Mini Review
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Moderate blood flow restriction training

Abstract

Blood flow restriction (BFR) training has become a common training method and a modern technique for strength gaining, (BFR) also associated with muscle mass, endurance, and muscle oxygenation. Scientific studies in (BFR) training concluded that resistance training with (BFR) can increase the strength gains and support muscle hypertrophy. Nowadays all researchers are looking for (BFR) as the definition of blood flow moderation training because they knew that the technique of restricting the blood should be in a moderate quantity of standard Kaatsu unite (SKU) cuff pressure. This manuscript letter is designed to address the importance of (BFR) training to develop muscle strength, endurance, and muscular inflation, muscle oxygenation using near infrared spectroscopy equipment, blood flow velocity, and how previous studies use it to develop the aerobic and anaerobic capacity for athletes.

Keywords: kaatsu, blood flow restriction, muscle hypertrophy, strength, muscle oxygenation

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Abbreviations: BFR, blood flow restriction; SKU, standard kaatsu unite; ACSM, american college of sports medicine; 1RM, one repetition maximum; VO_{2max}, maximal oxygen uptake

Introduction

In 1966, Sato Y received the inspiration of KAATSU. He felt numbness because of his sitting position on the floor. He recognized that pain is the same if the person did any resistance exercises. He attributed that swelling sensation to the decrease of blood flow and theorized that muscle swelling and altered sensation may be caused by, or associated with reduced blood flow to the muscle.[1] Thus, reducing the amount of arterial blood flow to the working muscles while simultaneously moderate restriction return of venous blood flow is a form of training traditionally known as KAATSU which means in Japanese with (additional pressure).[2]

KAATSU training became an important training strategy which can increase muscle mass, endurance, and strength. (BFR) training is also known as blood flow restriction moderation which involves restricting venous and arterial blood flow to an exercising muscle to increase strength gains and support muscle hypertrophy.[3] Additionally, (BFR) training involves the use of cuffs placed near around the proximal part of a limb, for maintaining blood vessel inflow while restricting venous return during the exercise.[4] One of the important benefits of (BFR) resistance exercises is that relatively light loads can be used to facilitate hypertrophic responses similar to traditional high-load unrestricted resistance exercise.[5]

Although the use of (BFR) resistance exercise seems to be effective, the mechanisms underpinning the hypertrophic adaptations are yet to be fully determined such as resistance exercises, strength, endurance, and high-intensity hypoxia training.[6] Consistently with (BFR) resistance exercises also strength training is a necessary element to most sports programs, and there are varying irregularly schools of thought and training terms used to enhance muscular strength, and a large portion of them are recognized and effective.[7]

Why blood flow restriction?

While the American College of Sports Medicine (ACSM) recommends training with a weight of at least 70% one repetition maximum (1RM) for achieving muscular strength and hypertrophy, as it is believed anything below this intensity scarcely produces radical muscle growth.[8] (BFR) training can increase muscular strength, hypertrophy, and muscle endurance with 20-25% of (1RM) intensity, by decreasing the volume of training to 15-20 minutes per day and the volume of training per week from 1-3 sessions.

Benefits of blood flow restriction

In order to gain increases in the size and strength of skeletal muscle, it is commonly believed that training intensity of at least 65% of (1RM) is required.[9] However, recent studies suggest such gains may be obtainable with considerably lower resistance in combination with (BFR), even in well-trained athletes with a history of resistance training.[10] In addition, the proposed (BFR) benefits of muscle hypertrophy,[11–13] strength gain[11–15] and endurance,[16] which have been observed quantifiable,[7] as well as there are many physiological effects of (BFR), including aerobic power,[17] and increasing protein synthesis,[7] while the increase in maximal oxygen uptake VO_{2max} have only been diversified following aerobic (BFR) training performed at or above 40% of the VO_{2max}.[15]

Consistently with previous paragraph (e.g. Along with strength, hypertrophy, endurance and aerobic exercises) it is also important for health and wellbeing to enhance the exercise economy, which is considered one of the most important achievement factors in sports, and it's also related to aerobic and anaerobic abilities, strength, endurance and other physical abilities of athletes, which can be combined with (BFR) exercises.

Obviously, one of (BFR) training benefits is increasing the effort of the VO_{2max} and performance enhancement which are related to exercise economy.[7] (BFR) has also been combined with a few unique exercises (e.g. knee extension, knee flexion, leg press, cycling, walking, elbow flexion, bench press) and most have observed the increase in muscle hypertrophy.[18] In addition, combining low-intensity aerobic exercise with (BFR) is considered as an adapted single training method, which can bring about many benefits including peripheral (e.g., muscle strength and hypertrophy, angiogenesis, increase in oxidative enzymes, glycogen content) and central aspects (e.g., stroke volume).[14,15]

Finally, (BFR) becomes one of the best training methods, which coaches turned to in recent years, because of its rapid positive effects on muscle size, strength, and health which can make differences in athlete's performance. Increasing muscle activation is also associated with low external loads 20–30% of (1RM) caused by the restriction of blood flow.[19] (BFR) is also characterized by its small volume, which saves time, costs, works in low intensities and allows the athletes to control their load. In addition, (BFR) training can also stimulate blood lactate release and then turns it into a protein because of those signals from the brain (growth hormone) which spreads to all the body's cells and eliminates fats.

Research interest

Plyometric exercises with light loads didn't used previously with (BFR) training, also the maximum repeated sprint ability exercises and only two studies used the interval endurance exercises with (BFR).[20,21] It's also very important to enhance the tissue saturation index for the players depending on this technique. Additionally, to let the muscle use a huge amount of oxygen during the training, which can improve the usage of oxy-deoxyhemoglobin of it.

Conclusion

The novelty of (BFR) studies concluded that, occluding the blood flow in veins may cause many problems, because venous blood flow occlusion will prevent blood cycle to be completed and this may cause heart failure and arterial stiffness. So it's better to define the blood flow restriction as blood flow moderation training. In this context, recent studies concluded a lot of scientific results regarding to the benefits of (BFR) training such as; improving the sprint time when it was compared with low-intensity sprint interval training, decreased the level of muscle damage, increase the rectus femoris muscle thickness,[22] a higher relative pressures result in the greatest cardiovascular responses, perceptual responses are augmented with increasing applied pressure, due to the cardiovascular response the relative restriction pressure decreases during exercise,[23] a physical exercise session with continuous or intermittent (BFR) didn't promote muscle damage[24] and the longitudinal use of (BFR) training lead an increases in strength and hypertrophy.[25]

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Conflict of interest

Author declares there is no conflict of interest in publishing the article.

References

1. Sato Y, Ishii N, Nakajima T, et al. KAATSU training: Theoretical and practical perspectives. *Goudan Co*. 2007.
2. Abe T, Beekley M, Hinata S, et al. Day-to-day change in muscle strength and MRI-measured skeletal muscle size during 7 days KAATSU resistance training: A case study International Journal of KAATSU Training Research. 2005;1(2):71−76.
3. Scifers JR, Fuchs E, Kaplan G, et al. Blood Flow Restriction Athletic Training and Sports Health Care. 2016;8(4):138−141.
4. Scott BR, Loenneke JP, Slattery KM, et al. Exercise with blood flow restriction: an updated evidence-based approach for enhanced muscular development. *Sports Med*. 2015;45(3):313−325.
5. Scott BR, Loenneke JP, Slattery KM, et al. Blood flow restricted exercise for athletes: A review of available evidence. *J Sci Med Sport*. 2016;19(5):360−367.
6. Pearson SJ, Hussain SR. A review on the mechanisms of blood-flow restriction resistance training-induced muscle hypertrophy. *Sports Med*. 2015;45(2):187−200.
7. Raymond C. High Intensity Strength Training in Conjunction with Vascular Occlusion. 2013.
8. Stand P. American College of Sports Medicine position stand Progression models in resistance training for healthy adults. *Med Sci Sports Exerc*. 2009;41(3):687−708.
9. McDonagh MJ, Davies CT. Adaptive response of mammalian skeletal muscle to exercise with high loads. *Eur J Appl Physiol Occup Physiol*. 1984;52(2):139−155.
10. Takarada Y, Sato Y, Ishii N. Effects of resistance exercise combined with vascular occlusion on muscle function in athletes. *Eur J Appl Physiol*. 2002;86(4):308−314.
11. Takarada Y, Takazawa H, Sato Y, et al. Effects of resistance exercise combined with moderate vascular occlusion on muscular function in humans. *J Appl Physiol*. 2000;88(6):2097−2106.
12. Madarame H, Neya M, Ochi E, et al. Cross-transfer effects of resistance training with blood flow restriction. *Med Sci Sports Exerc*. 2008;40(2):258−263.
13. Yasuda T, Fujita S, Ogasawara R, et al. Effects of low-intensity bench press training with restricted arm muscle blood flow on chest muscle hypertrophy: a pilot study. *Clin Physiol Funct Imaging*. 2010;30(5):338−343.
14. Abe T, Kearns CF, Sato Y. Muscle size and strength are increased following walk training with restricted venous blood flow from the leg muscle, Kaatsu-walk training. *J Appl Physiol* (1985). 2006;100(5):1460−1466.
15. Abe T, Sakamaki M, Fujita S, et al. Effects of Low-Intensity Walk Training with Restricted Leg Blood Flow on Muscle Strength and Aerobic Capacity in Older Adults. *J Geriatr Phys Ther*. 2010;33(1):34−40.
16. Kacin A, Strazar K. Frequent low-load ischemic resistance exercise to failure enhances muscle oxygen delivery and endurance capacity. *Scand J Med Sci Sports*. 2011;21(6):e231−e241.
17. Renzi CP, Tanaka H, Sugawara J. Effects of leg blood flow restriction during walking on cardiovascular function. *Med Sci Sports Exerc*. 2010;42(4):726−732.
18. de Oliveira MF, Caputo F, Corvino RB, et al. Short-term low-intensity blood flow restricted interval training improves both aerobic fitness and muscle strength. Scand *J Med Sci Sports*. 2016;26(9):1017−1025.
19. Abe T, Loenneke JP, Fahs CA, et al. Exercise intensity and muscle hypertrophy in blood flow–restricted limbs and non-restricted muscles: a brief review. *Clin Physiol Funct Imaging*. 2012;32(4):247−252.
20. Takada S, Okita K, Suga T, et al. Blood flow restriction exercise in sprinters and endurance runners. *Med Sci Sports Exerc*. 2012;44(3):413−419.
21. Taylor CW, Ingham SA, Ferguson RA. Acute and chronic effect of sprint interval training combined with postexercise blood-flow restriction in trained individuals. *Exp Physiol*. 2016;101(1):143−154.
22. Behringer M, Behlau D, Montag J, et al. Low intensity sprint training with blood flow restriction improves 100 m dash. *J Strength Cond Res*. 2017.
23. Mattocks KT, Jessee MB, Counts BR, et al. The effects of upper body exercise across different levels of blood flow restriction on arterial occlusion pressure and perceptual responses. *Physiol Behav*. 2017;171:181−186.

24. Neto GR, Novaes JS, Salerno VP, et al. Does a resistance exercise session with continuous or intermittent blood flow restriction promote muscle damage and increase oxidative stress? *J Sports Sci*. 2017. p. 1−7.

25. Baker T. What are the effects of blood flow restriction exercise and high load resistance exercise on the muscle activation patterns, oxygenation and metabolic responses in endurance and strength trained athletes? Masters thesis, St Mary's University College. 2016.