AN EXAMINATION OF PRE-ACTIVITY AND POST-ACTIVITY STRETCHING
PRACTICES OF NATIONAL COLLEGIATE ATHLETIC ASSOCIATION WOMEN’S
TRACK AND FIELD PROGRAMS

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BY
KELLY COOPER

DR. LAWRENCE JUDGE – ADVISOR

BALL STATE UNIVERSITY
MUNCIE, INDIANA
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The sprint, jump, and hurdle events in track and field are complex multi-joint, multi-planar activities that involve the vast majority of the musculature. All technical events in track and field use mechanical patterns that attempt to create a summation of forces by creating torques between different parts of the body via stretch reflexes. For this reason, it is essential that the body be finely tuned to optimally perform these techniques. Given the sequential nature and the large range of motions employed by the track and field athlete, training routines must be designed to emphasize strength, power, flexibility, and technique.

Pre-activity stretching is a common technique used by athletes to help prepare the body for the rigors of performance and diminish the incidence of injury through augmented muscle temperature, muscle compliance, and efficiency of physiological responses. From a pedagogical view the warm up and stretching protocols are an important set of inter-related activities that if properly executed will contribute to increasing the efficiency of practice and competition performance. Daily workouts for track and field athletes must begin and end with proper exercises that center around improved range of motion and optimal ranges of flexibility. An adequate warm-up should establish the ability of an athlete’s body to prepare for the demands of training and competitive activities while supporting an increase in performance and reducing the probability of injury (Baechle & Earle, 2008).

Pre-activity static stretching is a common coaching technique that has been multi-faceted across the spectrum of the sporting world for many years. Recent research has focused on the dilemma of what should be the proper protocol for athletes before participating in practice or
competition. Most research has been in agreement that some form of aerobic exercise, followed by a dynamic warm-up is the best protocol for pre-participation, and that static stretching is best used for post-participation. Track and field, with an emphasis on sprinters, hurdlers, and jumpers, is a sport that requires explosive movements. Numerous studies have agreed that pre-activity static stretching reduces performance in activities requiring strength, speed, and power (Faigenbaum et al., 2006; Favero, Midgley, & Bentley, 2009; Fletcher & Anness, 2007; Jaggers, Swank, Frost, & Lee, 2008; Kistler, Walsh, Horn, & Cox, 2010; LaTorre et al., 2010; Marek et al., 2005; Nelson, Driscoll, Landin, Young, & Schexnayder, 2005; Nelson, Kokkonen, & Arnall, 2005; Sekir, Arabaci, Akova, & Kadagan, 2010; Wallman, Mercer, & McWhorter, 2005; Winchester, Nelson, Landin, Young, & Schexnayder, 2008).

This study will examine current coaching practices in relation to static and dynamic stretching on performance and flexibility, and determine whether women’s college track and field coaches are in compliance with recommended pre- and post-activity stretching protocols while examining if years of experience and sources of information affect coaching practices.

The Effects of Static Stretching on Performance

Static stretching before performance can have adverse effects on the body that may also cause poor performance for an athlete. Jaggers et al. (2008) concluded that static stretching should be avoided in pre-activity workouts because of the detrimental effects on the body. Static stretching “involves holding muscle tension at the end of the passive range” (Favero et al., 2009, p. 51). Track and field is a sport that involves explosive movements such as sprinting and jumping. Research has indicated that athletes participating in these events can be hampered by participation in pre-event activities that involve static stretching. Nelson et al. (2005) found that
stretching prior to activity could result in diminished returns regarding performance in short-term exercise requiring explosive outputs such as the high jump and long jump.

Sprinters are susceptible to increased times when they use static stretching as a pre-performance routine. Winchester et al. (2008) found a 3% decrease in sprint performance in 40 meter sprint times when using static stretching methods. Fletcher and Anness (2007) point out that the traditional static stretch can have a deleterious effect on sprint performance. Fletcher and Anness (2007) reported that participants using static stretching, while even combined with dynamic stretching lead to a significant increase in sprint time. Kistler et al. (2010) concluded that the first 40 meters of a 100-meter sprint can be negatively effected when static stretching is utilized within a pre-performance regimen. The study of collegiate male sprinters led Kistler et al. (2010) to suggest that it is dangerous to include static stretching in warm-up activities for 100-meter sprinters.

Jumpers are also susceptible to decreasing performance indicators as a result of using static stretching in pre-performance activities. In a study concerning the effect of static stretching of the gastrocnemius muscle on vertical jump performance, Wallman et al. (2005) found a 5.6% decrease in jump height when static stretching of the gastrocnemius muscle occurred prior to the vertical jump. Wallman et al. (2005) proceeded to advise coaches and trainers that jump height of athletes will be adversely affected if static stretching is performed prior to commencing a prescribed maximal vertical jump, such as the high jump. La Torre et al. (2010) in a study on squat jump performance reported that an acute bout of static stretching reduced jumping performance in the categories of peak force, maximal velocity, and power output. This information suggested that sprinters (with the use of the starting block) and jumpers would be negatively affected by static stretching procedures prior to performance.
Research has also shown that static stretching can be detrimental to muscular strength endurance performance. Nelson et al. (2005) reported that abundant amounts of static stretching on a particular muscle group should be avoided prior to an activity that requires maximal muscular strength endurance. The central finding by Nelson et al. (2005) determined that knee-flexion muscle strength endurance performance was decreased significantly ($p < 0.05$) after an acute static stretching protocol was administered. Marek et al. (2005) reported that static stretching caused deficits in strength, power output, and muscle activation at both slow and fast velocities.

In contrast, several studies indicate that static stretching has no effect on performance. Bazett-Jones, Gibson, and McBride (2008) report that chronic static stretching had no effect on sprint or vertical jump performance in women’s Division III track and field athletes. Also, Lopes, Menegon, Franchini, Tricoli, and Bertuzzi (2010) reported that coaches may use a static stretching protocol as part of their basic warm-up in aerobic activities without fear of reduction in performance. Little and Williams (2006) concluded that static stretching, when included as part of a warm-up, did not negatively harm performance in soccer players. However, Little and Williams (2006) did report that the use of a dynamic warm up (active) was the most effective preparation activity. Chaouachi et al. (2010) reported that static stretching at maximal or submaximal intensity did not have a negative affect on performance in highly trained individuals. Chaouachi et al. (2010) continue to recommend that highly trained individuals that utilize static stretching should also include an appropriate warm-up and dynamic sport-specific activities that allows for five or more minutes of recovery before participation in a sport activity. Egan, Cramer, Massey, and Marek (2006) reported that static stretching had no impact on peak torque or power output during maximal, voluntary concentric isokinetic muscle actions in collegiate
women’s basketball players. It is interesting to note that highly trained athletes appear to be less susceptible to decreased performance or deficits in strength and power than untrained athletes. It is apparent that more conclusive research is needed in this area.

**The Effects of Dynamic Stretching on Performance**

Current research indicates that athletes should incorporate dynamic stretching into the pre-activity phase. Fletcher and Anness (2007) concluded that athletes, in this case track sprinters, should use active dynamic stretches that are similar to motions used in sprinting instead of the use of static stretching protocols. The previously mentioned study reported that all participants, men and women, improved their 50-meter sprint performance when passive static stretching was discontinued in a pre-activity warm-up. In a study on the acute effects of dynamic and ballistic stretching on vertical jump height, force, and power, Jaggers et al. (2008) determined that a significant difference existed in jump power outcomes when dynamic stretch was compared to no stretch. No significant difference was found for jump height or force. Jaggers et al. (2008) also continue to make the suggestion that coaches and athletic trainers should only use dynamic stretching in pre-activity warm-ups. Little and Williams (2006) reported that dynamic stretching resulted in significantly superior performance in acceleration and maximal speed when compared to no stretch, and significantly better performance in agility when compared to no stretch and static stretch warm-up protocols. Curry, Chengkalath, Crouch, Romance, and Manns (2009) concluded that dynamic stretching is superior to static stretching in relation to performance enhancement in power outcomes. For the power variables that were tested, dynamic stretching resulted in improved scores, while static stretching produced a decrement in performance.
Thompsen, Kackley, Palumbo, and Faigenbaum (2007) reported that dynamic exercise utilized in a pre-activity warm-up may produce jumping performances that are improved as compared to static stretching. Thompsen et al. (2007) found that performances on vertical jump and long jump were significantly greater after the use of dynamic warm-up protocols. Interestingly, the previously mentioned study also included the use of a weighted vest as a part of the dynamic exercise. Thompsen et al. (2007) reported that long jump performance was significantly greater with the inclusion of a weighted vest as compared to the same dynamic exercise without the use of a weighted vest. Performances on the vertical jump improved 5.3% and long jump improved 5.4% following dynamic exercise with the inclusion of a weighted vest as compared to a static stretching protocol that also included low-intensity stationary cycling. Also, long jump performance was 2.5% greater with the use of the weighted vest as compared to no use of a weighted vest in the dynamic warm-up. Thompsen et al. (2007) cautioned that the aforesaid suggestion is tentative because of the lack of research pertaining to injury rates with and without a weighted vest in dynamic warm-ups. It is also important to note that the study was only conducted on athletic women. Faigenbaum et al. (2006) studied similar findings in their investigation on high school female athletes which reported long jump performances improved 12.5% following a pre-activity warm-up of nine dynamic exercises performed with a vest weighted at 2% of body mass as compared to a static stretching routine. Vertical jump performance improved 13.5% following the dynamic exercises with a weighted vest. In track and field competitions, any percentage in improvement can become a substantial gain for an individual against all competitors. It appears that more research is necessary in this area concerning the application of weighted vests in a pre-activity warm-up routine.
Sekir et al. (2010) studied the acute effects of static and dynamic stretching on leg flexor and extensor isokinetic strength in elite women athletes. The results of the previously mentioned study found that concentric and eccentric quadriceps and hamstring muscle strength displayed a significant decrease following static stretching and a significant increase following dynamic stretching. These findings support previous research that dynamic stretching may be the most effective technique for enhancing muscle performance during a pre-activity warm-up. Hilfiker, Hubner, Lorenz, and Marti (2007) proposed that five modified drop jumps from a height of 60 cm added to a warm-up can immediately increase jump performance in sports competition that requires a single action, such as the high jump, long jump, and shot put. Hilfiker et al. (2007) reported a consistent tendency for improvement with added jumps to a warm-up routine. It is apparent that more conclusive research is needed in the area concerning the modified drop jumps. Any advantage that can be gained in events such as the long jump, high jump, and shot put are critical to sustained success when mere inches can separate champions from other competitors.

The Effects of Static Stretching on Flexibility

Stone et al. (2006) define stretching as “the act of applying tensile force to lengthen muscle and connective tissue” (p. 66). Stretching is utilized in the effort to improve mobility about a joint, commonly called range of motion (ROM). As previously stated, most research has concluded that static stretching prior to an activity, such as a track and field event that requires explosive movement, may negatively affect performance. The effects of static stretching after a workout in relation to improved flexibility are inconclusive at best, but most research recommends that static stretching, if used, should be included in post-activity workouts. Holt and Lambourne (2008) reported that if static stretching were to be employed, it should
commence after a sport performance. Stone et al. (2006) reported that studies show that athletes who incorporated chronic stretching (non-warm-up) over a long period of time showed performance enhancement through improved flexibility in gymnastics. Faigenbaum et al. (2006) also support the concept that static stretching increases the range of motion at a particular joint but they caution that prolonged static stretching might have unintended adverse effects on anaerobic performance in young athletes. Beedle and Mann (2007) reported that a majority of participants in a study on joint range of motion (ROM) reported in post-testing questions that they preferred static stretching as compared to ballistic stretching because they thought it allowed a better stretch, was less awkward, and that ballistic stretching made them more sore. Aguilar et al. (2012) reported that a static stretching warm-up protocol did not facilitate any positive or negative changes in muscle flexibility. Beedle, Leydig, and Carnucci (2007) found that the placement of stretching, whether prior to or after a workout, does not have any effect on flexibility. The literature indicates that more conclusive research needs to be produced in order to clear up some differences found in previous studies regarding the effects of static stretching on flexibility.

**Coaching Practices**

The placement of stretching, whether prior to and/or after performance, is a topic that requires significant discussion. As previously stated, recent research has delineated that dynamic stretching should be ascertained prior to performance while static stretching should be incorporated into post-activity workouts. Although, Beedle and Mann (2007) reported that athletes should perform a warm-up and stretching routine with which they are most comfortable. Many athletes are under the direct supervision of a coach who typically directs the stretching
protocol to be followed each day in practice. Thus, it is important to investigate the philosophies regarding the stretching activities that a coach may use on a daily basis.

Several studies have been conducted that examined the daily practices of collegiate coaches regarding stretching protocols utilized by their respective teams. In a study involving NCAA Division I women’s volleyball programs, Judge, Bodey, Bellar, Bottone, and Wanless (2010) reported that coaches usually incorporated a mixture of static and dynamic exercises (44%) or dynamic exercises (42%) prior to an athletic event. Static stretching protocols were utilized by 14% of coaches during pre-activity stretching practices. Fifty-eight percent of coaches who utilized dynamic stretching allowed athletes to perform some form of static stretching.

Judge et al. (2010) reported that 71.4% of coaches typically utilized static stretching exercises following an athletic event while 22.4% of coaches used a mixture of static and dynamic exercises post-activity, and 6.1% of coaches reported that they incorporated proprioceptive neuromuscular facilitation (PNF) stretching into post-activity exercises. Coaches indicated that 54% of athletes either always or almost always completed a stretching routine after completion of an athletic event while 44% of athletes completed a stretching plus jogging routine. The majority of coaches (75%) reported that pre-activity group stretching was beneficial in terms of injury prevention and 69.1% of coaches reported it was beneficial in allowing improved performance. Also, 87.3% of coaches reported that post-activity group stretching was beneficial for injury prevention while 69.6% of coaches reported improved performance.

In a study of the stretching practices of Division I and Division III college football programs in the Midwestern United States, Judge, Craig, Baudendistal, and Bodey (2009) reported that 30% of coaches indicated that they used dynamic flexibility stretching only. Nearly
70% of the coaches that responded to the survey indicated that their athletes incorporated post-activity stretching exercises. An interesting finding was that age, divisional status, and certification may influence coaches pre- and post-activity stretching protocols. The study reported that younger coaches (below age 36) did not use pre-stretching (p = 0.30) activities. Nearly 92% of Division I coaches employed a post-activity stretching routine as compared to only 45.5% of Division III coaches that utilized a post-activity stretching routine. Judge et al. (2009) also reported that 91.1% of Division I coaches and only 25% of Division III coaches had obtained Certified Strength and Conditioning Specialist (CSCS) certification. The previously mentioned study concluded that coaching certification helps coaches stay up-to-date with current trends and practices in the coaching field. In a similar study involving collegiate Division I tennis coaches, Judge et al. (2012) reported that the number of years of head coaching experience had a significant (p = 0.029) impact on the pre-activity stretching regimens utilized by coaches. The study also indicated that certification is an important factor in how well research guidelines are followed. It seems clear that coaches need to abide by the suggestions made in previous research regarding coaching practices to stay current on proposed advances made in the coaching field regarding the proper inclusion of stretching practices during daily activities.

Ample literature exists that discusses the benefits and deterrents of many different types of stretching exercises utilized by athletes during pre-activity and post-activity stretching programs. Prevailing research recommends that active dynamic exercises be included in a sufficient warm-up protocol prior to engaging in a competition while static stretching should be incorporated into a post-activity stretching protocol. Most research concludes that static stretching prior to performance will negatively affect performance, especially those activities that
require explosive movements (such as those involving sprinters and jumpers) as well as activities that require muscular strength endurance performance.

Most athletes are under the direction of a coach, which signifies the importance of a coach being highly trained, as well as remaining up-to-date on the most effective means of administering stretching protocols to athletes during daily practices. Recent research has discovered that many coaches still include static stretching in a pre-activity routine rather than following current suggested practices. It is also apparent that coaching certification is an important factor in how well coaches follow prescribed research guidelines. The literature is clear in proposing that track and field coaches evaluate their pre- and post-practice stretching routines with current research in order to provide their athletes with the greatest opportunity to achieve success.

Even with the proliferation of coaches’ education and certification programs, and a greater emphasis on research in this area, it is uncertain if coaching certification is actually impacting the training of athletes. The purpose of this study will be to examine coaching decisions made by women’s college track and field sprint, hurdle, and jumps coaches in relation to pre- and post-activity stretching and whether those decisions are influenced by knowledge acquisition and years of coaching experience.

**METHOD**

**Experimental Approach to the Problem**

The purpose of this investigation was to examine the pre-activity and post-activity warm-up and stretching practices of National Collegiate Athletic Association (NCAA) Division I, II, and III women’s track and field sprint, hurdle, and jump coaches. The use of the survey instrument allowed for the collection of data from a representative sample of the current
population. The survey instrument allowed for the collection of large amounts of information regarding current practices and was compared against demographic and educational classifications. These comparisons were used to understand variables that could potentially influence the alignment of coaching practices with the current scientific understandings.

**Subjects**

One coach at each Division I, II, and III institution was contacted through an email that contained a letter describing the proposed study and a hyperlink to the institutional review board approved web based informed consent and survey instrument. Contact information of the principal investigator was provided to each potential participant if any questions needed to be answered. Surveys were emailed to 770 women’s track and field coaches which were obtained through a Ball State University database and were cross-checked with each institution’s athletics department website.

**Experimental Procedures**

The author designed a questionnaire, based on previous investigations in this area, to gather demographic, professional and educational information, and specific pre-activity and post-activity practices (Judge, et al, 2009). Prior to data collection, content validity of the survey instrument was verified by three strength and conditioning professionals who reviewed the survey questions.

The survey consisted of 42 questions. The first 15 questions related to the participant’s personal and professional information, while the next 23 questions related to the pre-activity and post-activity practices the coaches utilized with their track and field athletes at their respective university. The last 4 questions pertained to each coach’s knowledge acquisition. The questionnaires were distributed via email, and the participants were asked to complete the
questionnaire within 7 days of the date of the initial letter. A follow-up email was sent to coaches a week after the introductory email was distributed to coaches. A hyperlink was included in both of the emails which utilized the services of Survey Monkey, an online survey and data collection website. Of the 770 questionnaires distributed, 101 were returned (13.1% return rate) and represents the subject pool for this study. After data collection was completed, an investigation of the instrument’s content validity was performed using principal component analysis. Like items on the survey were sampled and compared for similarity in response suggesting that the instrument had adequate construct validity. After careful review of the survey instrument, the panel of experts made no substantive changes to the instrument but did alter some of the wording to enhance the clarity of the survey. Wording of the questions was designed to include descriptive information to counteract against misunderstanding of key terminology. For example, ambiguous terms such as “warm-up” and “stretching” were defined for the respondent. Previous research using similar questions did not reveal any difficulty with participant comprehension. A pilot study (n = 20) of USATF level two certified jumps coaches was conducted prior to data collection; the current instrument was calculated using the Cronbach coefficient $\alpha$, and revealed acceptable internal consistency of $\alpha = .744$.

**Statistical Analyses**

Initial data analysis included computing frequency counts and means where applicable. Results were initially computed using all responses collectively to produce descriptive results for the whole sample. Subsequently, items of interest were analyzed by key demographic variables and applicable frequency counts were compared statistically via Pearson’s chi-square analyses in order to assess potential differences. Particular items of interest included the levels of coaching certification, number of years of experience, and key persons or sources of influence on the pre-
activity stretching activity of collegiate sprint, hurdle, and jumps coaches. Significance was set at alpha < .05 for all analyses, and all statistical analyses were performed using JMP version 9.0.

RESULTS

Out of 770 NCAA Division I, II, and III women’s track and field programs, 101 coaches returned completed usable surveys. This represents 13.1% of a finite population. The low response rate may be attributed to the following factors: a) coaches may not have had ample time to respond to the survey instrument due to the survey being distributed after their season had completed; and b) spam control software may have kept the emails from reaching the coaches. Even though the response rate of coaches is considerably lower than expected, review of institution and conference affiliation data suggests the sample is representative of Division I, II, and III women’s track and field programs. Caution is warranted, as factors may exist which limit the generalizations of the results produced by this study.

Demographics

Coaching Background. The characteristics of the coaching background for participants in the investigation were as follows: (n=101, 89.9% male, 9.9% female; age: 42.24±11.77yrs). A majority (72.4%) of respondents were head coaches with (27.7%) of respondents having 20 or more years experience as a college track and field coach, with the median being 12.00 (SD = 10.11). A large number of respondents (72.7%) reported participating in high school track and field. A moderate (22.2%) number of respondents reported that they participated in college track/amateur athletics, while five (5.1%) coaches reported they competed professionally in track and field.
Certification. Sixty-seven (78.8%) respondents maintained at least a USATF Level I certification, while 14 (16.5%) respondents held a USATF Level II certification. A large number (71.9%) of coaches that responded did not possess any certification in strength and conditioning.

Education. The level of formal education and area of degree attainment were also examined. The majority (71%) of respondents completed a graduate degree. A much smaller number (23%) of respondents held at least a college degree, and even fewer (6%) attained a doctorate degree. Interestingly, 27 (27.3%) of the respondents held a degree in physical education.

<Insert Table 1>

Current Pre-Activity Practices

One-hundred one (100%) of the respondents reported having their athletes perform a ‘general’ warm-up prior to the very beginning of their practices, with 87 (86.1%) of those coaches reporting that their teams perform a pre-activity warm-up for longer than ten minutes, 11 (10.9%) reported using 5-10 minutes of pre-activity warm-up, while (3%) reported using 2-5 minutes of pre-activity warm-ups. Eighty-nine (88.1%) respondents reported having their athletes perform some type of pre-activity stretch, with 12 (11.9%) respondents reporting not performing any stretching prior to activity. Of the 88 coaches who responded to the question about describing their pre-practice/competition stretching routine, dynamic stretching was used by 44 (50%) coaches, a combination of static and dynamic stretching was used by 41 (46.6%) coaches, ballistic stretching was used by 2 (2.3%) coaches, and static stretching was used by 1 (1.1%) coach. Of the 89 coaches who responded to the question about describing the length of time of their pre-activity stretching routine, 10 (11.2%) coaches reported that the pre-activity stretching routine lasted less than five minutes, while 28 (31.5%) coaches reported 5-10 minutes,
35 (39.3%) reported 10-15 minutes, and 16 (18%) respondents reported that their dynamic stretching routine lasted longer than fifteen minutes.

<Insert Figure 1>

<Insert Figure 2>

Interestingly, 42 (42.4%) coaches reported allowing for static stretching by their athletes between interval runs in practice and between events during competition. Also, 43 (43%) coaches reported that their athletes stretch with the assistance of the athletic trainer or massage therapist to perform static stretches pre-practice and pre-competition.

Twenty-four coaches (23.8%) reported that they do not think pre-activity flexibility work helps prevent injuries, while 77 (76.2%) think that pre-activity flexibility work does help prevent injuries. Twenty-one (20.8%) coaches reported that they do not think pre-activity flexibility work improves performance, while 80 (79.2%) coaches reported they do think that pre-activity flexibility work does improve performance. Interestingly, 9% of coaches do not believe that flexibility is an area that most sprinters, hurdlers, and jumpers can improve.

Seven (6.9%) coaches reported that they believed that stretching should be emphasized the most for sprinters, hurdlers, and jumpers during pre-activity.

**Current Post-Activity Practices**

One-hundred (99%) of the 101 respondents reported having their athletes perform a ‘cool down’ (i.e. light jogging) post activity, while 99 (98%) coaches reported that their athletes perform a post-activity stretching routine.

Forty-nine (49.5%) respondents stated that static stretching best describes their post-practice stretching while 40 (40.4%) coaches stated that a combination of static and dynamic stretching best describes their post-practice stretching routine. Five (5.1%) coaches indicated that
dynamic flexibility was the routine that best described their post-practice stretching. Four (4%) coaches reported PNF stretching, and 1 (1%) reported ballistic stretching.

<Insert Figure 3>

Seven (7.1%) coaches reported that their athletes’ post-activity stretching routines lasted less than five minutes, while 60 (60.6%) coaches reported stretching 5-10 minutes, 27 (27.3%) reported 10-15 minutes, and 5 (5.1%) reported stretching longer than fifteen minutes. Two (2%) coaches reported that their athletes did not perform post-activity stretching. Interestingly, only 16 coaches (15.8%) reported that their athletes always completed a full post-activity flexibility routine. Forty-eight (47.5%) respondents reported that their athletes almost always completed the full post-activity flexibility routine, while 32 (31.7%) reported their athletes sometimes complete the full post-activity flexibility routine.

<Insert Figure 4>

Twenty-eight (28%) coaches reported that their athletes always completed the full post-activity cool down, with a majority (52%) of coaches reporting their athletes almost always, and fewer (20%) coaches reported that their athletes sometimes complete the full post-activity cool down.

Eleven (11%) coaches reported that they do not think that post-activity flexibility work helps prevent injuries, while most (89%) coaches are in disagreement. Twelve (11.9%) coaches reported that they do not think that post-activity flexibility work improves performance while most (88.1%) coaches reported they do think that post-activity flexibility work helps improve performance.

Forty-five (44.6%) coaches reported that they believed that stretching should be emphasized the most for sprinters, hurdlers, and jumpers during post-activity. Forty-nine
(48.5%) coaches reported that both pre-activity and post-activity are equally important times to emphasize stretching to sprinters, hurdlers, and jumpers.

**Coaching Experience**

Another area of interest was the comparison of years of experience with coaching practices in relation to pre-activity and post-activity protocols. Descriptive data revealed that coaches with fifteen or more years of track and field coaching experience utilized more time on their team’s pre-activity warm-up than coaches with less than fifteen years of coaching experience. Only four out of forty-three (9%) coaches with fifteen or more years experience in coaching track and field reported their general pre-activity warm-up lasted ten minutes or less while 10 out of 58 (17%) coaches with less than fifteen years of coaching experience reported their general pre-activity warm-up lasted less than ten minutes. Three coaches reported their warm-up lasted from 2-5 minutes. All three coaches had less than fifteen years of track and field coaching experience.

Descriptive data revealed that most (93%) coaches with fifteen or more years of experience do allow their athletes to stretch prior to activity while (84%) of coaches with less than fifteen years of experience also allow their athletes to stretch prior to activity. Analysis of the pre-activity stretching routine showed that coaches with less than fifteen years experience, were more likely to utilize dynamic stretching. Twenty-nine out of 48 (60%) coaches with less than fifteen years experience reported that dynamic flexibility best described their pre-activity stretching routine as compared to 15 out of 40 (38%) with fifteen or more years of experience. Twenty-three out of 40 (58%) coaches with fifteen or more years coaching experience reported using a combination of static and dynamic stretching in their pre-activity routines, while only 18 out of 48 (38%) coaches with less than fifteen years experience reported using a combination of
static and dynamic stretching in their pre-activity routines. Chi-Square analysis was not significant. No differences were found for the amount of coaching experience and the type of pre-activity stretching used by coaches ($x^2=.976$, $p=0.614$).

The amount of time of the pre-activity stretching routine was also analyzed and compared with years of coaching experience. Descriptive data revealed that coaches with more experience had their athletes stretch for a longer period of time prior to activity. Ten out of 16 (63%) coaches that stretched less than fifteen minutes had fifteen or more years of coaching experience. Four out of 16 (25%) coaches with less than ten years experience reported that their stretching routines lasted less than fifteen minutes. Interestingly, all ten coaches that reported their teams stretched less than five minutes had less than fifteen years coaching experience. Chi-Square analysis was not significant. No differences were found in the amount of time allowed for the pre-activity stretching routine and coaching experience ($x^2=2.120$, $p=0.548$).

Analysis of post-activity stretching routines revealed that coaches with fewer years of experience were more likely to use static stretching. Thirty out of 58 (52%) coaches with less than fifteen years experience reported that static stretching best described their post-activity routine as compared to 19 out of 41 (46%) coaches with fifteen or more years experience. Twenty-two out of 58 (38%) coaches with less than fifteen years experience reported that a combination of static and dynamic stretching best described their post-activity stretching routines, while 18 out of 41 (43%) coaches with fifteen or more years of experience reported that their post-activity stretching routines were best described as using a combination of static and dynamic stretches. Interestingly, 61% of coaches that reported using static stretching had less than fifteen years experience.
The amount of time spent on the post-activity stretching routine was also analyzed and compared with years of coaching experience. Most coaches (68%) reported that their athletes stretch post-activity for ten minutes or less. Coaches with more experience had their athletes stretch for a longer period of time post-activity. Fifty-three percent of coaches with fifteen or more years experience reported that their athletes stretched post-activity for less than ten minutes, whereas 74% of coaches with less than fifteen years experience reported stretching post-activity for ten minutes or less. Interestingly, 6 out of 7 coaches that stretched less than five minutes had less than ten years coaching experience. In comparison, only 1 out of 60 coaches with ten or more years experience reported that their athletes stretched less than five minutes during post-activity stretching exercises.

Only 32 out of 58 (55%) coaches with less than fifteen years experience reported that their athletes always or almost always completed the full post-activity flexibility protocol, whereas 32 out of 43 (74%) coaches with fifteen or more years experience reported that their athletes always or almost always completed the post-activity flexibility routine. Only 20 out of 39 (51%) coaches with less than ten years coaching experience reported that their athletes always or almost always completed the post-activity flexibility protocol. Chi-Square analysis was not significant. No differences were found for the amount of coaching experience and the completion of post-activity stretching used by coaches ($\chi^2=2.159, p=0.540$).

Thirty-four out of 42 (81%) coaches with fifteen or more years experience reported their athletes always or almost always completed a full post-activity cool down. Forty-six out of 58 (79%) coaches with less than fifteen years experience reported that their athletes always or almost always completed the post-activity cool down.

Sources of Information
Another area of interest was the main source of information that influenced the respondent’s pre-activity warm-up. Thirty-two (31.7%) respondents reported that another sprint, hurdle, and jump coach was their primary source of information, while 19 (18.8%) respondents reported a coaches education program was their primary influence, followed by 13 (12.9%) coaches reporting that media (books, videotapes, online, etc.), strength and conditioning coach (11.9%), and high school coach (10.9%).

The responses to the main source of information for pre-activity stretching were similar to the pre-activity warm-up responses. Thirty (31.9%) coaches reported that another sprint, hurdle, and jump coach was their main source of information that helped them decide what their pre-activity stretching routine should consist of. Eighteen coaches (19.1%) reported that a coaches education program was their main source of information, while strength and conditioning (11.7%), media (11.7%), and their high school coach (11.7%) each had 11 coaches report that they were their primary source of information in regards to the establishment of their pre-activity stretching routine.

Thirty (31.3%) coaches reported that the main source of information that helped them establish a post-activity cool down was another sprint, hurdle, and jump coach, while 16 (16.7%) coaches reported that a coaches education program, and 15 (15.6%) coaches reported media as their main source of information.

The responses to the main source of information for post-activity stretching were similar to the post-activity cool down responses. Twenty-nine (29%) coaches reported that another sprint, hurdle, and jump coach was their leading influence in establishing a post-activity stretching protocol, while 19 (19%) coaches reported that a coaches education program was their
leading influence, and 14 (14%) coaches reported that a strength and conditioning coach was their primary resource in establishing their post-activity stretching routine.

DISCUSSION

A well-conceived strength and conditioning program includes a strategy dedicated to preparing the athlete for a specific activity. This concept is supported by the evidence presented as all (100%) of the coaches surveyed reported their athletes perform a general warm-up activity prior to beginning a workout. The results are similar to Judge et al. (2009) that reported that all Division I and Division III football coaches surveyed included pre-activity warm-ups, always or almost always, in daily practice routines. Muscle activation allows the body to properly prepare for optimal performance. It is apparent that the coaches are aware of this critical information.

An important element in proper muscle activation is stretching. Most (88.1%) coaches have their athletes perform pre-activity stretching prior to practice or competition. It is apparent these coaches are aware of the importance of including flexibility exercises in the daily pre-activity workouts for sprinters, hurdlers, and jumpers. It is interesting to note that the results of this study indicate that the coaches were not in agreement as to what is the most efficient technique. Half (50%) of the coaches reported they utilized dynamic stretching during their pre-activity routine. A smaller number (46.6%) of coaches reported having their athletes perform a stretching routine that included both static and dynamic stretches during pre-activity routines. The current literature recommends that dynamic stretching be included in the pre-activity warm-up. Nearly half of the coaches surveyed are not following the recommended pre-activity protocol. It is apparent that many coaches are not staying up to date on current research that focuses on establishing a proper pre-activity stretching protocol. It is important to point out that only one coach reported using only static stretching during pre-activity stretching routines. As
reported earlier, research has shown that pre-activity static stretching has been found to have deleterious effects on sprinters, hurdlers, and jumpers. It is interesting to document that many (23.8%) coaches reported they do not think that pre-activity flexibility work helps prevent injuries, while 21 (20.8%) coaches do not think that pre-activity flexibility work improves performance. It is also important to report that nearly half (42.4%) of the coaches reported allowing their athletes to perform static stretches between interval runs in practice and between events during competition.

The post-activity routine, usually called a cool down, is generally considered to be just as important to an athlete as the warm-up routine. This is supported by the evidence as nearly all (99%) coaches reported having their athletes perform some type of cool down post-activity. Surprisingly, nearly a third (31.7%) of coaches surveyed reported their athletes only sometimes complete the full post-activity stretching routine. It is apparent that more coaches need to remain current with new findings regarding stretching practices that may be best for their athletes. This can be supported by the coaches’ response to the amount of time their athletes spend on post-activity stretching. Unfortunately, only 32 (32.4%) coaches reported their athletes post-activity stretching routine generally lasted longer than ten minutes while two coaches reported their athletes did not even perform any stretching after training. It was encouraging to see that most (89.9%) coaches that had their athletes perform stretching included some form of static stretching during the post-activity stretching routine even though nearly half (40.4%) of the respondents reported that dynamic stretching was included in the post-activity routine. This practice goes against current literature, which recommends that dynamic stretching be included during pre-activity stretching.
Most of the coaches reported they recognize the benefits their athletes reap by inclusion of pre- and post-activity stretching exercises into their daily practice routines. Most (89%) coaches believe that post-activity flexibility work does help prevent injuries. Nearly the same amount (88.1%) of coaches believe that post-activity flexibility work does improve performance. An interesting component is where or from whom do coaches get the information they need that helps them develop their pre- and post-activity workouts. The largest percentage of coaches reported that the main source of information came from another sprint, hurdle, and jumps coach. While it is important to use valuable knowledge from colleagues, the information given may not be what is best for athletes, nor research-based.

The data reveal that coaching experience may play an important role in the decisions regarding pre-and post-activity stretching practices. More (93%) coaches with fifteen or more years experience had their athletes perform some type of pre-activity stretching routine than those coaches (84%) with less than fifteen years coaching experience. Furthermore, coaches with fifteen or more years experience were less likely to use dynamic stretching pre-activity. Just more than a third (38%) of coaches with fifteen or more years of experience reported using dynamic stretching during pre-activity routines as compared to those with less than fifteen years experience, as nearly two-thirds (60%) utilized the more current research based method of dynamic stretching during pre-activity routines. A majority (58%) of coaches with fifteen or more years experience favored both dynamic and static stretching during the pre-activity routine.

Coaches with fifteen or more years experience were less likely (46%) to use only static stretching in post-activity routines, while just over half (52%) of the coaches with less than fifteen years experience reported only using static stretching during post-activity. Almost two-
thirds (61%) of the coaches that reported using static stretching post-activity had less than fifteen years experience.

The experience of a coach may also impact the amount of time that coaches spend on pre- and post-activity stretching routines. Coaches with fifteen or more years of experience had their athletes stretch for a longer period of time during pre-activity stretching. Sixty-three percent of coaches that stretched less than ten minutes had fifteen or more years of coaching experience. All ten coaches that reported their athletes stretched less than five minutes had less than fifteen years coaching experience.

Similar results occurred for the post-activity stretching practices. Coaches with fifteen or more years experience reported stretching for longer periods of time than those coaches with less than fifteen years experience. Fifty-three percent of coaches with fifteen or more years of experience stretched longer than ten minutes while 74% of coaches with less than fifteen years experience stretched for ten minutes or less.

In reviewing these findings, it should be noted that the study is not without limitations as generalizations from the current study are problematic due to such factors as sample size. Thus, it is recommended that these results be interpreted with caution.

PRACTICAL APPLICATION

The results of this study indicate that track and field sprint, hurdle, and jumps coaches need to re-evaluate their own practices in comparison to recent available research. A coach cannot rely solely on information from other sources that is not research-based in nature. The stretching protocols that coaches introduce to their runners are essential in allowing runners to reach optimal effectiveness. For that reason, it is necessary that a coach stay up to date on the most current research-based practices. Although ample literature supports the method of a
dynamic warm-up over other pre-activity practices, many track and field coaches hesitate to completely discontinue routines that incorporate static stretching protocols during pre-activity stretching. Most available research recommends that coaches become certified within their sport and/or get involved in a coaches education program. Although important information can be ascertained, it is still critical that a coach be responsive to changes within the coaching field. An effective coach utilizes all available information and applies research-based methods into a daily practice routine that gives each athlete the best chance to achieve maximal results.
References


acute static stretching able to reduce the time to exhaustion at power output corresponding to maximal oxygen uptake? *Journal of Strength and Conditioning Research*, 24(6), 1650-1656.


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Table 1: Participant characteristics given in means with standard deviations or in percent of total with count.
If you answered yes to Question 19, which of the following best describes your pre-practice/competition stretching:

- Dynamic flexibility
- Combination of 'a' and 'd'
- Ballistic stretching
- Static stretching

Figure 1: Differences in reported pre-activity stretching routines
If you answered yes to Question 19, approximately how long does the stretching usually take:

- 10-15 minutes
- 5-10 minutes
- Longer than 15 minutes
- Less than 5 minutes

Figure 2: Differences in length of time of reported pre-activity stretching routines
If you answered yes to Question 27, which of the following best describes your post-practice stretching:

- Static stretching
- Combination of 'a' and 'd'
- Dynamic flexibility
- PNF stretching
- Ballistic stretching

Figure 3: Differences in reported post-activity stretching routines
If you answered yes to Question 27, approximately how long does the post-activity stretching usually take:

- 5-10 minutes
- 10-15 minutes
- Less than 5 minutes
- Longer than 15 minutes

*Figure 4: Differences in length of time of reported post-activity stretching routines*