

A longitudinal assessment (10-years) of bone mineral density in rock climbers

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Abstract

Purpose: To analyze the changes in bone mineral density (BMD) following 10-years of rock climbing.

Methods: Onsite climbing ability and BMD using dual energy X-ray absorptiometry (DXA) were assessed in five rock climbers (4 females).

Results: After 10-years, mean climbing ability was significantly higher in 2015 vs 2005 for all climbers (7b vs 7a, $p=0.025$). Moreover, BMD was improved over the 10-years of follow up in the whole sample, although significant differences were not observed taking into account the small sample ($n=5$).

Conclusion: Adhering to rock climbing over 10-years may have positive effects on preventing bone loss and osteoporosis related with aging. Furthermore, healthy sport climbing behaviors commencing in early life could optimize the quality of life among the oldest-old.

Keywords: bone mineral density, dual energy X-ray absorptiometry -DXA, climbers-follow-up

Résumé

Objectif: Analyser les changements dans la densité minérale osseuse (DMO) après 10 ans d'escalade.

Méthodes: On a évalué la capacité d'escalade et la DMO en utilisant l'absorptiométrie par rayons X à double énergie (DXA) ont été évalués en 5 échelons (4 femmes).

Résultats: Après 10 ans, la capacité d'escalade moyenne était significativement plus élevée en 2015, vers 2005 pour tous les grimpeurs (7b vers 7a, $p = 0,025$). De plus, la DMO a été améliorée pendant les 10 de contrôle pour toutes les preuves, malgré que l'on ait pu observer des différences significatives en tenant compte le moindre signe ($n=5$).

Conclusion: Adhérer à l'escalade sur 10 ans peut avoir des effets positifs dans la prévision de la perte osseuse et l'ostéoporose en relation avec l'âge. En plus, les comportements sains de l'escalade sportive qui commencent dans les premières années de vie entre les plus âges.

Mots-clés: densité minérale osseuse, absorptiométrie biénergétique aux rayons X - DXA, suivi des grimpeurs

INTRODUCTION

Regular physical activity is one of the strongest predictors of future health status (Heath et al., 2012). Physical activity is thought to play an important role in preventing bone loss and osteoporosis in older adults (McMillan et al., 2012). Osteoporosis is characterized by low bone mineral density (BMD), and poor bone geometry and microarchitecture, which confer an increased risk of minimal-trauma fractures associated with significant morbidity (Kanis, 1990). Sport climbing has been a physical activity recommended by the American College of Sports Medicine to maintain good cardiorespiratory fitness (Physical Activity Guidelines Advisory Committee, 2008), however, it does not include the possibility of benefits on BMD.

There are several sport rock climbing studies which have focused on BMD as a body composition parameter (España-Romero et al., 2009a; España-Romero et al., 2009b; España-Romero et al., 2012). España-Romero et al., (2009) analysed BMD in 16 Caucasian sport climbers, 8 women (28.6 ± 3.9 years) and 8 men (31.2 ± 5.6 years) using dual-energy X-ray absorptiometry (DXA) which is considered as reference methods to assess body composition (Well et al., 1999; Fields et al., 2000; Parker et al., 2003). Those participants classified as elite sport climbers (onsight climbing ability: 8b and climbing experience: 15.8 ± 5.7 years) had significantly higher BMD compared with those classified as expert climbers (onsight climbing ability: 7b and climbing experience: 9.7 ± 4.6 years). Specifically, the BMD was 1.019 ± 0.11 vs 1.004 ± 0.09 g/cm², in elite and expert sport climbers, respectively; $P \leq 0.05$) (España-Romero et al., 2009). However, to our knowledge, no study has conducted a follow up analyses of BMD in rock climbers. As such it is not known whether sport climbing has the potential to be used as a therapy for osteoporosis. The main purpose of this study was to analyze the changes in BMD following 10-years of rock climbing

METHOD

Participants

Sixteen rock climbers were recruited in 2005 (range aged 28-34y). Information on rock climbing ability and body composition parameters using DXA were collected. Five rock climbers (four females) for the present analysis who were recruited in 2005 were followed up in 2015. All participants were healthy and free of any lesions. Detailed information about self-reported sport rock climbing ability were recorded. Using the French grading system, a lifetime best self-reported on-sight climbing ability ranged from 6b+ to 7b+ in 2005, and 6c to 7c+ in 2015, respectively.

Participants read and signed the informed consent prior to participation in the study. The study protocol was performed in accordance with the ethical standards established in the 1961 Declaration of Helsinki (as revised in Brazil in 2013) and was approved by the Review Committee for Research Involving Human Subject of the University of Granada and Cádiz prior to data collection. Data from this study comes from the high-performance international rock-climbing research group C-HIPPER.

Bone Mineral Density

A full-body DXA scanner (Norland XR-46; Medical System, Inc. Fort Atkinson, WI, USA) with XR software was used to measure total BMD. Participants were placed supine in the middle of the examination table. To set the start and end points for the DXA assessment, two anatomical reference points were marked: one at the proximal center of the head and another in the soft tissue of the abdomen, adjacent to the spine. Participant wore no shoes, had minimal clothing and all metal jewelry which could interfere with X-ray images were removed. During the scanning process, participants remained motionless with their eyes closed.

RESULTS

Following 10 years of sport climbing, mean climbing ability was significantly higher in 2015 vs 2005 (7b vs 7a, $p=0.025$), as was BMD (Figure 1). BMD was higher for women ($n=4$) in 2015 ($0.99 \pm 0.06 \text{ g/cm}^2$) compared to 2005 (0.97 ± 0.7 g/cm^2), and men (1.1 g/cm^2 in 2015 and 1.05 g/cm^2 in 2005). Significant differences were not found for BMD in those 10 years of follow up taking into account the small sample ($n=5$).

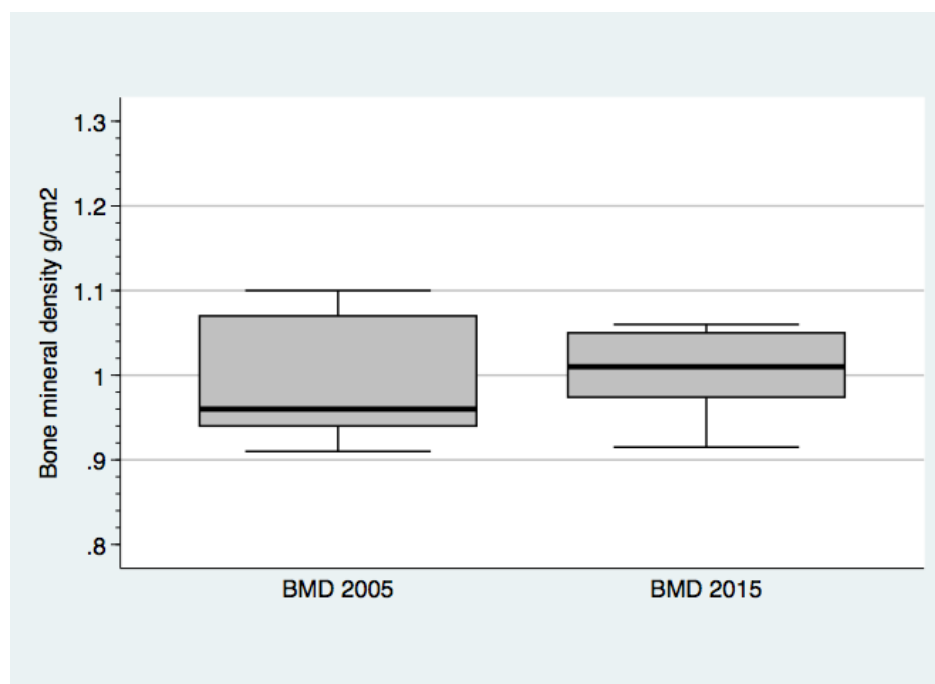


Figure 1. Median (inter-quartile range, box) bone mineral density (g/cm^2) measured by dual energy X-ray absorptiometry -DXA- scanner pre and post 10 years sport climbing (2005 and 2015). Whiskers represent the adjacent range values.

DISCUSSION

To the best of our knowledge, no studies have previously followed BMD for a prolonged period of time in sport climbers. The results may suggest that as lean mass is composed primarily of skeletal muscle, sport climbing participation may not only have a direct osteogenic effect by impact loading, but also an

indirect effect by increasing muscle mass. Larger muscles develop greater force, inducing more intense mechanical stimulation of the bones to which they are attached (Vicente-Rodriguez et al, 2005). Therefore, improvements of muscular fitness accompanying muscular development in climbers would increase the generation of forces on bone attachment, indirectly stimulating bone growth (Vicente-Rodriguez et al., 2005; Frost et al., 2000).

CONCLUSION

Adhering to rock climbing over 10-years may be have positive effects on preventing bone loss and osteoporosis related with aging. Furthermore, healthy sport climbing behaviors commencing in early life could optimize the quality of life among the oldest-old.

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