

# B3 / B STRONG STUDIES

1. Bands Comparison Safety Study - Walking
2. Safety and Systemic Response Study - Yoga

*\*B Strong and B3 Bands are the same Bands made at the same facility, but with a different pull tab*

## 1. Safety Study Walking – Narrow Flexible Bands vs Wide Rigid Bands

See attached ‘Tanaka Manuscript’

B3 / B Strong Bands (Narrow Elastic) vs Hokanson Cuffs (Wide Rigid) (Similar to Delfi and Smart Cuffs)

(B Strong and B3 Bands are the same Bands made at the same facility, but with a different pull tab)

### Exercise: Walking

**Summary** - In conclusion, the main finding in the present study is that the use of wide-rigid BFR cuffs elicited markedly increased pressor responses and a heightened myocardial oxygen demand during low-intensity walking compared with the narrow-elastic bands or control. It appears that an exaggerated blood pressure response should be expected when using wide-rigid BFR cuffs that increase systemic vascular resistance by occluding arterial inflow, compressing tissues, and reducing the ability of the skeletal muscle pump to function. Therefore, we conclude that wide-rigid cuffs may only be safe within a narrow window of pressures and should be conducted in a setting in which continuous hemodynamics are monitored. In contrast, the narrow-elastic bands do not seem to elicit an augmented exercise pressor response compared to control. These findings suggest that at-risk populations can perform BFR without fear of overt cardiovascular risk. By nature of its width and material, it is difficult to minimize the risks associated with wide-rigid cuffs when occluding any amount of arterial blood flow, and as such, it should be prescribed carefully.

## 2. Safety Study Yoga

See attached ‘Yoga and Blood Flow Restriction’

Study using B Strong / B3 Bands

Exercise: Yoga

**No increase in arterial pressure or BP when using B Strong with Yoga** - The present study investigated the hemodynamic responses induced by combining BFR and yoga exercise. We found that there were no further elevations in arterial blood pressure and myocardial oxygen demand when BFR was added to yoga practices. These results suggest that BFR can be added to yoga without inducing exaggerated pressor and myocardial responses in young healthy adults.

**Significant increase in circulating Lactate** - One of the proposed mechanisms of BFR for augmenting muscle hypertrophy is the greater production of lactate and other metabolites that stimulate the

release of growth hormone, insulin-like growth factors, and protein synthesis. **Blood lactate concentration was significantly greater after yoga with BFR.** Greater concentrations of blood lactate have been observed in a number of previous BFR exercise studies. Our findings indicate that BFR can be applied to yoga while avoiding unfavorable hemodynamic responses and preserving the intended effects on muscle hypertrophy.

## **BLOOD FLOW RESISTANCE TRAINING RESEARCH FINDINGS**

- 1. Athletes - Muscle Strength and Size**
- 2. Bone Strength**
- 3. Brain Benefits**
- 4. Cardiac Benefits**
- 5. Diabetes Benefits**
- 6. Growth Hormone Impact in Men**
- 7. Growth Hormone Impact in Women**
- 8. Vein Health**
- 9. Weakness or Injury in Lower Extremity**
- 10. Blood Sugar / Insulin Benefits**

### **1. Athletes - Muscle Strength and Size and BFR Training:**

This review summarizes the benefits of BFR training for athletes (Duquesne Athletics - Rugby and Football).

[Go here to Read the Review](#)

Quote: **"All four investigations demonstrated that a significant increase in muscle strength and/or hypertrophy occurred with BFR and training"**

**Conclusion:** **Research supports** the testimonials from all kinds of athletes using BFR training that **BFR is at the forefront of a breakthrough in exercise and performance for athletes of all ages.**

### **2. Bone Strength and BFR Training:**

It is a well-known fact that high intensity strength training with heavy weights is beneficial to bones. However, many people cannot tolerate heavy weight training, and many more just do not want to lift heavy weights. Certainly, the senior population cannot consider heavy weight training.

### **BFR training benefits the bones.**

Below is a review article that looked at a large sampling of studies and research done on BFR as it applies to **Bone Metabolism and Bone Density**. Two researchers, independently and blindly, selected the studies to review based on established inclusion and exclusion criteria (Keywords such as BFR and Bone Metabolism) and showed that **BFR training increases the expression of bone formation markers**.

#### [Go here to Read the Review](#)

Summary and Conclusion with 4 direct quotes:

"Using BFR showed improved skeletal bone mass patterns in people with certain diseases (e.g. avascular necrosis of the femoral head and osteopenia or osteoporosis), and other papers showed that low intensity exercise combined with BFR may provide not only an increase in muscle adaptation, but also in bone and consequently modification in its biomarkers"

"Studies analyzed two biomarkers (bone alkaline phosphatase and amino-terminal telopeptides, respectively) and found that BFR training also accelerates bone metabolism"

"The results presented by the selected studies showed that both aerobic and anaerobic exercises combined with BFR can provide satisfactory results related to the bone biomarkers. Thus, this technique (BFR) is a feasible and applicable alternative to many population groups (elderly, young, physically active or not), that aim to treat or slow up the effects of bone diseases"

"The results of this study may assist future clinical research with the method of RFS and bone metabolism (formation and resorption) and show the positive effect of this technique combined with exercise in the prevention and treatment of bone diseases"

**Conclusion:** BFR and low intensity exercise are good for the bones.

### **3. Brain Benefits and BFR Training:**

Research shows high intensity exercise stimulates release of IGF-1 (Insulin Like Growth Factor), and that **IGF-1 is proven to be beneficial for the brain.**

IGF-1 helps the body in fighting the effects of aging. Benefits of IGF-1 include: building muscle mass, preventing muscle wasting, building bone mass, helping with growth, managing blood sugar levels and **protecting against neurological disorders.**

**The Problem:** most people cannot do high intensity exercise, especially senior citizens.

**The Solution:** BFR training with light load exercise stimulates Growth Hormone release, which in turn results in increased IGF-1. Lighter Load exercise is exactly what the senior population needs to protect against disorders like Parkinson's, Alzheimer's, and dementia.

Research reports reduced symptoms and improvement in daily function.

Links to numerous studies on BFR as well as a summaries of what was concluded by the researchers:

**A. Parkinson's Patient Case Study with BFR > [Go here to Read the Study](#)**

**Conclusion:** BFR training can produce functional improvements, reduce restless leg syndrome symptoms and can be safely utilized with a subject with Parkinson's who wishes to maintain the ability to remain recreationally active. Low-load resistance training with BFR could be a promising strategy especially for older adults unable to tolerate high loads.

**B. BFR better than Traditional Exercise for your Brain > [Go here to Read the Study](#)**

**Conclusion:** Short-term and long-term low-load resistance training with BFR is more efficient regarding the enhancement of cognitive functions than a "traditional" resistance exercise regime without BFR.

**C. BFR increases Cerebral Blood Flow > [Go here to Read the Study](#)**

**Conclusion:** BFR training has a positive effect on the brain by increasing cerebral blood flow and that it is useful for treating diseases such as stroke and cognitive disorders caused by brain dysfunction.

**4. Cardiac Benefits and BFR Training:**

Exercise as simple as walking while utilizing BFR can provide tremendous benefits for people suffering from cardiovascular disease.

[Go here to Read the Study](#)

VEGF (Vascular Endothelial Growth Factor) > Stimulates vascular remodeling or the rebuilding of more elastic blood vessels. VEGF is stimulated in greater amounts (four fold) with BFR exercise.

NO (Nitric Oxide) > Results in improving blood vessel elasticity, vasodilation of arteries, thinning of the blood, as well as increased energy and endurance.

**Study Results:**

*"The most notable transcriptional change in response to BFR was for VEGF. VEGF is the central growth factor involved in regulating angiogenesis. This potent growth factor is a critical signal in vascular remodeling because it maintains vascular integrity and stimulates the production of the vasodilatory mediator nitric oxide (NO). In the present study, we observed a fourfold increase in VEGF mRNA expression after BFR exercise, an elevation that remained 24 hours after exercise."*

[Go here to Read the Study](#)

**Study Results:**

*"Our findings suggested that BFR training might be effective in lowering blood pressure during exercise. These data have potential clinical application in the treatment of hypertension, which should be further investigated in patients with high blood pressure"*

[Go here to Read the Study](#)

**Study Results:**

"This study shows that low intensity BFR training in people with ischemic heart disease resulted in: increased muscle strength and mass, as well as endurance or VO2 max improvement. The study concludes that BFR is a promising and effective method for cardiac rehabilitation"

[Go here to Read the Study](#)

**Study Results:**

"Safety review of 12,000 + subjects, concluded that BFR is safe. Moreover, it is likely that BFR training is a useful method for training patients with a variety of diseases such as diabetes, hypertension and obesity. BFR training has additional effects, such as increasing GH secretion. GH enhances lipolysis and bone formation, which may contribute to the reduction of obesity and bone diseases such as osteoporosis. It also stimulates the liver to secrete insulin-like growth factor-1 (IGF-1), resulting in improvement of function of the endothelial cells and insulin sensitivity"

**Conclusion:** Numerous research studies have concluded BFR Training offers promising cardiovascular system benefits.

## 5. Diabetes and BFR Training:

[Go here to Read the Study](#)

**Study Objective:** To determine the effects of short-term, moderate intensity blood flow restricted (BFR) walking on blood glucose and insulin responses to a standard meal challenge in healthy, college-aged males. Twelve, apparently healthy men (18-35 years), performed 10 sessions of treadmill walking at 50 ± 5% of their predetermined VO2 for 20 min separated by 2-3 days. The men were randomly placed into one of two groups—control, no BFR (CON) or BFR training groups.

**Results:** In the short term, 10 training sessions of moderate intensity aerobic BFR exercise significantly increased the effectiveness of insulin in the fasted and postprandial state. Further study is recommended to determine if these findings may translate into beneficial applications for other populations, such as within the prediabetic or diabetic population who may not be able to sustain high intensity exercise.

**Conclusion:** Exercise is good for diabetics, BFR exercise is better.

## 6. Growth Hormone Impact in Men and BFR Training:

The two studies below demonstrate that men can perform low intensity BFR exercise and stimulate a big Growth Hormone release. Without BFR, men would have to perform extremely high intensity exercise to get this type of response in their bodies.

**Study #1: Hemodynamic and hormonal responses to a short-term low-intensity resistance exercise with the reduction of muscle blood flow.**

**Summary:** The hemodynamic and hormonal responses were measured in response to a short-term low-intensity resistance exercise with the reduction of muscle blood flow. Eleven untrained men performed bilateral leg extension exercise under the reduction of muscle blood flow of the proximal end of both

legs pressure-applied by a specially designed BFR Band. The intensity of exercise was 20% of one repetition maximum. The subjects performed 30 repetitions, and after a 20-second rest, they performed three sets again until exhaustion. Serum concentrations of growth hormone (GH) were measured.

**Results:** The BFR Bands significantly increased GH as compared to the control group. (0.11±0.03 to 8.6±1.1 ng/ml)

[Go here to Read the Study](#)

**Study #2: Circulating hormone and cytokine response to low-load resistance training with blood flow restriction in older men.**

**Summary:** Seven healthy older men (age 71.0 ± 6.5 year) performed five sets of unilateral LLRT (low load resistance training) knee extensions (20 % 1-RM) of both limbs, with or without BFR in a counterbalanced order. Venous blood samples were taken at rest and 30-, 60- and 120-min post-exercise and measured for plasma concentrations of growth hormone (GH). GH increased from rest to 30-min post-exercise and was greater during LLRT with BFR than without.

**Results:** A single bout of LLRT with BFR increases the circulating concentrations of GH in older men and may explain the skeletal muscle adaptations observed following training with BFR.

[Go here to Read the Study](#)

**Conclusion:** These results demonstrate that BFR significantly stimulates the exercise-induced GH response.

## 7. Growth Hormone Impact in Women and BFR Training:

### Growth Hormone Benefits in Women:

- Feel Younger
- Look Younger
- More Energy and Better Sleep
- Stronger Bones
- Healthier Cardiovascular System
- Live Longer
- And Perform Better

### The Problem:

- Most Women do not have an hour a day, or ability to get to a gym daily
- Most women do not want to lift heavy weights
- Most women do not want the pain and soreness following high intensity exercise

### The Solution:

- Women of any age (8-90) can now use BFR training and do Light Exercise
- Less than 20 minutes a day from anywhere
- Stimulate a Big Growth Hormone Release
- Little or No Soreness

### **Study #1: Effect of a low-intensity resistance exercise program with blood flow restriction on growth hormone and insulin-like growth factor-1 levels in middle-aged women**

**Summary:** The effect of a 12-week low-intensity resistance exercise program with blood flow restriction (LI-BFR) on growth hormone (GH) and insulin-like growth factor-1 (IGF-1) levels in middle-aged women (52.7 +/- 7.8 years) was examined. 44 women completed pre- and post-assessments of GH hormone and IGF-1 levels.

**Results:** A significant increase in GH and IGF-1 levels was observed in the High Intensity and Low Intensity BFR groups when compared with a control group.

[Go here to Read the Study](#)

### **Study #2: Hormone Responses to a Low Intensity Blood Flow Restricted Resistance Exercise in College-Aged Females**

**Summary:** To evaluate how the hormone response to exercise differed between low intensity blood flow restricted resistance exercise and traditional high-intensity resistance exercise in college-aged women. A total of 13 healthy women (aged 18-25 yrs), volunteered for this randomized crossover study. Subjects performed a session of low intensity blood flow restricted resistance exercise (BFR) and a session of traditional high intensity resistance exercise without blood flow restriction (HI) on separate days.

Fasting growth hormone (GH) response was measured in the morning pre and post exercise sessions. GH significantly increased immediately post exercise for both protocols compared to baseline (No exercise). In contrast, ratings of perceived exertion were significantly higher for the HI protocol.

**Results:** Low intensity BFR exercise stimulated GH responses equal to high intensity exercise in young women, and perceived exertion was much lower in the BFR group

[Go here to Read the Study](#)

**Conclusion:** These studies demonstrate that women can perform low intensity, short BFR exercise sessions that results in a large GH response similar to high intensity exercise, while reducing exertion and stress on their body.

## **8. Vein Health and BFR Training:**

Varicose veins are common issues as people get older. Veins in the legs can lose their ability to expand and contract which is essential to moving blood back to the heart as the heart is pumping,; this is called Venous Compliance (ability of the vein to expand and contract). Reduced venous compliance is one of the common risk factors of varicose veins.

Many experts believe venous compliance is improved by endurance exercise. Studies show that people who do regular endurance type exercise have much higher venous compliance and thus less varicose veins and complications from varicose veins.

**The Problem:** Most people as they get older cannot perform, or do not want to perform endurance exercise, and thus they are highly susceptible to declining venous compliance.

**The Solution:** BFR Walking has been proven to improve venous compliance.

**Study on Effect on Veins with BFR Walking** > [Go here to Read the Study](#)

**Study Objective:** It was hypothesized that slow walking with BFR may affect limb venous compliance and this study examined the influence of 6 weeks of walking with BFR on venous compliance in older women. Sixteen women aged 59–78 years were partially randomized into either a slow walking with BFR group or a non-exercising control group.

**Results:** After 6 weeks, leg venous compliance increased significantly in the BFR walk group and maximal venous outflow (MVO) also increased significantly after the BFR walk group trained for 6 weeks. No significant differences were observed in venous compliance and MVO in the control group

Increased venous compliance means the veins are working better to move blood. Increased MVO (maximal venous outflow) means more blood is moving through the veins. This is exactly how the veins should function.

**Conclusion:** In conclusion, 6 weeks of slow walking with BFR in elderly subjects significantly resulted in increased limb venous compliance. BFR training represents a safe alternative for improving vein health.

## 9. Weakness or Injury in Lower Extremity and BFR Training:

**Case Study:** [Go here to Read the Study](#)

**Background:** Blood flow restricted (BFR) training, the brief and partial restriction of venous outflow of an extremity during low load resistance exercises, is a safe and effective method of improving strength in healthy, active individuals. A relatively unexplored potential of this adjunctive modality lies in treating patients with severe musculoskeletal trauma, persistent chronic quadriceps and hamstring weakness despite traditional therapy, and low improvement during early postoperative strengthening.

**Conclusion:** BFR therapy at low loads can affect improvement in muscle strength in patients who are unable to perform high-resistance exercise or patients who have persistent extremity weakness despite traditional therapy.

## 10. The Glycemic and Insulinemic Effects of Short-Term Blood Flow Restricted Walk Training:

**Case Study:** [Go here to Read the Study](#)

**Background:** The purpose of this investigation was to determine the effects of short-term, moderate intensity blood flow restricted (BFR) walking on blood glucose and insulin responses to a standard meal challenge in healthy, college-aged males. Twelve, apparently healthy men (18-35 years), performed 10 sessions of treadmill walking at  $50 \pm 5\%$  of their predetermined  $VO_2$  for 20 min separated by 2-3 days. The men were randomly placed into one of two groups—control, no BFR (CON) or BFR training groups.

**Conclusion:** In conclusion, the current investigation demonstrated that in the short term, 10 training sessions of moderate intensity aerobic BFR exercise significantly increased the effectiveness of insulin in the fasted and postprandial state. Although not confirmed, these findings may translate into beneficial applications for other populations, such as within the prediabetic or diabetic population who may not be able to sustain high intensity exercise.