

EFFECTS OF WEIGHT-BEARING ACTIVITIES ON BONE DENSITY IN CHILDREN AND YOUNG ADULTS WITH DOWN SYNDROME: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Down syndrome (DS) is the most common chromosomal disorder. Individuals with DS often present with low bone density, which places them at a higher risk of developing osteoporosis and fracture as compared to the general population. Mechanical stress associated with weight-bearing activities (WBA) has been shown to improve bone mineralization in various population. However, the effects of WBA on bone density in children and young adults with DS have not been fully elucidated. **Objective:** The objective of this review was to investigate whether WBA improved bone mineral density (BMD) and/or bone mineral content (BMC) in children and young adults with DS. **Methods:** PubMed, Embase and Cinahl were searched through November 15, 2020 for all clinical trials that investigated the effectiveness of WBA in individuals with DS. The search strategy included a list of terms associated with the target population (children and young adults with DS), intervention (WBA), and outcome (BMD and/or BMC). Studies related to whole body vibration were excluded from this review. Risk of bias of the included studies was assessed with PEDro. **Results:** Four studies with PEDro score ranging from 4-5 were identified through electronic search and a stepwise selection procedure. A total number of 150 individuals with DS were included in this review. The interventional groups received a variety of WBA treatment for 4-12 months, while the control groups did not receive any intervention. Three studies demonstrated that WBA intervention led to a 4.0-14.6% of improvement in BMD and/or BMC at the lumbar spine and femur. The magnitude of improvement was greater than that of the control group ($p < 0.05$). However, WBA intervention did not result in improvement in BMD or BMC as compared to the control group ($p > 0.05$) in one study. **Conclusion:** Although WBA showed potential in improving bone density in young adults and children with DS, the results from the current systematic review are not conclusive due to inconsistent findings and low level of evidence.

Key words: Down syndrome, bone mineral density, bone mineral content, exercise, physical activity

INTRODUCTION

Down syndrome (DS) is the most common chromosomal disorder characterized by lifelong intellectual disability and developmental delay. Individuals with DS have marked skeletal abnormalities, as well as reduced bone density compared to the general population [1]. It has been found that children and adults with DS have lower bone density compared to their age- and sex-matched counterparts without DS, which places them at a higher risk of developing osteoporosis and fracture [2], [3]. The decrease in bone density is likely resulted from reduced bone mass accrual rather than increased bone resorption, as it was found that bone resorption mediated by osteoclasts was unaffected, while bone formation mediated by osteoblasts was significantly reduced in the DS population [4]. Interestingly, several observational studies have revealed that the bone mineral density (BMD) of the hip and lumbar spine in DS adolescents was positively correlated with their levels of physical activity [5], [6]. There is abundant evidence