

SPORT SCIENCE & MANAGEMENT (SSM)

Examples of Sport Science & Management Final Year Projects

Effects of blood flow restriction (BFR) training and high-intensity interval training (HIIT) on aerobic and anaerobic capacities of physically active individuals

Blood Flow Restriction Training (BFR) and High-Intensity Interval Training (HIIT) are two exercise modalities that show promise in improving physical fitness. This study aims to investigate the differences between BFR with HIIT and HIIT alone on aerobic and anaerobic capacities in physically active individuals through VO2max and Wingate tests, hypothesising that BFR with HIIT will elicit greater improvements in aerobic and anaerobic capacities than just HIIT itself.

Acute Effects of Static and Dynamic Stretching Exercises on Jump Performance in Rhythmic Gymnasts

This study aimed to evaluate the effects of static and dynamic stretching on jump performance in rhythmic gymnastics through biomechanical analysis. It was hypothesised that dynamic stretching would be the most beneficial to rhythmic gymnastics jump performance.

An Institute of





**NANYANG
TECHNOLOGICAL
UNIVERSITY**
SINGAPORE

Effects of Blood Flow Restriction Training and HIIT on Aerobic and Anaerobic Capacities of Physically Active Individuals

Syntyche Yeo Syn Yu
Physical Education and Sports Science Academic Group
National Institute of Education, Nanyang Technological University, Singapore

ABSTRACT

Blood Flow Restriction Training (BFR) and High-intensity Interval Training (HIIT) are two exercise modalities that show promise in improving physical fitness. This study aims to investigate the differences between BFR with HIIT and HIIT alone on aerobic and anaerobic capacity in physically active individuals through VO2max and Wingate tests, highlighting significant differences. In this randomized, counterbalanced study, 10 male participants completed 3 sessions: screening, familiarization, training (3 weeks), and post-test. Participants were allocated to either the BFR + HIIT group or the HIIT Alone group. Training involved a high-intensity short burst of 2 minutes during rest breaks. Group 1 received 80% of isometric cuff pressure for 2 minutes during rest breaks. Group 2 received 100% relative (p<0.001), relative (p<0.001). With further post-test analyses revealed changes in the BFR group (p<0.005). This suggests that BFR supplementation in HIIT does not significantly enhance aerobic capacity, but does enhance anaerobic capacity. Future studies exploring BFR with HIIT could consider additional performance measures and HIIT protocols for more robust evidence.

RESULTS

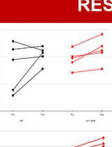


Figure 4. Line Graph of VO2max (ml/min)

No significant (p>0.181) difference between VO2max values in BFR+HIIT (36.18 to 45.63) and HIIT (36.18 to 34.32).

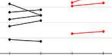


Figure 5. Line Graph of VO2max (ml/min)

No significant (p>0.081) difference between VO2max values in BFR+HIIT (10.05 to 12.05) and HIIT (10.05 to 8.61).



Figure 7. Line Graph of relative MPO (kg)

Significant (p<0.028) difference between MPO values in BFR+HIIT (0.007 to 0.013) and HIIT (0.007 to 0.006).

INTRODUCTION

Evidence has shown that BFR training can lead to various physiological adaptations, including increased strength, endurance, and muscle hypertrophy (Lorenzetti et al., 2011). However, most research has primarily paired BFR training with low-to-moderate aerobic exercises and evidence is then equivocal with regards to the effects of BFR training with high-intensity aerobic exercises.

Research Objectives

- Investigate hypothesis that BFR and HIIT significantly improves aerobic and anaerobic capacities compared to just HIIT training
- Propose that this can help first strategies to optimize the adaptive responses to training, as well as ensure its safe and effective implementation in individuals.

METHODS

- Participants: 10 male physically active individuals
- Randomized, counterbalanced experimental design
- 3 weeks: 1 screening and familiarization, 3 training sessions, 1 pre-test and 1 post-test

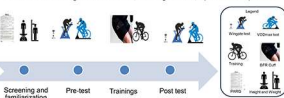


Figure 1. Schematic representation of procedures

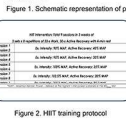


Figure 2. HIIT training protocol



Figure 3. Categorization of Blood Occlusion Pressure (LOP) with Arterials

Using JASP statistical,
 Paired t-test measures ANOVA used to determine significant differences (p<0.05) followed by Bonferroni adjustment
 Confidence intervals set at 90%, statistical significance set at p<0.05

SUMMARY AND CONCLUSION

- BFR + HIIT was not observed to significantly increase relative and absolute VO2max as compared to just HIIT alone, rejecting our first hypothesis.
- Significant difference in MPO, with further post-test analyses revealing a significant gain and time effect.

The findings of this study suggest that implementing BFR into HIIT training protocols adds no significant benefit to aerobic capacity but is beneficial for anaerobic capacity. Limitations include sample size, adaptive blinding and lack of gold standard measurement for cardiovascular performance.

Considering the novelty of this research area, future studies should be conducted to form more conclusive evidence. Additionally, other exercise performance measures should be included to better understand the effects of BFR training.

ACKNOWLEDGEMENTS

I am grateful to Associate Professor Stephen Francis Burns, Dr Man Tong Chuan and Dr Aislinn Sim for their guidance and cooperation throughout this project, and all my participants for their time and effort.

REFERENCES

1. Smith, D. J., & Smith, D. J. (2013). *Effects of Blood Flow Restriction Training on Muscle Strength and Hypertrophy*. *Journal of Strength and Conditioning Research*, 27(1), 1-10.

2. Lorenzetti, B., & Lorenzetti, B. (2011). *Effects of Blood Flow Restriction Training on Muscle Strength and Hypertrophy*. *Journal of Strength and Conditioning Research*, 25(1), 1-10.

3. Smith, D. J., & Smith, D. J. (2013). *Effects of Blood Flow Restriction Training on Muscle Strength and Hypertrophy*. *Journal of Strength and Conditioning Research*, 27(1), 1-10.



NIE
NANYANG INSTITUTE OF EDUCATION
(SINGAPORE)

NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

Han Shan Rong Cheryl Anne
Physical Education and Sports Science Academic Group
National Institute of Education, Nanyang Technological University, Singapore

Acute Effects of Static and Dynamic Stretching Exercises on Jump Performance in Rhythmic Gymnastics (RG)

ABSTRACT

Background: Dynamic stretching has been found to improve jump performance compared to static stretching.

Aim: To evaluate the effect of static and dynamic stretching on jump performance in rhythmic gymnasts using a biomechanical approach.

Methods: 17 rhythmic gymnasts underwent static and dynamic stretching interventions. They performed a series of jumps, including countermovement jumps, split leaps and stag leaps. Jump performance was evaluated using 2-D video analysis of joint angles (split angle, knee angles, backbend angle) and flight time.

Results: Static stretching resulted in significant outcome measures, especially for split angles and backbend angles.

Conclusion: Static stretching improves RG jump performance compared to dynamic stretching.

INTRODUCTION

Flexibility is a critical component in rhythmic gymnastics jumps. Traditionally, static stretching techniques are implemented to RG training to reduce injury risk and increase range of motion. However, prior studies suggest that static stretching may cause reductions in strength and power production, hindering jump performance (d'Anna & Paloma, 2015). Dynamic stretching has been proposed as an alternative and is hypothesized to show greater improvements in jump performance.

METHODOLOGY

Study design: Randomised, repeated measures

DEVELOPING BIOMECHANICAL METHODS OF ASSESSING JUMP PERFORMANCE

PARTICIPANT RECRUITMENT

Characteristics of participants (n=17):



Videos were taken for all jumps

2-D video analysis on Kinovea

For all jumps: Flight time
= frame rate x number of frames in air

For RG jumps: Joint angles

Fig 1. Split angle Fig 2. Frontback knee angle Fig 3. Backbend angle



INTERVENTION OUTLINE

Each participant went through 2 intervention sessions – static or dynamic stretching. Each session was conducted as follows:

Pre-tests

- Countermovement jump (CMJ)
- Countermovement jump with arm swing (CMJswing)

Stretching Intervention

- 20-minute static or dynamic stretching programme
- Static: splits, back stretches, etc.
- Dynamic: hamstring, hip and back stretches, kicks, etc.

Post-tests

- CMJ
- Split
- CMJswing
- Stag



Are these measures a suitable assessment in RG?

3 judges assessed RG jump videos.

Correlation analysis → Significant correlation of judges' Execution (E) deduction with most measures. Split angle and back knee angle were correlated for all jumps.

These measures can therefore be used to assess jump performance.

RESULTS

ANOVA: No significant effect of time (pre vs post) or condition (static vs dynamic) on flight time

T-Test: Static stretching showed significantly greater improvements in measures as highlighted in Table 1

DISCUSSION

Conclusion: Static stretching is associated with better jump performance in RG, especially in increases in split angles and backbend angles.

Since split angles are shown to correlate to judges' E deductions, this is likely to result in better scores.

Table 1: T-values for all measures comparing static to dynamic stretching

Measure	FlightTime	Split < P	Front knee < P	Back knee < P	Backbend < P
Split	2.785*	6.548*	-0.487	0.978	
Split backbend	0.709	4.051*	0.443	-1.084	3.217*
Stag	1.975	1.641	-0.983	1.403	
Stag backbend	1.647	4.188*	-2.182*	-0.36	4.113*

Significant results are marked with *

Possible consideration: Psychological effects

Participants are more accustomed to static stretching, thus more willing to push their range of motion. Future studies may implement a longer intervention period to allow participants to adapt to new stretching programmes.

ACKNOWLEDGEMENTS

Thank you to A/P Kong Pui Wah and Dr Berfin Serdöl ÖRS for your guidance and input.

REFERENCES

d'Anna, Cristiana & Paloma, G. (2015). Dynamic stretching versus static stretching in gymnastics performance. *Journal of Strength and Conditioning Research*, 29(1), 342-350.

Waters, R. A., & Brown, C. A. (2015). Effects of static and dynamic stretching on upper limb and jump performance in knee and hip. *The Journal of Strength and Conditioning Research*, 29(2), 534-540.

www.nie.edu.sg