LETTER TO THE EDITOR

Second letter to the Editor about the article "The addition of blood flow restriction to resistance exercise in individuals with knee pain: a systematic review and meta-analysis"

We read with interest the recent systematic review entitled "The addition of blood flow restriction to resistance exercise in individuals with knee pain: a systematic review and meta-analysis" by Cuyul-Vásquez et al.¹

The use of blood flow restriction (BFR) by musculoskeletal rehabilitation and sports medicine professionals is increasingly popular which makes this systematic review an important addition. Although the authors reported that they conducted the review following recommendations in the Cochrane Handbook,² there are some important departures, which have likely introduced biases and inconsistencies we would like to draw attention to.

Our first concern is how the data for pain reduction (Fig. 3A in Cuyul-Vásquez et al.¹) were extracted and pooled. Their results suggest no difference between interventions (SMD = −0.37, 95% CI: −0.93, 0.19) at short-term follow-up.

On close inspection of the raw data used to generate the described effect sizes, we suspect a few critical errors may have inadvertently crept into the final analyses which have influenced the ultimate outcomes as calculated and reported. Firstly, the authors appear to have not imported and pooled homogenous outcome measures, but instead different methods of calculating these measures. Specifically, it is hard to justify pooling "mean ± standard deviation (SD)" values for Numerical Pain Rating Scale (NPRS), Visual Analogue Scale (VAS), and Western Ontario and McMaster Universities Osteoarthritis Index pain subscale (WOMAC_{pain}),^{3–5} along with "mean difference ± SD"

values for Knee injury and Osteoarthritis Outcome Score pain subscale (KOOS_{pain}),⁶ and "percentage (%) mean difference ± SD" values for KOOS_{pain},⁷ notwithstanding the use of standardized mean differences (SMD). Furthermore, it would appear that the direction of the effect estimate has been reversed in one study.⁷ The net effect of this is that the effect estimate in the study of Segal et al.⁷ is overestimated 4.5 times, and the overall effect size has been extremely (37 times) overestimated based on our calculations (SMD = −0.010, 95% CI: −0.267, 0.247) as depicted in Fig. 1A. In addition, they excluded from the meta-analyses a study⁸ that reported pain outcomes (KOOS_{pain}) that appears to meet their inclusion criteria for quantitative synthesis (SMD = −0.058, 95% CI: −0.311, 0.236 – Fig. 1B) given the clinical heterogeneity of the studies pooled in this review.⁹

Another concern is how the authors' reported and selected data throughout the review. Specifically: (a) the corresponding sample sizes for the included studies deviate from the numbers reported in original publications, for example in Giles et al.,⁵ the sample of the strengthening group was n = 39 and not 30; (b) the inclusion of a single-session study by Korakakis et al.,¹⁰ that does not meet the inclusion criteria (i.e. treatment duration between two weeks to three months); (c) the exclusion from the knee function meta-analysis of studies reporting relevant outcome measures, such as the Kujala patellofemoral score⁵ and KOOS.⁸

The pooling of heterogeneous outcome measures, the discrepancies in eligible studies, and the overestimation of the pooled effect estimate suggest that these recommendations on the effectiveness of BFR should be interpreted with some caution until the authors provide clarification. Anecdotally, BFR training is very common,^{11,12} however is also associated with potentially serious side effects^{13,14} and decisions on its use need to be based upon unbiased summaries of the available evidence.

Figure 1 Pain reduction pooled results at short-term follow-up. (A) Re-calculation of pooled effect size of included studies in the systematic review. (B) Pooled effect size with the additional study⁸ that was excluded from quantitative synthesis.

Conflicts of interest

The authors declare no conflicts of interest.

References

- Cuyul-Vásquez I, Leiva-Sepúlveda A, Catalán-Medalla O, Araya-Quintanilla F, Gutiérrez-Espinoza H. The addition of blood flow restriction to resistance exercise in individuals with knee pain: a systematic review and meta-analysis. *Braz J Phys Ther.* 2020; <http://dx.doi.org/10.1016/j.bjpt.2020.03.001> [in press].
- Higgins JPT, Green S, Version 5.1.0 ed. *Cochrane Handbook for Systematic Reviews of Interventions*. The Cochrane Collaboration; 2011.
- Bryk FF, dos Reis AC, Fingerhut D, et al. Exercises with partial vascular occlusion in patients with knee osteoarthritis: a randomized clinical trial. *Knee Surg Sports Traumatol Arthrosc.* 2016;24(5):1580–1586.
- Ferraz RB, Gualano B, Rodrigues R, et al. Benefits of resistance training with blood flow restriction in knee osteoarthritis. *Med Sci Sports Exerc.* 2018;50(5):897–905.
- Giles L, Webster KE, McClelland J, Cook JL. Quadriceps strengthening with and without blood flow restriction in the treatment of patellofemoral pain: a double-blind randomised trial. *Br J Sports Med.* 2017;51(23):1688–1694.
- Segal NA, Williams GN, Davis MC, Wallace RB, Mikesky AE. Efficacy of blood flow-restricted, low-load resistance training in women with risk factors for symptomatic knee osteoarthritis. *PMR.* 2015;7(4):376–384.
- Segal N, Davis MD, Mikesky AE. Efficacy of blood flowrestricted low-load resistance training for quadriceps strengthening in men at risk of symptomatic knee osteoarthritis. *Geriatr Orthop Surg Rehabil.* 2015;6(3):160–167.
- Tennent DJ, Hylden CM, Johnson AE, Burns TC, Wilken JM, Owens JG. Blood flow restriction training after knee arthroscopy: a randomized controlled pilot study. *Clin J Sport Med.* 2017;27(3):245–252.
- Cerqueira MS, Brito Vieira WH. Letter to the Editor about the article “The addition of blood flow restriction to resistance exercise in individuals with knee pain: a systematic review and meta-analysis”. *Braz J Phys Ther.* 2020; <http://dx.doi.org/10.1016/j.bjpt.2020.05.005> [in press].
- Korakakis V, Whiteley R, Giakas G. Low load resistance training with blood flow restriction decreases anterior knee pain more than resistance training alone. A pilot randomised controlled trial. *Phys Ther Sport.* 2018;34:121–128.
- Yasuda T, Meguro M, Sato Y, Nakajima T. Use and safety of KAATSU training: results of a national survey in 2016. *Int J KAATSU Train Res.* 2017;13(1):1–9.
- Patterson SD, Brandner CR. The role of blood flow restriction training for applied practitioners: a questionnaire-based survey. *J Sports Sci.* 2018;36(2):123–130.
- Hughes L, Paton B, Rosenblatt B, Gissane C, Patterson SD. Blood flow restriction training in clinical musculoskeletal rehabilitation: a systematic review and meta-analysis. *Br J Sports Med.* 2017;51(13):1003–1011.
- Whiteley R. Blood flow restriction training in rehabilitation: a useful adjunct or Lucy's latest trick? *J Orthop Sports Phys Ther.* 2019;49(5):294–298.

Vasileios Korakakis^{a,*}, Kieran O'Sullivan^b,
Rodney Whiteley^a, Brayden Grantham^b

^a *Aspetar, Orthopaedic and Sports Medicine Hospital,
Doha, Qatar*

^b *Faculty of Education and Health Sciences, University of
Limerick, School of Allied Health, Limerick, Ireland*

*Corresponding author at: Aspetar, Orthopaedic and Sports
Medicine Hospital, PO Box 29222, Doha, Qatar.

E-mail: Vasileios.Korakakis@aspetar.com (V. Korakakis).

21 July 2020