

Eccentric Overload Training and Injury Prevention during Running

Berzosa C^{1,2*} and Marta S Valero³

¹Universidad San Jorge. Autov. A-23 Zaragoza-Huesca Km. 299. 50.830 Villanueva de Gállego., Zaragoza, Spain

²ValorA Research Group, Health Science Faculty, Universidad San Jorge, Spain

³Departament of Pharmacology and Physiology, Faculty of Health and Sports, Universidad de Zaragoza, Huesca, Spain

Running is, maybe, the most ancient physical activity. Nevertheless, it has been on the spot in the last years, and actually is a trending exercise around the world. Running is a whole body activity that stresses our systems both in metabolic and mechanistic way. This stress, repeated continuously, could lead into an overuse injury in muscle, tendon or even bone, being running one of the sports in which overuse injuries develop more frequently, in around 59.4% of the cases [1]. As Videbæk [2] found in their study, the incidence of injury is higher in beginners than in recreational runners, which could be explain, at least partially, in the adaptations reached along their physical training period.

Different exercises have been proposed to prevent all these overuse injuries related to running, being eccentric overload training one of the most accepted in the last years because its ability to improve the state of tendons without a great metabolic impact. Eccentric overload means that the eccentric phase of the movement is performed with higher loads and velocity than the concentric. For example, squat movement combined with eccentric is the “gold standard” for the patellar tendon, and it is commonly used to cause beneficial changes in the tissues. The protocol most widely used [3-5] consists in 12–15 weeks of treatment for patellar tendinosis injuries [6]. For the Achilles tendon, a number of studies have used eccentric overload to improve the state of tendon and muscle in reduced time [7,8] These (patellar and Achilles) are the tendons that support more loads during running, and we must take this in account when we plan specific training or therapy for runners, even more if they are beginners.

During running, not only tendons suffer a bigger stress. Muscles are contracting both in concentric, isometric and eccentric manner, with more implications of each one depending on the terrain (uphill or downhill running) [9], so it could be interesting to train muscles to face concentric and eccentric contractions safely.

Different exercises produce an eccentric overload, like plyometric, drop jumps or downhill running, but isoinertial devices avoid joint impacts and maybe that is why they are widely used in the last years to increase the eccentric phase [10] having an important work also during the concentric. Tissue adaptations caused by eccentric overload training are apparent, but the increased load of the eccentric training can increase pain and muscle damage markers in subjects under training [11], increasing resting metabolic rate during 72 h [12], so we must take these in account when scheduling training loads.

These devices have been used in different sports like football [13] basketball or volleyball [14], but not yet in running. Our group described muscles and tendon adaptations during 3 consecutive days of running performing a 1-h running session [8,15,16], and how eccentric overload training reduces the risk of injury according to thermographic and ultrasound parameters.

It can be concluded that eccentric overload training causes particular adaptations in muscle and tendon tissues. This kind of training with eccentric overload suggests less time for adaptation and a more normalised response pattern in these tissues, so it may have beneficial effects in the prevention of structural tissue changes during running.

The changes generated helped tolerate new effort in healthy participants and it could also be incorporated into a training programme for different sports with running as the main activity. This type of training could be developed as a part of a pre-season period in the coaching schedule or during therapy as a treatment of some overuse tendon injuries.

References

- Ristolainen L, Heinonen A, Turunen H, Mannström H, Waller B, et al. (2010) Type of sport is related to injury profile: a study on cross country skiers, swimmers, long-distance runners and soccer players. A retrospective 12-month study. *Scand J Med Sci Sports* 20: 384-393.
- Videbæk S, Bueno AM, Nielsen RO, Rasmussen S (2015) Incidence of Running-Related Injuries Per 1000 h of running in Different Types of Runners: A Systematic Review and Meta-Analysis. *Sports Med* 45: 1017-1026.
- Young MA, Cook JL, Purdam CR, Kiss ZS, Alfredson H (2005) Eccentric decline squat protocol offers superior results at 12 months compared with traditional eccentric protocol for patellar tendinopathy in volleyball players. *Br J Sports Med* 39: 102-105.
- Purdam CR, Jonsson P, Alfredson H, Lorentzon R, Cook JL, et al. (2004) A pilot study of the eccentric decline squat in the management of painful chronic patellar tendinopathy. *Br J Sports Med* 38: 395-397.
- Visnes H, Bahr R (2007) The evolution of eccentric training as treatment for patellar tendinopathy (jumper's knee): a critical review of exercise programmes. *Br J Sports Med* 41: 217-223.
- Stanish WD, Curwin S, Rubinovich M (1985) Tendinitis: the analysis and treatment for running. *Clin Sports Med* 4: 593-609.
- Hortobágyi T, Devita P, Money J, Barrier J (2001) Effects of standard and eccentric overload strength training in young women. *Med Sci Sports Exerc* 33: 1206-1212.
- Sanz-López F, Berzosa Sánchez C, Hita-Contreras F, Cruz-Díaz D, Martínez-Amat A (2015) Ultrasound changes in Achilles tendon and Gastrocnemius Medialis muscle on squat eccentric overload and running performance. *J Strength Cond Res*.
- Vernillo G, Giandolini M, Edwards WB, Morin JB, Samozino P, et al. (2017) Biomechanics and Physiology of Uphill and Downhill Running. *Sports Med* 47: 615-629.
- Norrbbrand L, Pozzo M, Tesch PA (2010) Flywheel resistance training calls for greater eccentric muscle activation than weight training. *Eur J Appl Physiol* 110: 997-1005.
- Conceicao MS, Libardi CA, Nogueira, Bonganha V, Gaspari AF, et al. (2012) Effects of eccentric exercise on systemic concentrations of pro- and anti-inflammatory cytokines and prostaglandin (E2): comparison between young and postmenopausal women. *Eur J Appl Physiol*.

*Corresponding author: Berzosa C, PhD, Universidad San Jorge, Autov. A-23 Zaragoza-Huesca, Km. 299, 50.830 Villanueva de Gállego., Zaragoza Spain, Tel: (34) 976060100, Fax: (34) 976077581; E-mail: cberzosa@usj.es

Received March 26, 2017; Accepted March 30, 2017; Published March 31, 2017

Citation: Berzosa C, Valero MS (2017) Eccentric Overload Training and Injury Prevention during Running. *Sports Nutr Ther* 2: e104. doi: [10.4172/2473-6449.1000e104](https://doi.org/10.4172/2473-6449.1000e104)

Copyright: © 2017 Berzosa C, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

12. Dolezal BA, Potteiger JA, Jacobsen DJ, Benedict SH (2000) Muscle damage and resting metabolic rate after acute resistance exercise with an eccentric overload. *Med Sci Sports Exerc* 32: 1202-1207.
13. de Hoyo M, Pozzo M, Sañudo B, Carrasco L, Gonzalo-Skok O, et al. (2015) Effects of a 10-week in-season eccentric-overload training program on muscle-injury prevention and performance in junior elite soccer players. *Int J Sports Physiol Perform* 10: 46-52.
14. Gual G, Fort-Vanmeerhaeghe A, Romero-Rodríguez D, Tesch PA (2016) Effects of In-Season Inertial Resistance Training With Eccentric Overload in a Sports Population at Risk for Patellar Tendinopathy. *J Strength Cond Res* 30: 1834-42.
15. Sanz-López F, Berzosa C, Hita-Contreras F, Martínez-Amat A (2017) Effects of eccentric overload training on patellar tendon and vastus lateralis in three days of consecutive running. *Knee* 14: 7-13.
16. Sanz-López F, Berzosa C, Hita-Contreras F, Cruz-Díaz D, Martínez-Amat A (2015) Ultrasound changes in Achilles tendon and Gastrocnemius Medialis muscle on squat eccentric overload and running performance. *J Strength Cond Res* 30: 2010-2018.

Citation: Berzosa C, Valero MS (2017) Eccentric Overload Training and Injury Prevention during Running. Sports Nutr Ther 2: e104. doi: [10.4172/2473-6449.1000e104](https://doi.org/10.4172/2473-6449.1000e104)

OMICS International: Open Access Publication Benefits & Features

Unique features:

- Increased global visibility of articles through worldwide distribution and indexing
- Showcasing recent research output in a timely and updated manner
- Special issues on the current trends of scientific research

Special features:

- 700+ Open Access Journals
- 50,000+ editorial team
- Rapid review process
- Quality and quick editorial, review and publication processing
- Indexing at major indexing services
- Sharing Option: Social Networking Enabled
- Authors, Reviewers and Editors rewarded with online Scientific Credits
- Better discount for your subsequent articles

Submit your manuscript at: <http://www.omicsonline.org/submission>