

Knowledge about Blood Flow Restriction Therapy among Physiotherapy Students

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Abstract: *Background:* Blood flow restriction (BFR) known as “kaatsu training,” meaning “training with added pressure”. Traditional training routines use loads greater than 70% of one maximum repetition (1RM) to stimulate muscle development. This may not be safe for all patients, especially those recovering from an injury where they are unable to tolerate high - load resistance. Therefore, this low - load resistance technique can still stimulate anabolic pathways and is increasing in popularity in the fitness and rehabilitation settings due to its role in optimizing muscle mass and strength. This research is therefore done to see how many physiotherapy students are currently aware of this popular ‘BFR technique’ and assess the quantity of knowledge within them which will give us an insight about the level of knowledge of this technique within physiotherapy students of India. *Aim:* To assess knowledge about blood flow restriction therapy among physiotherapy students. *Methods:* A cross sectional study with 100 physiotherapy students. *Demographic data, BFRT knowledge was assessed in physiotherapy students. Results:* Majority of the respondents showed a lack in knowledge, i. e up to 61% weren't able to identify the BFR application correctly. *Conclusion:* Majority of physiotherapy students is only aware about the term BFRT. They showed a lack in knowledge in identifying the application of the technique; its nature and contraindications.

Keywords: Blood flow restriction training; KAATSU; Occlusion training; Rehabilitation.

1. Introduction

Blood flow restriction (BFR) is a training method partially restricting arterial inflow and fully restricting venous outflow in working musculature during exercise. Performing exercise with reduced blood flow - achieved by restriction of the vasculature proximal to the muscle bought up by Dr. Yoshiaki Sato in Japan, where it was known as “kaatsu training,” meaning “training with added pressure.”¹ Kaatsu training is now performed all over the world and is more commonly referred to as “BFR training”.¹

The technique of BFR is basically using a pneumatic tourniquet system that involves applying an external pressure, typically using a tourniquet cuff, to the most proximal region of the upper and/or lower limbs of the specific muscle group^{1,2}. When the cuff is inflated, there is gradual mechanical compression of the vasculature underneath the cuff, resulting in partial restriction of arterial blood flow to structures distal to the cuff. Compression of the vasculature proximal to the skeletal muscle results in inadequate oxygen supply (hypoxia) within the muscle tissue.^{1,2}

Pathophysiology of BFRT - Tissue hypoxia – Cellular swelling – Metabolites - Increased protein synthesis – Increased type 2 muscle fibers – Increased systemic and local hormones – Increased myogenic stem cells - Increased muscle strength – Increased hypertrophy – Angiogenesis²

Traditional training routines generally use loads greater than 70% of one maximum repetition (1RM) to stimulate muscle development³. This may not be safe for all patients, especially those recovering from an injury where they are unable to tolerate high - load resistance due to the stress placed on the joints, soft tissues, and surgical sites. Therefore, there is utility in a low - load resistance routine

that can still stimulate anabolic pathways and is increasing in popularity in the fitness and rehabilitation settings due to its role in optimizing muscle mass and strength as well as cardiovascular capacity, function, and a host of other benefits.^{3,5}

The magic of BFR in athletes to work at lower intensities than usual, While lifting weights of 70% of one - rep max is widely considered to be required for optimal muscle growth, using BFR allows athletes to lift at 20 - 30% of their one - rep max and attain similar results. Through BFR, muscle hypertrophy can be increased beyond anything that conventional weightlifting alone is able to achieve. BFR training even allows athletes to continue their progress on rest days due to the lack of significant muscle damage. There are further benefits to those recovering from injury or illness who are unable to train conventionally. BFR can be used as a clinical rehabilitation tool to speed up recovery, enabling muscle growth at an intensity that can be tolerated. BFR has the ability to help accelerate recovery, which is useful for athletes after competing, or on day's off.³

However, despite the interest in this area of research, there are likely some perceived barriers that practitioners must overcome to effectively implement this modality into practice⁵. These barriers include determining BFR training pressures, access to appropriate BFR training technologies for relevant demographics based on the current evidence, a comprehensive and systematic approach to medical screening for safe practice and strategies to mitigate excessive perceptual demands of BFR training to foster long - term compliance.⁵

This research is therefore undertaken to see how many physiotherapy students are currently aware of this popular ‘BFR technique’ for rehabilitation of their patients. To assess the quantity of knowledge within them this will give

us an insight about the level of knowledge of this technique within physiotherapy students of India.

2. Method

A cross - sectional observational study was conducted at a tertiary care hospital using a self - administered online questionnaire which took 10 - 15 min to complete. All participants had the opportunity to read an information sheet and then provided written informed consent. For the structured interviews, the researchers explained that the participant was giving their voluntary consent to be part of the research project as stated at the beginning of the structured interview sheet. This study conformed to the Declaration of Helsinki and received approval from the School Of Physiotherapy, DY Patil University, Nerul. The inclusion criteria included willingness of the physiotherapy students to participate in the study, UG students in 4th year, Interns and PG students. Exclusion criteria included students pursuing physiotherapy from 1st year, 2nd year, 3rd year during the period September 2022 till March 2023. A multiple - choice questionnaire was used for data collection and participants were given the opportunity to expand on their responses. The questionnaire contained two sections, containing 18 questions – demographic details and self – made BFRT knowledge Questionnaire.

The questionnaire was distributed to physiotherapy students. The sample size for this study was 100 physiotherapy students. A link was provided to the internet - based questionnaire in addition to some brief information about the research. The participants were informed that by participating in the questionnaire and informed consent was obtained.

3. Data Analysis

All data was collected using an online questionnaire. Data were analyzed using descriptive pie –charts and percentages were calculated.

4. Results

Demographic Details

Table 1: Showing the demographic details of physiotherapy students in percentages.

Age Distribution	Mean = 22.3
Gender Distribution	Percentage
Male	85.4%
Female	14.6%
Distribution Of Academic Year	Percentage
Fourth Year	41.7%
Interns	26.2%
Masters	32%
Current Work Setting	Percentage
Hospital Setup	74.8%
Clinical Setup	23.3%
Professional Sports	0%
Other	1.9%

Responses to blood flow restriction training knowledge

Question	Yes	No	Maybe
Do you think physiotherapists should be updated with recent techniques or technologies?	100%	0%	0%

Question	Yes	No	Maybe
Do you feel anaerobic training is effective?	81.6%	0.9%	17.5%

Question	Low intensity training	High intensity training
What do you prefer for strength training (as rehabilitation) of your patients?	69.9%	30.1%

Question	Yes	No
Are you aware of Blood Flow restriction Training?	52.4%	47.6%

Question	Low intensity training	High intensity training
BFRT follows which principle?	75.7%	24.3%

Question	Mechanical compression	Metabolic compression	Both	None
BFRT involves application of?	25.2%	16.5%	57.3%	1%

Question	Tourniquet Cuff	Non - inflated cuff	Elastic automated cuff	Nylon cuff
Which types of cuffs are used in BFRT?	56.3%	19.4%	35.9%	15.5%

Question	Arterial Vessels	Venous vessels
Which blood vessel is mainly occluded in BFRT	72.8%	27.2%

Question	0.5 inch for arms 1.5 inch for legs	1.5 inch for arms 2.0 inch for legs	2.0 inch for arms 3.5 inch for legs	2.5 inch for arms 3.5 inch for legs
What is the ideal cuff used for BFRT?	55.6%	33.3%	8.1%	3%

Question	Determining BFR pressures	Availability of various size of cuffs	Economical	Lack of understanding	All of above
According to you what are primary barriers for application of BFRT in daily practice?	10.7%	5.8%	5.8%	13.6%	64.1%

Question	100 mm of Hg	150 mm of Hg	200 mm of Hg	Not aware
How much should be acceptable pressure for BFRT?	10.7%	35%	9.7%	44.7%

Question	Muscle atrophy	Post – operative rehabilitation	Parkinson disease	Multiple sclerosis
In which condition can BFRT be used	56.3%	61.2%	13.6%	12.6%

Question	Increase in muscle mass	Increase in muscle strength	Increase in cardiovascular capacity	All of above	None
BFRT may lead to	9.7%	13.6%	14.6%	56.3%	5.8%

Question	Thromboembolism	Vascular conditions	Joint replacements	Dialysis
In which patients BFRT is contraindicated	65%	45.6%	13.6%	35%

Table 2: showing the blood flow restriction training knowledge of physiotherapy students in percentages.

Question	Yes	No
Does BFR at low loads give similar changes like heavy strength training?	68.9%	31.3%
Does BFR training improve muscle performance?	87.4%	12.6%
Can BFR training improve muscle atrophy?	81.6%	18.4%
Do you feel that this training should be used in daily practice?	72.8%	27.2%

5. Discussion

This study investigated knowledge about BFR training in physiotherapy students this is the first major study to investigate the knowledge of BFR training in Indian physiotherapy students.

After conducting this research for six months and analyzing the data through our self – made questionnaire. As far as the awareness about the term BFR Training or BFRT in concerned 52.4% of 100 physiotherapy students were aware whereas 47.6% still didn't knew about the term and what exactly is BFR Training. Even though majority of them were able to identify the term still there is considerable amount of students who weren't able to do the same.

Which projects the lack of use of term BFRT in the syllabus or the practical scenarios.

75.7% of physiotherapy students were correct about the principle followed in BFRT which is low intensity training and this also what most of the physiotherapy students use in rehabilitation of their patients which indicates a good sign.

However on questioning the application and practical usage of BFRT there was a major drop of percentages in correct responses.58% of 100 physiotherapy students thought only tourniquet type of cuffs are used and they weren't aware about the use of elastic automated cuff and nylon cuff that are also being used in treatment of patients through BFR Training. So even after having an option of multiple selection of answers major votes were only for tourniquet cuff.

Majority of students were not able to guess the right width of cuff size that is used for arms and legs respectively.66.7% votes were for 0.5 inch for arms an 1.5 inch for legs which is

incorrect, the ideal cuff width used is 1.5 inch for arms and 2.0 for legs.

65.1% were incorrect on identifying the ideal pressure that is used for rehabilitation with BFR Training which is 150 mm of hg.44% of the incorrect answers opted for the option not aware about the ideal pressures used. These responses clearly show us that there is a major lack in knowledge about application of BFRT in physiotherapy students which will eventually affect the usage of BFRT in treatment of patients if not educated the students enough about it in the future.

Majority of students were correct in identifying the possible barriers of BFR Training that is limiting its use in practical setups these included 1. Difficulty in determining correct pressures used in BFR as there was a lack in knowledge 2. availability of various cuff sizes that are used in the training either the manufacturing of the cuffs could be less in India or students are not aware where it can be easily accessible 3. Economical and 4. Lack of understanding 64.1% were correctly able to identify all the four barriers.

Most of physiotherapy students were able to identify conditions in which BFR can be used which included muscle atrophy (56.3%), post – operative rehabilitation and Parkinson diseases. Though the votes for use of BFR training for Parkinson were less compared to other two options. Might be due to lack of knowledge about its benefits in this specific condition.67.7% of them were also able to identify the conditions wherein BFR Training is contraindicated which is extremely important to be known as a part of healthcare.

On a good note, even after a lack in knowledge in application and usage of BFR Training physiotherapy students are at least correct about the benefits of BFR Training which was 56.3% out of 100 physiotherapy students were correct.68.8% said that it gives similar results like training with high resistance.81.6% said yes that BFR Training can improve muscle performance.

Majority of total physiotherapy students 72.8% believed that BFR Training should be used in daily practice and more rehabilitation of patients with this technique should be done.80.6% of them will also encourage usage of this training method to their colleagues in the future after acquiring complete knowledge about BFR Training.

6. Conclusion

This study gives us an overview about the amount of knowledge physiotherapy students have for Blood Flow Restriction Training. Even after BFR Training being the most popular technique used worldwide due its role in optimizing muscle mass, strength and hosts other benefits too. However, despite of the interest in this area of research, there are some gaps found in Indian population. After assessing the knowledge in physiotherapy students about blood flow restriction training we got to know that majority of physiotherapy students are only aware about the term BFR Training. They showed a lack in knowledge in identifying the application of the technique; its nature and contraindications.

Clinical Implications

One solution that can be implemented in future is professional developmental of opportunities to target identified gaps in knowledge - By including blood flow restriction training as a part of curriculum in the study program and practical implication about it should be increased too.

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Appendix I: Data collection tools**A. DEMOGRAPHIC DETAILS**

1. Age – _____
2. Gender
 - Male
 - Female
 - Prefer not to say
 - Other
3. Currently in which academic year?
 - Fourth year
 - Intern
 - Postgraduate
4. Current work setting
 - Hospital setup
 - Clinical setup
 - Professional setup
 - Other

B. BLOOD FLOW RESTRICTION TRAINING KNOWLEDGE QUESTIONNAIRE

1. Do you think physiotherapists should be updated with recent techniques or technologies?
 - Yes
 - No
 - Maybe
2. Do you feel anaerobic training is effective?
 - Yes
 - No
 - Maybe
3. What do you prefer for strength training (as rehabilitation) of your patients?
 - Low intensity training
 - High intensity training
4. Are you aware of Blood Flow restriction Training?
 - Yes
 - No

5. BFRT follows which principle?
- Low intensity training
 - High intensity training
6. BFRT involves application of?
- Mechanical compression
 - Metabolic compression
 - Both
 - None
7. Which types of cuffs are used in BFRT? [multiple answers can be selected]
- Tourniquet Cuff
 - Non - inflated cuff
 - Elastic automated cuff
 - Nylon cuff
8. Which blood vessel is mainly occluded in BFRT?
- Arterial Vessels
 - Venous Vessels
9. What is the ideal cuff used for BFRT?
- 0.5 inch for arms 1.5 inch for legs
 - 1.5 inch for arms 2.0 inch for legs
 - 2.0 inch for arms 3.5 inch for legs
 - 2.5 inch for arms 3.5 inch for legs
10. According to you what are primary barriers for application of BFRT in daily practice? [multiple answers can be selected]
- Determining BFR pressures
 - Availability of various size of cuffs
 - Economical
 - Lack of understanding
 - All of above
11. How much should be acceptable pressure for BFRT?
- 100 mm of Hg
 - 150 mm of Hg
 - 200 mm of Hg
 - Not aware
12. In which condition can BFRT be used? [multiple answers can be selected]
- Muscle atrophy
 - Post – operative rehabilitation
 - Parkinson disease
 - Multiple sclerosis
13. BFRT may lead to
- Increase in muscle mass
 - Increase in muscle strength
 - Increase in cardiovascular capacity
 - All of above
 - None
14. In which patients BFRT is contraindicated? [multiple answers can be selected]
- Thromboembolism
 - Vascular conditions
 - Joint replacements
 - Dialysis
15. Does BFR at low loads give similar changes like heavy strength training?
- Yes
 - No
16. Does BFR training improve muscle performance?
- Yes
 - No
17. Can BFR training improve muscle atrophy?
- Yes
 - No
18. Do you feel that this training should be used in daily practice?
- Yes
 - No