MONTHLY

THE S&C RESEARCH REVIEW

By Chris Beardsley

SEPT 2018
EDITION

September 2018 Edition

Editorial by Chris Beardsley

Welcome to the September 2018 edition! As usual, there is plenty of new research for both strength coaches working with athletes and bodybuilding enthusiasts. This month, the strength training section is quite varied, but the overall theme is a comparison of different exercise variations, where variety can be produced in quite traditional and relatively novel ways. One study looked at the effects of adding a looped elastic band around the thighs in the back squat. Another study assessed the effects of verbal and tactile cues during the glue bridge. And one study compared the effects of ballistic and non-ballistic bench press exercise variations.

In the athletic performance section this month, the studies covered provide an insight into the force vector hypothesis of training transfer to sprinting, and confirm our understanding of the importance of strengthening the hip flexors for improving sprint running ability. In the hypertrophy section, the research is again quite varied. Overall, the literature is expanding in a number of directions, and the selection of studies covered in this edition reflects this trend. Researchers are currently particularly interested in understanding the effects of weekly training frequency (whether volume-matched or not), as well as the effects of (various types) of aerobic exercise when they are performed concurrently with strength training. So far, however, there is no real consensus in either of these areas. Some data suggest that neither frequency nor concurrent aerobic exercise have any meaningful effects on hypertrophy, while other research suggests the opposite.

Next month is the one year anniversary of the new format! To celebrate the occasion, the edition will feature reviews of "modern classics" that have fundamentally changed our understanding of strength training and the process of hypertrophy over the last couple of years.

September 2018 Edition

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S&C RESEARCH REVIEW

Assessing the effects of a looped band around the thighs during back squats

Some bodybuilders and physique athletes squat with a elastic band looped around the lower part of the thigh, with the intention of increasing the amount of gluteus maximus muscle activation by increasing the requirement to produce a hip abduction and external rotation joint moment. In addition, it has been suggested that using an elastic band in this way may function as a proprioceptive aid that encourages lifters to increase the frontal plane distance between their knees, thereby reducing the amount of knee valgus.

Key findings

In both strength-trained and untrained males, the addition of a looped band around the lower (distal) thigh does not affect the maximum load that can be lifted for 3 reps (the 3RM load) nor the number of reps that can be done with a bodyweight load. However, it does increase the activation of most lower body muscles, although the gluteus maximus may be less affected in trained subjects, than in untrained subjects.

Practical implications

Recreational lifters can use a looped elastic band around the lower part of the thighs to increase muscle activation in the squat, without affecting the load on the bar or the number of reps. However, gluteus maximus activation may only be improved reliably in untrained lifters, and trained lifters may achieve increases mainly only in the thigh musculature.

Effects of a band loop on lower extremity muscle activity and kinematics during the barbell squat. Foley, R. C. A., Bulbrook, B. D., Button, D. C., & Holmes, M. W. R. (2017). *International Journal of Sports Physical Therapy*, 12(4), 550.

Looped band around thigh ↑ gluteus maximus activation in squats?

STUDY OBJECTIVE

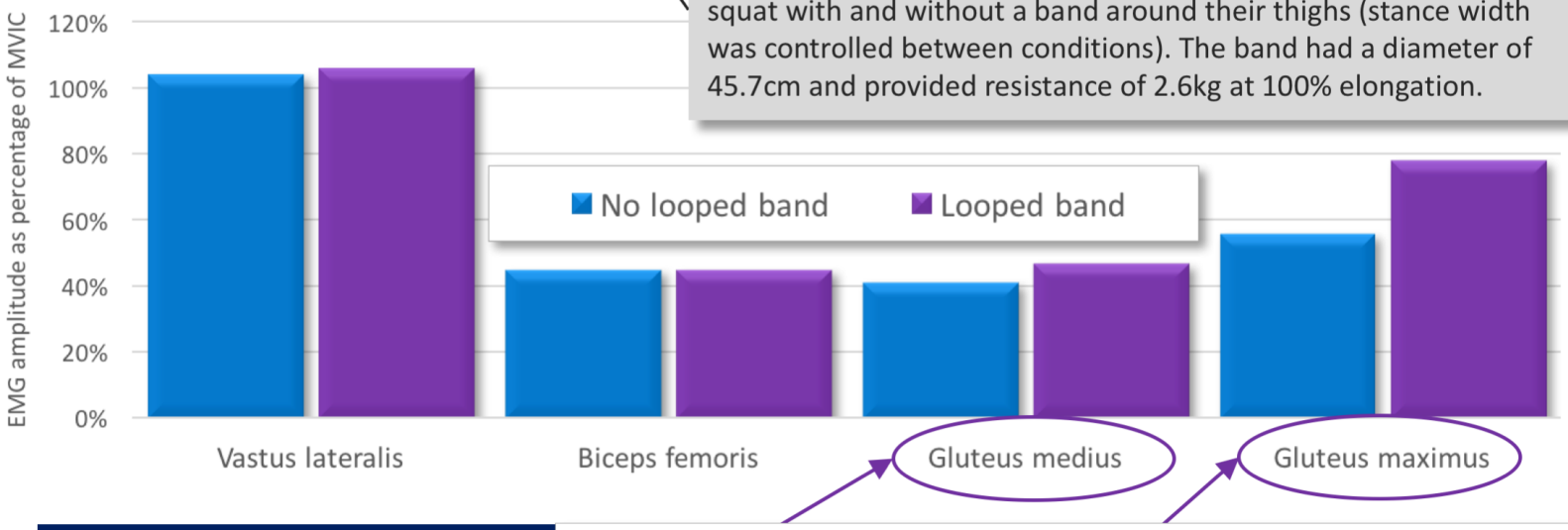
To assess the muscle activation of the hip and knee extensors (and the number of repetitions that could be performed to failure) in a free-weight back squat with and without a looped resistance band around the lower thigh, just above the knee, in strength-trained males

What was measured?

MEASUREMENTS

- 3RM back squat to 90° knee angle (by an electronic goniometer); muscle activation by electromyography (EMG) mean amplitudes of the gluteus medius, gluteus maximus, vastus lateralis, and biceps femoris in tests with 80% (reps 1, 3, and 5, only rep 1 shown below) and 60% of 1RM, and normalized to maximum voluntary isometric contraction (MVIC) against fixed external resistance

Testing: Subjects did 5 reps at 80% of 1RM (predicted from 3RM), and as many reps as possible to failure at 60% of 1RM, of the back squat with and without a band around their thighs (stance width was controlled between conditions). The band had a diameter of 45.7cm and provided resistance of 2.6kg at 100% elongation.



WHAT DOES THIS MEAN?

There was no *significant* difference in the number of reps done with 60% of 1RM, in squats with or without the band around the thighs (21.4 ± 6 vs. 20.4 ± 4.7 reps).

Placing a looped band around the thighs during the back squat leads to greater muscle activation of the **gluteus medius** and **gluteus maximus**, and may also allow a slightly ↑ number of reps to be performed to failure with light-to-moderate loads.

Spracklin, K. F., Button, D. C., & Halperin, I. (2017). Looped Band Placed Around Thighs Increases EMG of Gluteal Muscles Without Hindering Performance During Squatting. *Journal of Performance Health Research*.

Strength & Conditioning Research

OBJECTIVE

To assess the effects of a looped elastic band around the lower part of the thighs on knee valgus and lower body muscle activation in back squats performed by both trained and untrained subjects.

INTERVENTION

Both untrained and trained subjects did squats with a 3RM load and with a barbell load equal to bodyweight on two different days. On the first day, the subjects did both sets of squats without a looped band around the thighs. On the second day, the subjects did the same two sets of squats with a red (moderate resistance) elastic band looped around the lower (distal) part of the thighs, just above the knee, placed in order to resist the outward movement of the knees during the exercise. The subjects were requested to "keep the band tight throughout the entire squat."

POPULATION

16 male subjects, (8 trained, aged 25.4 ± 4.4 years; and 8 untrained, aged 22.8 ± 1.6 years)

MEASUREMENTS	RESULTS
Muscle activation: By peak electromyography (EMG) amplitudes normalized to levels during maximum voluntary isometric contractions (MVICs) for four lower body muscles, on the right and left sides of the body.	EMG amplitudes were greater with the band for all muscles in the lowering (eccentric) phase, and for all muscles except the right gluteus maximus in the lifting (concentric) phase. Only the EMG amplitude of the gluteus maximus differed with training status, but all muscles appeared to increase in EMG amplitude with increasing load (from bodyweight to 3RM).
Knee Width Index (KWI): By recording joint angles by a 3D motion capture system, to record the ratio of the distance between the right and left lower thigh, and the distance between the right and left ankles.	KWI was similar with and without the band in the lowering (eccentric) phase, with both 3RM and bodyweight loads, in both trained and untrained subjects. KWI was similar with and without the band in the lifting (concentric) phase in both trained and untrained subjects, but the KWI was lower with a heavier load (3RM vs. bodyweight load).
Number of reps with bodyweight load, and 3RM load	The number of reps to failure with a bodyweight load was similar with and without the band in the trained group (17.7 ± 9.1 and 18.1 ± 10.0 reps) and also in the untrained group (14.9 ± 9.5 and 16.1 ± 6.5 reps). The 3RM loads were similar with and without the band in the trained group (132.7 ± 21.2 and 130.3 ± 19.5 kg) and in the untrained group (104.5 ± 10.8 and 104.0 ± 9.7kg).

SUMMARY

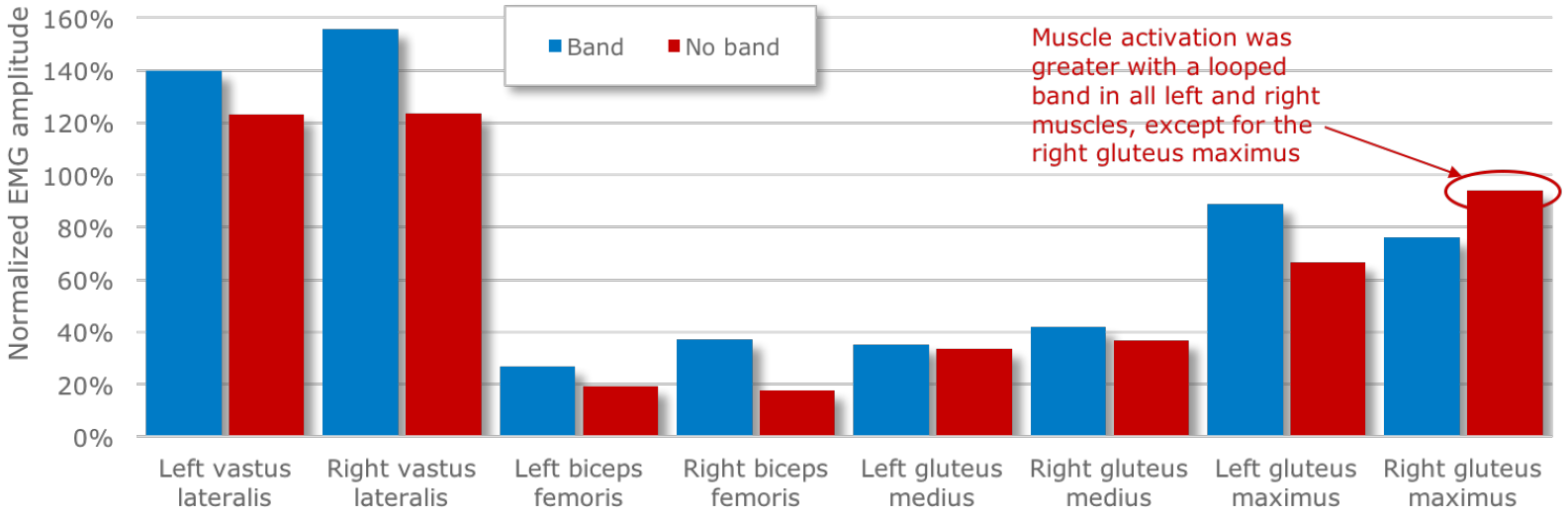
In both strength-trained and untrained males, the addition of a looped band around the lower (distal) thigh does not affect the maximum load that can be lifted for 3 reps (the 3RM load) nor the number of reps that can be done with a bodyweight load. However, it does increase the activation of most lower body muscles, although the gluteus maximus may be less affected in trained subjects, than in untrained subjects.

Analysis

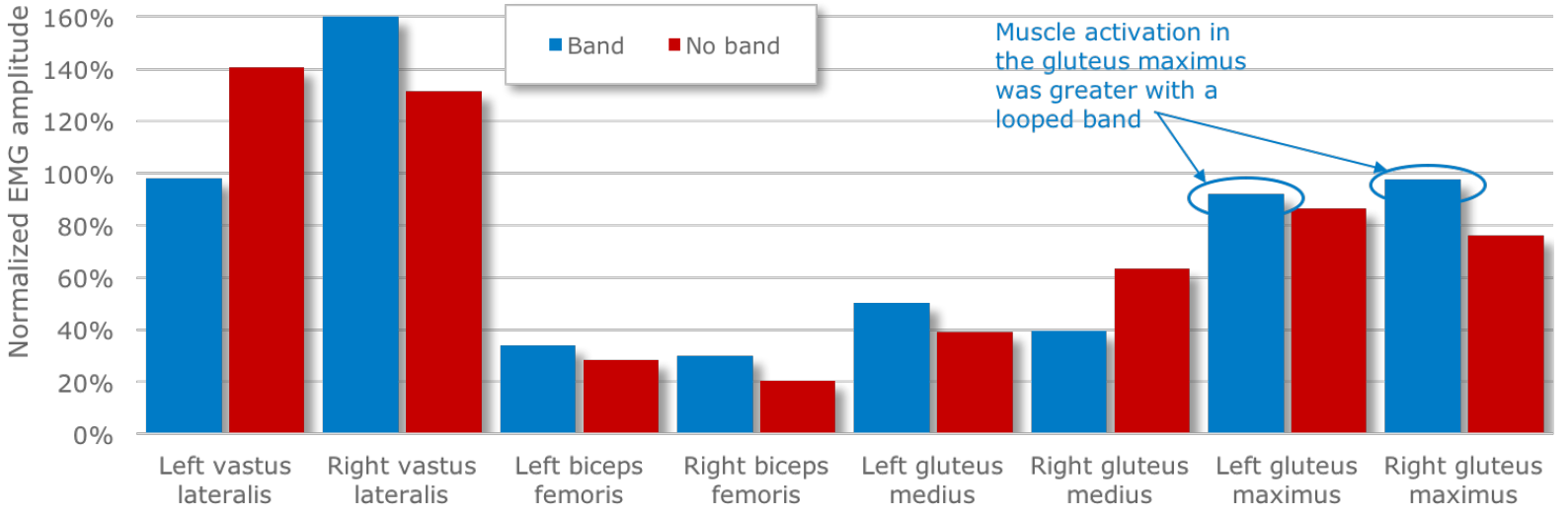
This study reported that wrapping a looped elastic band around the lower (distal) thighs increases the activation of most lower body muscles, although the gluteus maximus appears to be less affected by the looped band in trained subjects, compared to in untrained subjects.

Importantly, these increases in lower body muscle activation were achieved without any differences in the load used in a 3RM test, and without any differences in the number of reps performed to failure during a set of as many reps as possible with a bodyweight load.

Normalized electromyography (EMG) amplitudes of the lower body muscles during the lifting phase of 3RM back squats with and without a looped band placed around the bottom of the thighs, in **strength-trained males**



Normalized electromyography (EMG) amplitudes of the lower body muscles during the lifting phase of 3RM back squats with and without a looped band placed around the bottom of the thighs, in **untrained males**



Overall, these results are somewhat in agreement with previous research, which reported greater gluteus maximus and gluteus medius (but not vastus lateralis or biceps femoris) muscle activation, but no changes in the number of reps to failure with a 60% of 1RM load, when applying a looped elastic band around the lower thighs in barbell back squats, in strength-trained males (1).

It is unclear why previous research found a greater effect of the looped band on hip muscle activation, while this study found that the gluteus maximus was not reliably increased by using the looped band. The differences between the two studies may relate to the differences in band type. The previous study used an 18-inch diameter blue elastic band, rated "extra heavy" while this current study used a 12-inch diameter red elastic band, rated "moderately heavy." While it is unclear which of these two conditions would have involved greater band tension at the knee width achieved by the subjects in the squat, the necessary hip abduction/external rotation torque may have influenced the amount of hip muscle activation achieved.

The researchers also found that using the looped band around the thighs did not alter the amount of knee valgus that was achieved by the lifters in the squat, as knee width index (KWI) was not affected.

No previous studies have assessed the effects of using a looped elastic band around the lower thighs on joint angle movements in the loaded barbell back squat. However, studies have assessed the effects of applying a looped elastic band around the lower thighs on joint angle movements in the bodyweight squat, jump, and jump landing movements (2,3). These studies have also shown that using a looped elastic band around the lower thighs does not appear to affect knee valgus in bodyweight squats or jumps (2), but may alter some joint angle movements in certain phases of landing from a jump (3).

Since this study normalized the levels of muscle activation in the squats to the levels of muscle activation achieved during maximum voluntary isometric contractions, we can compare the muscles to one another with some degree of confidence. This analysis reveals the quadriceps are by far the most activated muscle of the group measured, with the gluteus maximus coming a distant second. The hamstrings are only minimally activated. This analysis agrees with the predictions of musculoskeletal models (4,5), and also with previous research using electromyography (6,7). In this study, the activation of the adductor magnus was not recorded, but we would expect the activation of this key hip extensor to be higher than that of the gluteus maximus (4).

Conclusions

In both strength-trained and untrained males, the addition of a looped band around the lower (distal) thigh does not affect the maximum load that can be lifted for 3 reps (the 3RM load) nor the number of reps that can be done with a bodyweight load. However, it does increase the activation of most lower body muscles, although the gluteus maximus may be less affected in trained subjects, than in untrained subjects.

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Knowing the science of strength training will help you write better programs for yourself, your clients, and the athletes you train

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