

Aquatic exercise in Osteoporosis: does it works?

Cantista P⁽¹⁻²⁻³⁻⁴⁾, Cantista M⁽²⁻³⁻⁴⁾

⁽¹⁾Department, Centro Hospitalar Universitário do Porto/Hospital de Santo António,
Porto, Portugal

⁽²⁾Termas de S. Jorge, Portugal

⁽³⁾Termas de Luso, Portugal

⁽⁴⁾Balneário Pedagógico de Vidago, Portugal
pedro.cantista@gmail.com

Background: Usually advises or prescriptions concerning physical activity in Osteoporosis only refer as useful exercises those with high impact and mechanical loading. The reason for this is due to the fact that only mechanical load exercises have been linked to a positive effect on bone mass, bone quality or bone turnover. By opposition water-based exercise (WBE) have been excluded of the exercise type recommendations for Osteoporosis

Objective: The aim of this lecture is to demonstrate the interest and benefits of aquatic exercises in osteoporosis

Methods:

1- Theoretical approach: by presenting our vision of the mechanisms that may influence bone turnover, namely the influence not only of gravity but also of all muscle on load, compression, strain and tension forces exerted on the bone and the answer of bone cells (osteoblasts and osteoclasts) to mechanical stimuli in the remodelling process of trabecular architecture (both gravity and anti-gravity forces)

2 - Bibliographic review: a search of relevant databases and the references of identified studies was performed.

Results: We identified several historical theoretical approaches such as those from Julius Wolff (1836 –1902), Karl Cullman, (1821 –1881), Christian Otto Mohr (1835 –1918), Albert Hoffa (1859-1907) or Wilhelm Roux (1850 –1924). These authors related bone formation with external forces stimuli, particularly with load. This tends to exclude water exercise as a useful modality to prevent fractures. But in fact there are extrinsic forces besides gravity, namely the tension forces produced by antigravity muscles. To answer to these forces bones must also built trabecular systems to resist to avulsion for example. In our theoretical approach we explain the relevance of exercise to stimulate bone formation, not only load exercises but also these antigravity resisted movements. We refer many experimental

studies namely those performed in Biomechanical Laboratories or those linked to Spatial Programs.

Concerning our bibliographic review we found some relevant papers including RCT's, Systematic Reviews and Meta-analysis. In one important Systematic review (by Vini Simas, Wayne Hing, Rodney Pope and Mike Climstein) 12.617 records were identified with 11 studies included in critical narrative synthesis and meta-analysis. Eight studies compared WBE to a sedentary control group, and four studies had land based exercise (LBE) participants as a comparison group. Meta-analyses revealed significant differences between WBE and control group in favour of WBE for changes in bone mineral density (BMD) at the lumbar spine (mean difference [MD] 0.03 g/cm²; 95% confidence interval [CI]: 0.01 to 0.05) and femoral neck (MD 0.04 g/cm²; 95% CI: 0.02 to 0.07). Significant differences were also revealed between WBE and LBE in favour of LBE for changes in lumbar spine BMD (MD -0.04 g/cm²; 95% CI: -0.06 to -0.02). However, there was no significant difference between WBE and LBE for changes in femoral neck BMD (MD -0.03 g/cm²; 95% CI: -0.08 to 0.01).

In another relevant paper by Moreira, Linda Denise Fernandes et al. (*“Physical exercise and osteoporosis: effects of different types of exercises on bone and physical function of postmenopausal women”*) women who did a high-intensity aquatic workout for six months increased their strength and suffered fewer falls, suggesting that bone- and muscle-building resistance can be achieved with the right kinds of water exercises.

Conclusions: Theoretically it is easy to understand that the effects of external forces (both mechanical load and tension) influence bone strength. But besides concepts there is a significant evidence that WBE benefits osteoporosis. It allows muscular strengthening, benefits bone remodelling, protects from falls, promotes cardio-training. Nevertheless we still don't have any RCT with the occurrence of fractures as endpoint. Because of this lack we decided to start our own study with this methodology.

Keywords: osteoporosis, exercise, water based exercise, aquatic exercise, hydrotherapy, balneotherapy