, there is often a “predictable rate of improvement” that the endurance athlete achieves. There are limits (i.e. genetic factors) to the amount of improvement that the runner will achieve, so a qualified coach will design a program to reach these limits at the end of the season. Also, the more stress that is applied to a runner's body, the less the benefits will be, and rest will be needed. Increasing training too quickly can cause unneeded stress to a runner's body as well. In order to be a better runner, the body parts that are involved in the running process must be involved in the running training. Legs and associated muscles must be stressed in order to see a benefit. Once a certain level is achieved, it does not need as much stress to maintain the level of fitness as it took to get there (Daniels, 2001).

Daniels (2001) goes on to warn that there are certain mistakes that can be made when training distance runners. One common mistake is assuming that every runner has the same physical qualities. Coaches need to design workouts that are geared towards runners of all abilities. Runners very often ignore the signs that something is wrong. As a result, injuries often go untreated and persist for longer than necessary. Another common

mistake for runners is the lack of focus on flexibility and the unwillingness to change their behaviors to make improvements in the area of flexibility (Daniels, 2001).

Flexibility is a particularly important focus area for a running coach when entering a new season.

All coaches recognize that intense training and exercising of any kind can have certain inherent risks along with benefits. Muscles are broken down in order to be rebuilt more strongly (Baechle & Earle, 2008). Energy stores are often depleted but are restored in an effort to increase endurance. Injuries can occur when athletes push beyond their physical limitations. Distance runners assume these risks on a daily basis as they must train regularly to maintain a solid endurance base. The coaches of these runners realize that in order to minimize risks, pre-activity warm-up is required. A good coach must weigh the costs and benefits of training and exercise to make an informed decision about the best approach for each athlete. The recommendations for stretching approaches have changed over the years. There are four basic forms of stretching that are used by coaches. These include ballistic stretching, Proprioceptive Neuromuscular Facilitation (PNF) stretching, static stretching, and dynamic stretching.

Ballistic stretching is one of the older forms of stretching used before a workout. This exercise involves bouncing movements that are intended to activate the muscles and increase core temperatures (Baechle & Earle, 2008; Judge, Bodey, Bellar, Bottone, & Wanless, 2010). In this form of stretching, the stretch is not held for any length of time. According to Woolstenhulme, Griffiths, Woolstenhulme, and Parcell (2006), the use of ballistic stretching before activities that involve jumping can improve vertical jump.

However some coaches believe that this form of stretching is contradictory to a primary purpose of stretching which is to avoid injuries. In fact, Mann and Whedon (2001) found that there was actually a greater risk of injury when using ballistic stretching routines.

PNF stretching replaced ballistic stretching, but this routine had its own set of weaknesses. PNF stretching was an effective way of increasing a muscle's range of motion, as it combined the idea of static stretching with an isometric contraction (Sharman, Cresswell, & Riek, 2006). This is opposite of the purpose of ballistic stretching where the range of motion improves but the muscle temperatures do not increase (Mann & Whedon, 2001). Many studies have been completed to discover the importance of using PNF stretching in a regular routine (Bradley, Olsen, & Portas, 2007; Mahieu, Cook, Wilde, Boon, & Witrouw, 2009; Rees, Murphy, Watsford, McLachlan, & Coutts, 2007; Sharman et al., 2006). However, most studies have found that PNF stretching has a significant impact on increasing range of motion, but other benefits of PNF stretching are limited. In fact, Carvalho, Prati, Carvalho, and Dantas (2009) found that PNF stretching did not help increase muscle actions in strength and power sports. Bradley et al. (2007) also found that PNF stretching should actually not be performed before doing any type of explosive activity.

These studies led many coaches to resort to static stretching as a warm-up routine. In fact static stretching has been the main form of stretching for years. Static stretching involves stretching a muscle and holding the muscle in a stretched position for a pre-determined amount of time (Baechle & Earle, 2008; Judge et al., 2010). Many coaches

believe that static stretching before running could decrease the risk of injuries. However, recent research findings contrast with these traditional beliefs. Negative effects from static stretching range from issues with torque production (Cramer et al., 2006; Papadopoulos et al., 2005) to decreases in strength and power (Curry et al., 2009; Kistler et al., 2010; Marek et al., 2005; Torres et al., 2009; Yamaguchi et al., 2006). Many coaches will still argue that the loss of power and strength is a viable trade-off for the increases in muscle flexibility, especially in sports that do not rely heavily on power production. In a study by Beedle, Leydig, and Carnucci (2007), however, stretching is not required before activity as there is no difference in flexibility between pre-activity and post-activity. Tonoli, Cumps, Aerts, Verhagen, and Meeusin (2010), also pointed out that stretching can be used for flexibility, but it is not effective in injury prevention. Many coaches are finding that performing static stretching at the end of practice is an effective way to increase flexibility without the loss of strength and power. In addition, strength is also important to a runner. According to Karp (2010), strength has actually been proven to increase running economy, one of the major factors in distance running. Grivas, Soulas, Manou, Voutselas, and Papanikolaou (2009) continues to say that not only does strength improve running economy, but also improves technique, and better technique makes for more efficient running.

In sports such as football and sprinting, these force deficits are extremely important to consider. On the contrary, in the sports of cross country and distance running where muscle endurance and oxygen consumption are the main focus and overuse injuries are frequent, there are still many questions. A study by Allison, Bailey, and

Folland (2008) proved there is no benefit to running economy for those runners who performed static stretching before activity. In a similar study by Bonacci, Chapman, Blanch, and Vicenzino (2009), it was discovered that no improvements to running economy were found with the use of pre-exercise stretching. As a result, many coaches now believe that past practices of pre-exercise stretching may be obsolete. Static stretching can be moved to the end of practice for increased flexibility.

Coaches have turned to dynamic warm-up to meet the pre-activity stretching needs of their athletes. Dynamic stretching involves movements that are similar to the actions athletes will be performing in the sport they are participating in (Baechle & Earle, 2008; Judge et al., 2010). This type of stretching is growing in popularity as the coach can tailor the stretching to the movements of the sport that they are coaching. The coach will choose motions that will be used by the runners in this type of stretching and, similar to ballistic stretching, the muscle temperature increases and activation of muscles is produced. This type of stretching is better for the athlete as it removes the bouncing that can lead to injuries.

In dynamic stretching, the main benefit to the runner is the activation of the muscles needed for exercise. According to Skof and Strojnik (2007), sprinting and bounding activities before exercise can actually help increase muscle activation. Therefore many coaches believe that dynamic stretching is more beneficial to the athletes.

There is an abundance of research on stretching, but despite contradicting evidence, many coaches still prefer to include static stretching before a workout rather

than at the end. Many would agree that the sport of cross country and distance running requires more aerobic fitness than power and strength. However, distance running requires strength and force to climb hills that are components of many cross country courses and any deficit created by improper warm-up routines could cause problems for the runner. Moreover, as stated earlier, there is no benefit to pre-activity static stretching for distance runners. Running economy, one of the most important factors determining competitive running success, remains the same whether static stretching is performed or not (Allison et al., 2008; Bonacci et al., 2009).

Many organizations have developed certification programs to help provide pertinent information to coaches. In the sports of track and field and cross country, the major governing body that makes recommendations is the United States Track and Field (USATF, 2011) organization. The USATF offers three levels of certification. Level one certification is designed as a fundamental program that develops the basics of track and field and cross country. This program is designed to help coaches become more informed about high school track and field and learn how to develop runners.

Level two certification is geared towards more specific training. Each coach that attends the level two training must choose a specific focus area. Focus areas include sprints, endurance, jumps, throws and combined events. Level two certification is generally geared at higher level coaching.

Level three certification is even more specific and focused. Each coach learns more specific coaching training in their chosen focus areas. This certification level is geared toward coaches wishing to coach at and above the college level.

In addition to the certification and training in the different events of track and field and cross country, many coaches have the resources to work with certified strength and conditioning experts. The strengths and conditioning experts are governed and certified by the National Strength and Conditioning Association (NSCA, 2011). All certified strength coaches can offer the head coaches advice on training the athletes in a more effective way. The strength and conditioning coach could advise the coach on using proper stretching and warm-up routines to train the athletes.

Coaches have many resources available to help them become more knowledgeable about the advances in training techniques, including the previously mentioned certification courses. The question still remains regarding the effectiveness of these certification courses in teaching proper stretching techniques. If the coaching certification is effective, then coaches who are certified by the USATF would likely be using the most up to date stretching techniques. If coaches are certified, then they would be expected to be using dynamic stretching as a more effective stretching routine as current research indicates. They would also know and appreciate that flexibility can be increased by placing the static stretching at the end of the workout. But there is little research into whether the training is actually producing these desired actions in the coaches being certified.

Previous studies by Judge et al. (2008, 2009, In Press) have been performed to examine the use of dynamic stretching over static stretching or other pre- and post activity stretching regimens in college football, volleyball, basketball, and tennis coaches. In both cases, the research performed was used to determine if coaching certification had

an effect on whether a coach used static stretching or dynamic stretching. In most of the studies, further research was needed due to insignificant evidence pointing to the idea that certification increased the use of dynamic stretching. However, not much research has been completed to determine the effect of coaching certification on the stretching practices of distance coaches. The purpose of this study will be to examine coaching decisions made by college cross country and track and field distance coaches related to pre- and post-activity stretching and whether those decisions are influenced by the education and certification level of the coach.

Method

Sampling Procedure

The purpose of this study was to ascertain stretching practices conducted in men's Division I, Division II, and Division III cross country and track and field programs. To avoid redundancy, only one coach per program, the head coach, or distance coach in the instance where the head track and field coach was not the distance coach, was contacted about the study. The assumption was that the head coach would complete the survey instrument or direct the staff member responsible for stretching activities to complete the survey instrument. Current email addresses for all Division I, Division II, and Division III head cross country and track and field coaches were obtained from the current athletic websites of the institutions involved in the study. An introductory email explained the purpose of the study and provided a hyperlink to the institutional review board approved, web based informed consent and survey instrument. Data was collected during a three week period in February/March 2011. Early season was determined to be the best

timeframe to maximize coaches' recall of stretching practices used during the current season and coaches' participation in the study. A reminder email was sent to non-respondents one week after the initial email in an effort to increase the overall response rate.

Instrumentation

The authors designed an institutional review board approval survey instrument to gather demographic and educational background information as well as specific pre- and post- activity practices. The survey instrument consisted of 35 questions. The first part of the questionnaire (12 questions) focused on the participant's personal and educational background information whereas the second half (23 questions) pertained to the pre- and post- activity stretching practices used with the runners. Content validity was established in two ways. The survey was reviewed by experts for clarity and construction of the questions, and only minor editing was required to improve the clarity of the questions. Wording of the questions was designed to include descriptive information to counteract against misunderstanding of key terminology. Responses were similarly worded to maximize participant comprehension; previous research using similar questions did not reveal any difficulty with participant comprehension.

Statistical Analysis:

Data was analyzed via Pearson's χ^2 tests to determine reported differences on items of interest based upon descriptive data. All analysis was done using a modern

statistics software package (JMP ver 9.0). Statistical significance was set a priori at alpha < 0.05.

RESULTS

From the 770 NCAA Division I, II, and III track and field programs, 108 coaches returned completed usable surveys. This represents 14.1% of a finite population. The low response rate may have resulted from the following factors: (a) spam control software may have sorted introductory and follow-up emails into a bulk mail folder, (b) coaches may not have been interested in the topic or may not have perceived a tangible benefit from study participation, and (c) coaches may not have had sufficient time to complete the survey instrument due to the competitive or recruiting calendar (e.g., placed on “to do” list). While the response rate is relatively low by traditional standards, review of institution and conference affiliation data suggests the sample is representative of Division I, II and III track and field programs. Nonetheless, caution is warranted as factors may exist which limit the generalization of study results.

Demographic Data

The demographic characteristics for participants in the investigation were as follows: (n=108, 77.6% male 22.4% female, age: 41.31 ± 12.0 yrs). Respondents were primarily head coaches (60.2%), and possessed an average of 13.6 ± 10.2 yrs overall years of experience coaching college track and field and/or cross country. A large number of coaches (46.1%) did not possess a USATF track and field coaching certification nor a strength and conditioning coaching certification.

Pre-Activity Warm-up and Stretching Practices

One hundred-six (98.1%) of the respondents reported having their athletes perform a pre-activity warm-up ‘always’ or ‘almost always.’ Most (89.4%) of the respondents of this survey reported having their athletes perform some sort of pre-activity stretch, with only sixteen not performing any stretching. Coaches typically prescribed a combination of static and dynamic stretching activities (44.7%) or dynamic stretching activities (41.5%) prior to the athletic event. To a much lesser extent coaches exclusively utilized static stretching activities (8.5%), ballistic stretching exercises (4.3%), and PNF stretching exercises (1.1%). Interestingly, among coaches who incorporated dynamic stretching into the group warm-up, 43.4% subsequently allowed athletes to perform static stretching independently and/or with assistance from the athletic trainer or the massage therapist.

Post-Activity Cool-Down and Stretching Practices

Coaches indicated athletes either always or almost always completed a stretching regime (61.3%) or jogging cool-down (86.0%) after an athletic event. Coaches typically used static stretching activities (53.8%) following the athletic event. To a much lesser extent, coaches used dynamic stretching (4.8%), a combination of static and dynamic stretching activities (36.5%), and PNF stretching (4.8%). Ballistic stretching was not reported as a post-activity stretching practice.

Perceived Benefits of Stretching Activities

The majority of coaches indicated pre-activity group stretching was beneficial in terms of injury prevention (77.8%) and improved performance (76.4%). Similarly, coaches indicated post-activity group stretching was beneficial in terms of injury prevention (88.9%) and improved performance (87.7%).

Sources of Information

Another area of interest was the key sources of influence for the foundation of knowledge regarding pre-activity stretching. A majority of the respondents n=40 (36.1% of the total respondents) reported that media (books, videos, online, etc.) was their primary source of influence regarding pre-activity stretching. The remaining coaches reported that coaching education was the primary influence (33.3%), followed by your coach (high school or college) (28.1%), another distance coach (26.0%), and finally the strength and conditioning coach (11.5%).

Coaching Certification

Coaching certification was another area of significant difference for pre-activity stretching routines. The results of the analysis revealed two differences in reported stretching activities between coaches who had or had not earned a USA Track and Field Coaching Certification (Figure 1). Non-certified coaches responded differently than their certified peers regarding pre-activity stretching practices ($\chi^2=21.582$, $p=0.0174$). Non-certified coaches reported greater usage of static stretching alone (18.9%) versus their certified counterparts (1.8%); and certified coaches reported higher usage of dynamic flexibility only during the pre-activity period (47.4%) versus non-certified peers (32.4%).

Chi-square analysis also revealed a difference between USATF certified and non-certified coaches (Figure 2) in allowing static stretching between interval runs during practice ($\chi^2=11.948$, $p=0.0177$). A higher percentage of non-certified coaches (45.5%) reported allowing athletes to perform static stretches between intervals at practice than certified peers (37.9%).

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DISCUSSION

Pre-activity Warm-up and Flexibility

A properly designed strength and conditioning program includes a strategy devoted to preparing the athlete for a specific activity. This is supported by the evidence as most (98.1%) of the coaches surveyed reported to performing some sort of warm-up activity before doing the prescribed training. This is similar to Judge's et al. (2009, In Press) earlier studies where all of Division I and III football coaches surveyed and most (98.6%) of Division I and III basketball coaches surveyed performed pre-activity warm-ups of some kind always or almost always. Without proper activation, the muscles needed for running cannot perform optimally, and these coaches seem to be aware of this fact.

One of the primary components of proper muscle activation is stretching. Most coaches (89.4%) have their athletes perform pre-activity stretching before training. These coaches can recognize a need for flexibility as an integral ingredient of the ideal

endurance runner. However these coaches were heavily divided on the proper technique. The largest number of coaches (44.7%) claimed they used a combination of static and dynamic stretching in their pre-activity training. This was followed by a smaller percentage of coaches (41.5%) who said that they only have the runners perform dynamic stretching activities before training, which is the current research supported technique for warming up prior to training. This may lead some to believe that these coaches have not been kept completely up to date on recent research into stretching practices. Fortunately, only nine (8.5%) of the coaches are limiting the pre-activity stretching to static stretching which has been found to have negative effects on running.

As stated earlier, it is interesting to report that 47 (43.5%) of the coaches reported that they have allowed their athletes to perform static stretching on their own or with the assistance of an athletic trainer. Many distance runners have developed many of their own training routines including pre-activity training. Distance running is a sport that requires a large amount of self accountability on the runner's part. As such, the runner will ultimately need to be informed of research discoveries as well. Any changes in the pre-activity stretching activities will need to be communicated by the coach to the runners involved.

Post Activity Stretching

Cooling down after any activity is as important as any activity done before the athletic event. This is apparent as 86% of the coaches surveyed felt that they always or almost always had their athletes do some sort of light jogging to cool down after activity. What was surprising was that only slightly more than half (61.3%) of the coaches had the

athletes perform stretching of some kind. Since post-activity is the optimal time to perform the static stretching to improve flexibility, it would be expected that more coaches would have their athletes perform stretching at that time. It is, however, encouraging that most of the coaches (90.3%) that had the athletes perform stretching included some form of static stretching in the post activity stretching routine.

Perceived Benefits

Most of the coaches were willing to admit that there is some benefit to using a pre- and post activity stretching routine as part of the prescribed work being performed. Benefits ranged from injury prevention to improved performance and most saw some or both as a benefit. An important question was where coaches get the information regarding pre- and post-activity routines and the components needed for inclusion. The largest percentage reported that the information came from the media which included, but was not limited to, books, videos, and journals. However this was only slightly more than one third of the coaches surveyed which means that approximately two thirds of the other coaches surveyed were spread out among other sources like coaching education classes, the coach's former coaches, and speaking directly with other coaches. With such a wide array of means of finding the information, a coach could unknowingly and easily utilize information that is not research-based.

Coaching Certification

It has been stated repeatedly that static stretching before activity has more of a negative effect on running abilities than a positive effect. And it has been believed that

coaching certification courses would be a great benefit to a coach in communicating this information. The results do point to this to an extent. A low percentage of coaches in general perform static stretching as part of the pre-activity routine. This means that coaching certification is not necessarily a determinant for knowing the proper training routines. However, since 18.9% of the non-certified coaches reported allowing static stretching by itself compared to 1.9% of the certified coaches allowing only static stretching, it can be inferred that coaches who are certified are less likely to perform stretching practices that are not research based.

Also, almost half (47.4%) of the certified coaches only utilized the more current research based idea of dynamic stretching with their athletes as opposed to 32.4% of the non-certified coaches reporting only using dynamic warm-up routines. This indicates that coaching certification has made an impact on those involved in the education program; however, caution should be taken with these statements as these numbers still only show less than half of the certified coaches doing the research based dynamic stretching, meaning that there are many certified coaches that have not adopted the dynamic stretching only routine.

The other interesting finding was the number of coaches that allowed static stretching between intervals or events. Almost half of the non-certified coaches allowed this practice compared to only a third of the certified coaches agreeing on this idea. It would seem that certification classes have helped to deter coaches from this practice, but there are still many who utilize the static stretching in a way that could hinder athletes' abilities before they race.

In reviewing these findings, it should be noted that the study is not without limitations as generalizations from the current study are difficult due to the sample size. Self-reported questionnaires and limited comparable data create difficulty in assessing result reliability (Alaranta et al., 2006). Survey research has limitations: answers may be intentionally false as the subjects questioned may not wish to reveal their true feelings, even if anonymity and confidentiality are guaranteed by the investigators. Thus, these results should be interpreted with caution.

Practical Applications

It is apparent that a coach cannot solely rely on past practices that have been handed down by previous coaches, especially when it comes to the flexibility and injury prevention programs of their cross country and distance teams. Pre- and post-activity stretching practices are very important to a runner, and a coach must stay up to date on the latest research based stretching practices. The availability of coaching certification courses provided by the USATF is a useful resource in allowing coaches to find the most pertinent information about running practices. By getting involved in these coaching education courses, a coach can tap into a valuable resource regarding the most current research-based practices in the field of distance running. However, if a coach is to improve the coaching practices of his program, he must be willing to look at current accepted ideas with an open mind and adopt new practices with the intention of doing the best he can for his runners.

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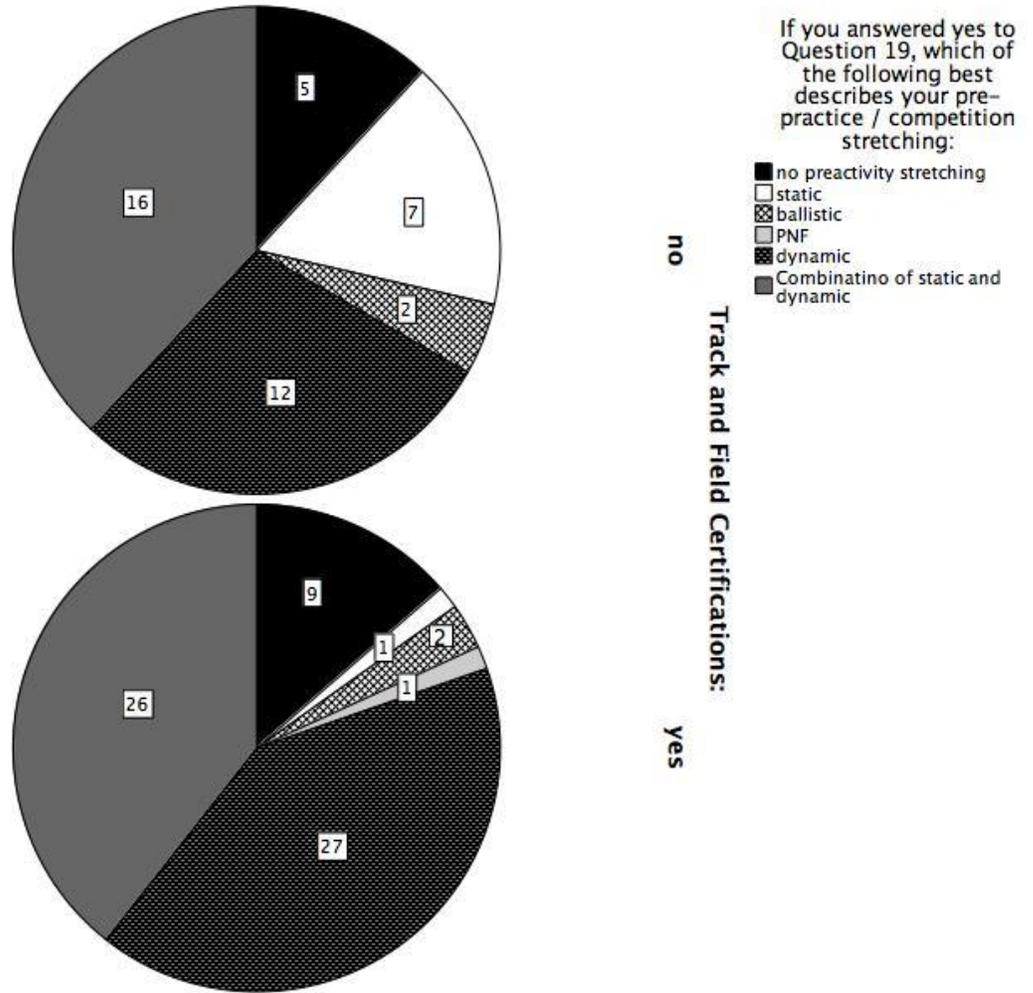


Figure 1: Differences in reported stretching activities between coaches who had or had not earned a USA Track and Field Coaching Certification

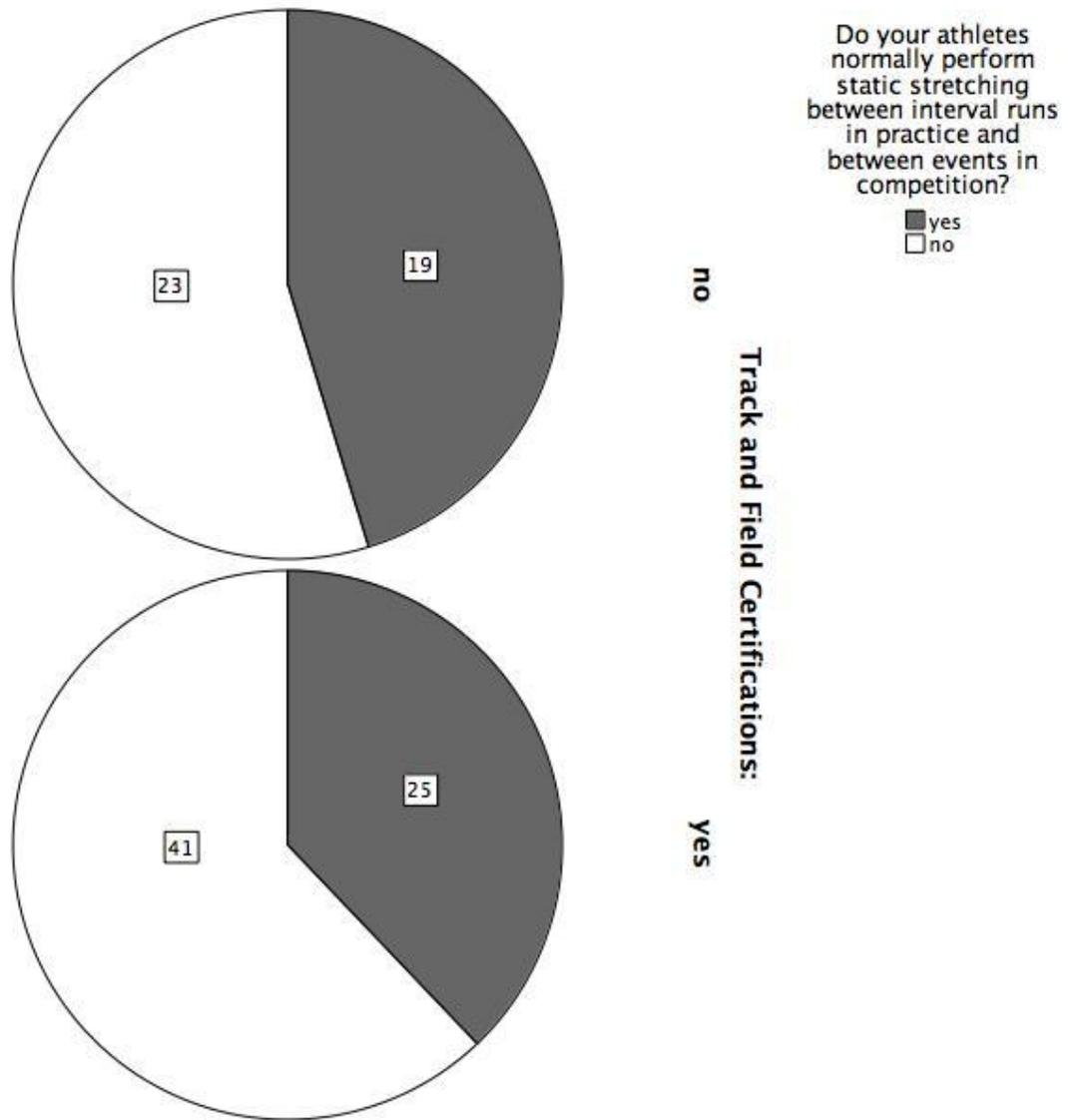


Figure 2: Difference between USATF certified and non-certified coaches in allowing static stretching between interval runs during practice.