The Effect of performing a warm-up and cool-down on the flexibility of the calf and hamstring prior to a 50 minute work
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ABSTRACT
There is limited data regarding the association of stretching and athletic injuries. Warm up and the cool-down exercises have long been used in the exercise routine with the aim of enhancing performance and reducing the risk of injury; however, the literature surrounding the position of the warm up and cool down in exercise questions this practice. In fact, studies examining the effect of warm-up and cool down exercise on the flexibility of the calf and hamstring have delivered conflicting results (Radford et al., 2007; Franco et al., 2012; Beedle et al.2008).

BACKGROUND
• Warm- and cool-down exercises have long been used in the exercise routine with the aim of enhancing performance and reducing the risk of injury.
• Studies examining the effect of warm-up and cool down exercise on the flexibility of the calf and hamstring have delivered conflicting results (Radford et al., 2007; Franco et al., 2012; Beedle et al.2008).
• A warm-up period of approximately 5 to 10 minutes should increase the range of motion of the joints and muscle-tendon units as well as increase the muscle temperature and the efficiency of the muscle contractions. A cool-down period of more than 5 minutes but less than 15 minutes is likely to produce the greatest ergogenic effect on short term performance (Bishop, 2003).
• The universal goniometer is as reliable and valid instrument used to measure range of motion (Careya, Lairdb, Murray and Stevenson, 2008)

PURPOSE
To assess the effect of a 10 minute warm-up and a 10 minute cool-down on the flexibility of the hamstring and calf prior to a 50 minute workout.

METHODS
• The study was conducted as a one group, pre-test, post-test study.
• Forty-five participants ranging from 30-65 years of age (M = 50.93, SD =11.54) who attended fitness classes at a health and fitness center in Atlanta, Georgia participated in the study. Participants were excluded from the study if they: were pregnant women; were under 35 or over 65; had chronic diseases of the musculoskeletal system and/or had previous injuries to the hamstring or calf.

RESULTS
Eighty-seven percent of the participants were female; 42.2% were employed; and 48.9% were married. The mean age was 50.93 years (SD= 11.54; range= 18-65) =11.54 who attended fitness classes at a health and fitness center in Atlanta, Georgia participated in the study. Participants were excluded from the study if they: were pregnant women; were under 35 or over 65; had chronic diseases of the musculoskeletal system and/or had previous injuries to the hamstring or calf.

• Flexibility of the calf and hamstring was measured using the Myrin Goniometer. The hamstring and calf flexibility scores were determined as the mean of two measurements of the left and right legs before and after the warm up and cool-down exercises
• Descriptive statistics and univariate analysis including distribution, measures of central tendency, and measures of dispersion were conducted on continuous data. Statistical significance was set at 0.05 with a two-tailed statistical test
• Data was assessed for normality using the Shapiro-Wilk test. In order to test the hypothesis that there is no difference in the mean flexibility scores of the calf and hamstring before and after warm up and cool down exercises, the Wilcoxon signed rank test was used. The independent variable (predictor) is the participants’ participation in cool-down and warm-up exercises and the dependent variable (criterion variable) is the change in muscles’ flexibility.

REFERENCES
• Bishop, D. (2003). Warm up II: Performance changes following active warm up and how to structure the warm up, Sports Medical Journal, 33(7), 483-496, http://dx.doi.org/10.2165/00000725-20033307-00002

CONCLUSIONS
The results of this study support the role of pre-exercise or postexercise stretching as an intervention addressing flexibility of certain muscles.
• Comprehensive research focusing on ways to improve adherence to stretching exercises prior to workouts and to assess correlations between stretching and injury risk reduction is recommended.

DISCUSSION
In this study, the median increase in flexibility after the warm up and cool down exercises for the hamstring was 6 (cm) and for the calf was 9 (cm). Our findings show that conducting warm-up and cool-down exercises before a 50-minute workout increase the flexibility of certain muscles.