The Effect of Dynamic versus Static Stretching Warm-up on Muscle Performance as Measured by Vertical Jump in NCAA Division III Basketball Players

ALVERNIA UNIVERSITY ATHLETIC TRAINING PROGRAM
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The purpose of this research project was to examine the effect of static and dynamic warm-up on muscle performance measured by vertical jump height. Although both warm-up methods are widely recognized, there is no consensus about their effect on performance. In this study, researchers measured the jump height of NCAA Division III male and female basketball players after completion of each of three different warm-up protocols (jogging only; jogging + static stretch; jogging + dynamic stretch). The following statistically significant (p < 0.05) results were obtained: 1) male jump heights were greater than female jump heights in each of the three protocols (95% confidence interval of the difference was typically 6 to 13 inches); 2) in direct comparison, the dynamic stretching protocol resulted in increased jump heights relative to the static stretching protocol, although the improvement was less than one inch. However, when comparing all three protocols simultaneously, ANOVA results were not significant: none of the protocols could be distinguished from the others (n = 14). It was also found that jump heights were generally negatively correlated with the height of the individual, although not significantly.
The purpose of this research project was to examine the effects of static and dynamic stretching on muscle performance as measured by vertical jump performance.
Warm ups are essential for increasing muscle temperature, muscular blood flow and physiological responses.\(^1\)

Warm ups are vital to injury prevention by reducing tissue stiffness, improving range of motion and preventing lesions in muscles, and regulating the functional balance of the musculoskeletal system.\(^2\)

The window before physical activity is crucial for injury prevention because until the athlete’s body is properly warmed up the body is at a high risk for injury.\(^3\)

Static stretching is when elongation of the muscles occur with tension past its resting length.\(^2\)

Dynamic stretching facilitates power, sprint and jump performance with minimal to no adverse effects.\(^4\)

Dynamic stretching is expected to be superior to static stretching due to the similarities to movements during the subsequent exercises.\(^4\)

A vertical jump is a simple and effective representation of a muscles maximum explosive performance in a single movement.\(^5\)
Materials

- Vertec - vertical jump height measuring device
- Apple iPhone stopwatches
- Demographic/Injury History Questionnaire
- Data Collection Sheets for Vertical Jump Performance
- Hydration Station
Methods

- **Method A:**
  - 5 minute paced jog around the perimeter of a collegiate basketball court

- **Method B:**
  - 5 minute paced jog followed by static stretching protocol
  - Protocol consisted of 5 different stretches held for 15 seconds each repeated twice

- **Method C:**
  - 5 minute paced jog followed by dynamic warm-up protocol
  - Protocol consisted of 12 different exercises performed for 15 meters each repeated twice
Participants

- **Inclusion Criteria**
  - Male or Female, 18-54 years of age
  - Healthy collegiate basketball players cleared for athletic participation by a physician

- **Exclusion Criteria**
  - Athletes that had not been cleared by a physician for full participation in athletics
  - Athletic Training Students enrolled in courses instructed by AT Faculty Advisor

- **This Investigation**
  - 23 Total Participants
  - Men’s and Women’s NCAA Division III Basketball Teams
  - 9 Females completed all 3 methods
  - 5 Males completed all 3 methods
Research Questions

RQ1: Are there statistically significant differences in vertical jump height among the three warm up protocols (A = jogging only; B = jogging + static stretch; C = jogging + dynamic stretch)?

RQ2: Are there statistically significant differences in vertical jump height, for any of the three protocols, depending on gender?

RQ3: Is there any interactive effect for vertical jump height between the three protocols and gender? (i.e. Is there a different change in height, depending on protocol, between genders?)
Paired data was used due to jump heights being dependent on the same individuals being tested 3 times.

A vs. B vs. C: p > 0.05 We cannot say that there is a significant difference between either of the stretching methods and the jogging only method.

Used only the n = 14 individuals (9F + 5M) who performed in all three methods.

When comparing A vs. B: p > 0.05 (n=16) there was no statistical significance.

When comparing B vs. C: p = 0.045 < 0.05 (n=14) there was minor statistical significance.

When comparing A vs. C: p > 0.05 (n=17) there was no statistical significance.
Change in Jump Height by Gender

- **Method A (M vs. F):** $p = 0.000$ (significantly different, $n = 11F, 12M$). 95% confidence interval of the difference in the means: 5 – 13 inches.
- **Method B (M vs. F):** $p = 0.000$ (significantly different, $n = 9F, 7M$). 95% confidence interval of the difference in the means: 7 – 13 inches.
- **Method C (M vs. F):** $p = 0.000$ (significantly different, $n = 10F, 7M$). 95% confidence interval of the difference in the means: 6 – 14 inches.
- **Method A vs. B vs. C (M vs. F):** $p = 0.000$ (significantly different, $n = 9F, 5M$). Consequently, the individual method results, above, are all valid.
Interactive Effects Between Gender

Interactive Effect (Method*Gender): $p > 0.05$ (no significant interactive effect, $n = 9F, 5M$)
Conclusions

- Male jump heights were greater than female jump heights in each of the three protocols (95% confidence interval of the difference was typically 6 to 13 inches).
- The dynamic stretching protocol resulted in increased jump heights relative to the static stretching protocol, although the improvement was less than one inch.
- ANOVA results were not significant: none of the protocols could be distinguished from the others (n = 14).
- Jump heights were generally negatively correlated with the height of the individual, although not significantly.
- Comparing only methods B vs. C there was minor statistical significance.
Future Considerations

- A larger sample size is recommended to increase possible significance level.
- Include sample that more equally represents both male and female participants.
- Conduct research study in the off-season for each sport included.
- Expand research to include multiple sports.


