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בקרב נשים בגיל הבלות**

מאת: דבורה (מושי) חרוש

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**The effect of a water exercise program on bone density
among Postmenopausal women**

Submitted by: Deborah (Mushi) Harush

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**THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE MASTER DEGREE**

**University of Haifa
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**THE EFFECTS OF WATER EXERCISE ON BONE DENSITY AMONG
POSTMENOPAUSAL WOMEN**

MUSHI HARUSH

ABSTRACT

Osteoporosis is a bone disease common among women and it constitutes one of the dominant factors reducing quality of life and even shortening life span. Almost 25 million people in the United States suffer from this disease, 80% of them post-menopausal women (Biondi, 1999; Birdwood, 1995; Riggs & Melton, 1995). In a national study of women's health conducted in Israel in 1998, osteoporosis was diagnosed among 7% of the women aged 45-54, 14% of the women aged 55-65, and 25% of the women aged 65-74 (Merom, 1999). The reason for the higher frequency of the disease with old age is attributable to the fact that as women age, the monthly period ceases and a gradual process of bone density loss commences, which may lead in the final analysis to fractures of spinal vertebrae, hip and wrist bones (Ish-Shalom, 1999; ACSM, 1997). Studies have shown that physical activity plays an important role in preventing and treating osteoporosis. Bone is built and develops in direct response to the application on it of mechanical loads (Dalsky, 1990) and when the load on the skeleton is reduced, more bone is lost than is created (Dalsky, 1990; Laynon, 1987; Renfro & Brown, 1998). Therefore, physical activity and especially activity that increases muscle tension or loads on the bones, helps to prevent the process of bone density loss (Riggs & Melton, 1998; Simkin & Ayalon, 1990). The conclusions of studies focusing on the effect of water exercise on post-menopausal women have not been unequivocal about its effect on bone density (Tsukahara, 1994; Goldstein & Simkin, 1994; Bravo, 1997). The present study focuses on the question of

whether water exercise can delay bone density loss among post-menopausal women. 35 women, mean age 55.45 ± 3.97 , volunteered to participate in the study. Over a period of seven months the women in the experimental group (N=25) participated in a water training program that included three one-hour sessions per week. At the same time, a control group (N=10) did not engage in any physical activity at all. Two hypotheses were formulated: a) Women in the control group, who did not participate in a water training program, would manifest a decline in bone density; and b) Women who engaged in water exercise would register no bone density loss, and might perhaps increase density by the end of the study, or, if there were a loss, it would be less severe than in the control group. Bone density was measured by means of DEXA and QUS equipment in four different parts of the body: vertebrae L1-L4, the neck of the hip bone on both legs, the proximal radius and the midshaft tibia. Bone density for all of the women was measured in the same part of the body before and after the training program (the proximal radius and the midshaft tibia were measured only for the experimental group). The main finding of the study was that although no significant pre- and post-test differences in bone density were found in the vertebrae (L1-L4 and L2-L4) for both the experimental and the control groups, a significant interaction was found between the variable Time and the variable Group for all four measures of BMD, BMC, T-Score and Z-Score. This interaction indicates that water exercise had a positive effect on bone density and allowed women in the experimental group to preserve and even increase their bone density, in comparison to the control group which registered a loss. On the other hand, for hip bone density a significant interaction was found between the variable Time and the variable Group only for BMC and in the right leg only ($p < 0.01$). No significant pre- and post-test differences in bone density (as measured by means of QUS) were found in the radius or the tibia for the experimental group. The main conclusion of this study is that water exercise several times a week constitutes appropriate medium for preserving bone density among post-menopausal women who generally suffer from a natural decline of about 1%-2% per year in bone density. It should also be noted, however, that the

relatively small number of participants in the study and the slow rate of changes in bone make it difficult to take a definitive, unequivocal stand in the matter.