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## Review article

# Swimming and cycling do not cause positive effects on bone mineral density: a systematic review



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### ABSTRACT

Osteoporosis is considered a common metabolic bone disease and its prevalence is increasing worldwide. In this context, physical activity has been used as a non-pharmacological tool for prevention and auxiliary treatment of this disease. The aim of this systematic review was to evaluate the effects of cycling and swimming practice on bone mineral density (BMD). This research was conducted in accordance with the recommendations outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. The studies were consulted in the period from 2004 to 2014, through major electronic databases: PubMed®, SciELO® and LILACS®. Ten studies evaluated the effects of cycling on BMD, and the results showed that nine studies have linked the practice of professional cycling with low levels of BMD. Another 18 studies have reported that swimming has no positive effects on bone mass. We conclude that cycling and swimming do not cause positive effects on BMD; thus, these are not the most suitable exercises for prevention and treatment of osteoporosis.

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### Natação e ciclismo não causam efeitos positivos na densidade mineral óssea: uma revisão sistemática

#### RESUMO

A osteoporose é considerada uma doença osteometabólica comum e sua prevalência está aumentando mundialmente. Nesse contexto, a atividade física tem sido usada como ferramenta não farmacológica para prevenir e auxiliar no tratamento dessa doença. O objetivo desta revisão sistemática foi avaliar os efeitos da prática do ciclismo e da natação na densidade mineral óssea (DMO). Esta pesquisa foi feita de acordo com as recomendações do Preferred Reporting Items for Systematic Reviews and Meta-Analyses. Os estudos foram consultados entre 2004 e 2014, por meio de importantes bases de dados eletrônicas: PubMed®, SciELO® e Lilacs®. Dez pesquisas avaliaram os efeitos do ciclismo sobre a DMO, os

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resultados demonstraram que nove estudos associaram a prática do ciclismo profissional com baixos níveis de DMO. Outros 18 estudos relataram que a natação não tem efeitos positivos sobre a massa óssea. Conclui-se que o ciclismo e a natação não causam efeitos positivos na DMO. Assim, não são os exercícios mais indicados para a prevenção e o tratamento da osteoporose.

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## Introduction

Osteoporosis is a disease characterized by a decrease in bone mineral density (BMD) and by a microarchitectural deterioration of bone tissue, leading to enhanced bone fragility and increased risk of fractures.<sup>1</sup> At present, osteoporosis is considered the most common metabolic bone disease, affecting mainly older people, and with a higher incidence in women, especially after menopause.<sup>2</sup>

According to the International Osteoporosis Foundation,<sup>3</sup> about 200 million women worldwide are affected by osteoporosis. In the European Community, from those 25 million people affected by this disease, about 80% are female.<sup>4</sup> In Brazil, a study with a representative sample found a prevalence of fractures in 15.1% and 12.8% in women and men over 40 years, respectively.<sup>5</sup>

The main risk factors for developing osteoporosis include: genetic predisposition,<sup>6</sup> advanced age in association with morphological changes<sup>2</sup> (e.g., a decrease in bone and muscle mass), a sedentary lifestyle especially in childhood and adolescence (taking into account that these are important stages to obtain a peak bone mass),<sup>7</sup> and nutritional deficits.<sup>8</sup> In this regard, it is noted that a large portion of risks factors are modifiable (behavioral). Thus, healthy habits and adequate levels of physical activity contribute to the prevention of this disease.

Among the non-pharmacological approaches for prevention and treatment of osteoporosis, physical activity has been recommended. However, the benefits promoted by physical activity on BMD are due in part to the intensity and type of exercise,<sup>9</sup> as well as to the control of the biological principles of training.<sup>7</sup>

Previous studies have shown that different types of physical activity<sup>10</sup> (swimming, cycling) as well as its intensity<sup>9</sup> (endurance and sprint) can even affect negatively BMD. Thus, the aim of this study was to evaluate the effects of cycling and swimming practice on bone mineral density, due to the high number of practitioners<sup>11</sup> of these modalities, their popularity and also considering their indication by health professionals.

## Methods

This systematic review was conducted in accordance with the recommendations and criteria set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).<sup>12</sup>

The studies were accessed from 2004 to 2014, through a survey in electronic databases: PubMed® (<http://www.ncbi.nlm.nih.gov/pubmed>), SciELO® (<http://www.scielo.org>) and LILACS® (<http://www.bireme.br>).

## Electronic search in databases

The following terms were adopted in a combined and/or individual way to search for articles: osteoporosis, bone density, bone mineral density, cycling and swimming. In SciELO® and LILACS® databases the terms mentioned above were entered in Portuguese.

## Study selection and data extraction

The evaluation of the studies was performed by two reviewers, and when necessary, a third reviewer resolved disagreements.

Inclusion criteria:

- 1) Types of study: descriptive, cross-sectional, longitudinal, randomized controlled and non-randomized controlled trials evaluating the effects of cycling and swimming on BMD.
- 2) Types of participants: adolescents, adults and older subjects. There was no restriction as to gender.
- 3) Types of results evaluated: whole body BMD with sub-regions (upper limbs or arms and lower limbs or legs), lumbar spine, and hip with sub-regions (femoral neck, trochanter, intertrochanteric region, and Ward's triangle).

Exclusion criteria:

- 1) Studies in other languages than English, Portuguese or Spanish.
- 2) Studies with animal models.

## Results

Initially 281 relevant articles were identified. After the title and abstract review, and with eventual duplicates already discarded, the total was reduced to 49 potentially relevant documents. Of these articles, 29 met the selection criteria and were included in this study (Fig. 1).

Ten studies<sup>10,13-21</sup> evaluating the effects of cycling on BMD (Table 1) were found. The results showed that nine studies have associated the practice of professional cycling with low levels of BMD. Furthermore, most of the studies compared BMD of cyclists and control groups, suggesting that this sport can be considered a risk factor for early development of osteopenia/osteoporosis.

Nineteen studies<sup>9,22-39</sup> evaluated the effects of swimming on BMD (Table 2). The results showed that swimming has no positive effects on bone mass. Some cross-sectional studies compared BMD between professional swimmers and control

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