

Comparison of the bony mineral density in practising women of water aerobics and sedentary in post-menopause

Original Article

Sandor Balsamo - CREF 00157 - DF

Universidade Católica de Brasília (UCB - DF)
Universidade Nacional de Brasília (UnB - DF)
sandorbalsamo@ciaathletica.com.br

Roberto Simão - CREF 2486 - RJ

Escola de Educação Física e Desporto Universidade Federal do Rio de Janeiro (EEFD/ UFRJ).
robertosimao@ig.com.br

Martim Bottaro Marques - CREF 00011 - DF

Universidade Nacional de Brasília (UnB - DF)
martimbottaro@unb.br

Ana Patrícia de Paula - CRM 5791

Coordenadora do ambulatório de osteoporose do Hospital Universitário de Brasília (HuB - DF)
anapaty@unb.br

João Lindolfo Borges - CRM 2885

Universidade Católica de Brasília UCB - DF
joaolindolfo@metabolismo.com.br

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ABSTRACT: The purpose of this study was to compare the bone mineral density (BMD) between callisthenic aquatic exercises group and sedentary group. The investigated group was composed by 48 women, 22 practitioners of callisthenic aquatic training (54.5 ± 3.3 years), and 26 sedentary women (52.0 ± 3.3 years). All of them were in the postmenopausal period and had been using hormone therapy for over one year. The dual-energy X-ray absorptiometry was measured by lunar, model DPX-IQ. The BMD were measured in the spine (L2-L4), femoral neck, total hip and forearm. The data analysis was one way ANOVA to independent sample ($p < 0.05$). There was significant difference between the group of callisthenic aquatic exercises and the sedentary control group in spine (L2-L4) and total hip. We conclude that callisthenic aquatic exercises showed to be positive to BMD if compared to the sedentary group.

Keywords: aquatic activity, menopause, sedentary.

Correspondence to:

Rua Manoel Vitorino, 533 - Piedade - Prédio MR Térreo - CEP 20748-900. Rio de Janeiro - Brazil

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RESUMO

Comparação da densidade mineral óssea em mulheres praticantes de hidroginástica e sedentárias na pós-menopausa

O objetivo deste estudo foi comparar a densidade mineral óssea (DMO) em mulheres praticantes de hidroginástica e mulheres sedentárias. Fizeram parte da amostra 48 mulheres, sendo 22 praticantes de hidroginástica ($54,5 \pm 3,3$ anos), e 26 sedentárias ($52,0 \pm 3,3$). Todas as participantes do estudo estavam na pós-menopausa e fazendo terapia de reposição hormonal há, no mínimo, um ano. A densitometria óssea foi feita por um aparelho da marca lunar, modelo DPX-IQ. Foi obtida a DMO da coluna lombar (L2-L4), do fêmur (colo do fêmur e quadril total) e antebraço. Para a análise dos dados utilizou-se, como tratamento estatístico, a análise de variância (one-way ANOVA) para amostras independentes. Nas praticantes de hidroginástica comparadas com as sedentárias, a DMO foi mais elevada ($p < 0,05$) em L2-L4 e quadril total, enquanto nos outros sítios analisados não houve diferença significativa. Concluindo, esses resultados sugerem que a hidroginástica mostrou ser positiva para uma maior DMO em relação à população sedentária nos sítios do L2-L4 e quadril total.

Palavras-chave: atividade aquática, hidroginástica, densidade mineral óssea, menopausa.

INTRODUCTION

The osteoporosis is an osteo-metabolic disturbance, characterized by the decrease of the bone mineral density (BMD), with deterioration of the bone micro-architecture, taking to an increase of the skeletal fragility and, consequently, risk of fractures. The osteoporosis is constituted, now, in one of the largest problems of public health of the developed and in development countries. In the United States of America (USA), the fractures caused by osteoporosis arrive at 1.3 million a year, with a cost of 13.8 billion annual dollars. The probability of happening a fracture due to the osteoporosis after the 50 years, and until the end of the life, it is of 40% in the women and 13% in the men (ACSM, 1995).

Studies evidence that the physical activity is an important factor in the maintenance of the bone mass (ACSM, 1995; ANDREOLI et al., 2001; O'BRIEN, 2001; HENDERSON et al., 1998; KELLEY, 1998). The proportionate mechanical force for the physical exercise to regulate stimulates the osteoblasts activity, through the piezoelectric effect, causing, like this, an incentive in the calcium incorporation in the bone. That process provokes an increase of the bone, doing with that an invigoration of those structures, happening like this the increase of BMD (BALM & SIMÃO, 2005).

The physical activity in the water has also been addressed for senior women, mainly those with osteoporosis, because it is an activity without fall risks and, consequently, without fracture risk (BAUM, 2000; CAMPION, 2000). Several authors have been mentioning the benefits of the water aerobics in the improvement of the physical fitness (strength, resistance, flexibility and corporal composition) and in the physical treatment of several diseases (BAUM, 2000; CAMPION, 2000; MAZO et al., 2001).

RESUMEN

La comparación de la densidad mineral ósea practicando a las mujeres de aeróbic de agua y sedentario en la poste-menopausa

El propósito de este estudio era comparar el hueso la densidad mineral (BMD) entre el grupo del ejercicio acuático y el grupo sedentario. El grupo investigando estaba compuesto por 48 mujeres, 22 el grupo de entrenamiento acuático ($54,5 \pm 3,3$ años), y 26 grupo sedentario ($52,0 \pm 3,3$ años). Todos los grupos investigando estaban en el periodo del post menopausal y usan con la terapia de la hormona encima de un año. El absorptiometry de Radiografía de dualenergía era moderado por DPX-IQ Lunar, ejemplar. El BMD sea moderado em la espina (L2-L4), cuello femoral, cadera total y antebrazo. El análisis de los datos era una manera ANOVA a la muestra independiente ($p < 0,05$). había diferencia significativa entre el grupo del ejercicio acuático y el mando del grupo sedentario en la espina (L2-L4) y la cadera total. Nosotros concluimos ese la muestra del ejercicio acuática para ser positiva a BMD cuando comparó a las mujeres sedentarias.

Palabras clave: la actividad acuática, la menopausa, el hueso, la densidad mineral, sedentario.

Matsudo & Matsudo (1991) mention that the practice of the water aerobics provides a reduction of the heart frequency, of the blood pressure, of the activity of the plasmatic renin, of the aldosterone and increases the veined return. Beyond of those organism benefits, its is indicated for patients with mobility limitations (osteoarthritis), sustentation difficulty of the weight (obesity), muscle-skeletal rehabilitation, column illnesses and osteoporosis.

These benefits can be explained by the pressure in the tendons, ligaments and periosteum. According to Matsudo & Matsudo (1991), the incentive of BMD happens in the osteo-tendineae junction. Mazo et al. (2001) complement that the exercises that involve a pressure on the bone structure and that work against the resistance, such as movements of to push and to pull, can stimulate the bone development. In that way, they act, positively, for the patients with osteoporosis.

The water aerobics has been indicated for patients with osteoporosis, for being an exercise with little fall risk (CAMPION, 2000). Sinaki (1989) suggests that are made rehabilitation exercises inside of the water only in cases in that the bone mass loss has been severe. The shortage of experimental studies is emphasized mentioning the real benefits of the water aerobics and its osteogenic stimulation. The researches on the aquatic way limit, in majority, to the analysis of the effects of the swimming about the bone mineral density. Due to that context, the best need is verified to know the relationship of the water aerobics and their effects in BMD.

Therefore, the objective of this study is to compare the women's BMD in the post-menopause practicing of water aerobics with the women's BMD in the sedentary post-menopause.

MATERIALS AND METHODS

This work was approved by the committee of ethics of the Universidade Católica de Brasília. The sample was composed of 48 healthy women in the post-menopause (47 to 61 years). All of the women were resident in Brasília, and they participated in the study in a voluntary way. All were informed of the objective of the study, of the procedures, of the possible discomforts, of the risks and their benefits, before they sign the consent term, according to Resolution of National Council of Health (Resolução do Conselho Nacional de Saúde) (196/96). The sample was divided in two groups: 1) 22 participant women of water aerobics; 2) 26 sedentary women.

So the same ones participated in the groups of the study, but the following inclusion criteria were adopted: a) women that are, in the minimum, one year in the menopause; b) women that are in hormonal replacement therapy (TRH), in the minimum, one year; c) post-menopause women that are water aerobics apprentices, in the minimum, one year; e) post-menopause sedentary women. The following exclusion criteria were adopted: a) diseases or medicines that affect the bone metabolism, except calcium supplementation and TRH; b) women with body mass index (BMI) above 30.

The water aerobics apprentices followed a training methodology with a frequency of three times a week, a moderate intensity (60 to 80% of the maximum heart frequency). The exercises of the classes sought to work mainly the great muscular groups, with movements of to push and to pull, jumps and displacements. The sedentary women were patient of the Hospital Universitário de Brasília (HUB).

The volunteers that participated in the research were invited to attend the bone densitometry unit of Brasília and to sign the consent term. Afterwards, the tests were applied in the following order: weight, stature and DXA. A single doctor accomplished the analysis of the exams, without information about the participants' physical activity. The questionnaire of health and physical activity report was applied in the intention of obtaining descriptive data of the samples.

The bone densitometry was made by an apparel Lunar, model DPX-IQ. It was obtained BMD of the lumbar column (L2-L4), femur (anterior femur and total hip), forearm (ultra-distal radio, 33% radio and total radio). Before the tests, the apparel was gaged according to the manufacturer's recommendations.

Table 1 - Clinical and physics characteristics of the participants

Variables	Water aerobics (n = 22) (Mean ± DP)	Sedentary (n = 26) (Mean ± DP)
Age (years)	54.5 ± 3.3*	52.0 ± 3.4
BMI (weight/height)	24.7 ± 2.7	24.0 ± 3.4
Time of menopause (years)	5.1 ± 2.5	3.5 ± 2.8
TRH (years)	3.8 ± 2.5	4.0 ± 2.8

Where: * $p < 0.05$ among water aerobics and sedentary

DP = Pattern Deviation

BMI = body mass index

TRH = therapy of hormonal replacement

That is a research of the traverse and causal analytical type comparative. It was made Kolmogorov Smirnof's test to evaluate the sample normality. Therefore, for the data analysis, it was used, as statistical treatment, ANOVA for repeated measures in independent samples. The level of adopted significance was $p < 0.05$.

RESULTS

All the research participants were in the post-menopause and making TRH in the minimum time of one year. In the Table 1 the variables are presented with the physical characteristics, clinics, means and the pattern deviations of the variables (DP): age, body mass index (BMI), time of menopause and time of TRH. With the analysis of those data, it is verified that the practicing women of water aerobics were significantly older than the sedentary group, however they presented similar results regarding the body mass index (BMI), time of menopause and time of TRH.

In the Table 2 the results of BMD of the practicing women's of water aerobics group and of the sedentary group are presented. A significant difference ($p < 0,05$) was observed among the mean of the water aerobics apprentices' BMD in the sites of L2-L4 and of the total hip. In the other appraised sites a larger mean was verified in the water aerobics apprentices than in the sedentary ones, however there was not significant difference.

DISCUSSION

The main obtained results (Table 2) demonstrated that the water aerobics apprentices have a bone mass significantly larger in the sites of the lumbar column (L2-L4) and in the femur (total hip). It was not obtained significant difference in BMD in other appraised areas, but, even so, a larger BMD was observed.

In one of the few researches relating aquatic training with water aerobics characteristics with BMD, Tsukahara et al. (1993) evaluated 67 women in the post-menopause, that were accompanied by one year period. They participated in exercises in the aquatic way, at least once a week. The proposed exercises were jumps, walks and calisthenics exercises or light located. The training session consisted of 10 minutes of warming, 20 minutes of aerobics exercises, 10 minutes of swimming and 5 minutes of turn to the calm. The control group was continued of 30 women. The results showed that the control group lost 1% of BMD of the lumbar column (L2-L4), and the trained group obtained an increase of

1.55% in lumbar BMD. The authors increases that the training in the aquatic way is an important factor in the prevention of bone mass loss.

The present study demonstrated similarities in the results with the research of Tsukahara et al. (1993), in the ranch of the lumbar (L2-L4) column. It was still demonstrated in the present study a significant difference in the area of the total hip, area that no appraised in the mentioned research.

Another research involving physical activity with similar characteristics to the water aerobics was accomplished by Bravo et al. (1997), with 77 osteopenic women, with age between 50 and 70 years, for 12 months. The training consisted of jumps exercises with movements and located exercises, between 15 and 20 repetitions. The frequency of the training was of just once a week, with 60 minutes duration. The results demonstrated that the participants improve the physical cardiorespiratory fitness, agility, flexibility, strength and the resistance, reducing, like this, the factors of fall risk. In spite of that, there was not significant difference after a year of training in BMD of the lumbar column (L2-L4) and in the femoral lap. Bravo et al. (1997) justifies the negative results of BMD because of the little impact in the jumps work in the water, and also due to the participants' fact, with elapsing of the training, they create adaptation mechanisms to reduce the impact and, consequently, with smaller gravitational force of the encounter of the feet to the bottom of the swimming pool. Another reason might have been in function of the training just have happened once a week.

Our results related to the participant women's group of the water aerobics encounter space to the results of the experimental research of Bravo et al. (1997), in which didn't demonstrate a significant difference in the area of the lap of the femur of osteopenic women after a year of training of aquatic physical activity similar to the water aerobics. In that mentioned research (BRAVO et al., 1997), the methodology of the training consisted of exercises with jumps and located exercises for different parts of the superior members. However, they were just accomplished once a week, differently of the present study that there was a weekly frequency of training of three times.

In the research of Bravo et al. (1997) it was mentioned that the jumps accomplished in the swimming pool produce a compres-

sion force in the larger lumbar column area than a walk in soil. In goal-analysis accomplished by Kelley (1998), it was ended that aerobic training helps to maintain BMD of the lumbar column in post-menopause women, and most of the researches in that goal-analysis was accomplished with walks. In the methodology of our study consists in jumps, possibly influencing positively at the sites of the lumbar column (L2-L4) and in the femur (total hip).

In this study it was evaluated, still, the radio area, no appraised site for Bravo et al. (1997) and Tsukahara et al. (1993) in their studies with aquatic physical activity similar to the water aerobics. The results of our study didn't demonstrate significant difference in the means of the water aerobics participants' BMD in relation to the sedentary group in the radio area in none of the appraised sites (RUD, R33% and Rtotal). Therefore, this result suggests that the water aerobics, maybe, provide little incentive to the forearm area (radio - RUD, R33% and Rtotal).

Bravo et al. (1997) methodologically criticized the research of Tsukahara et al. (1993). The authors' main observations were in relation to the statistical part, in which was not mentioned, there was been, differentiates significant among the women's group that and the control group. Just was mentioned difference in the means.

The association among the activity level and bones mineral density that don't support weight (as metacarpus, radio and ulna) has not been evidencing significant benefits (MATSUDO & MATSUDO, 1991), however, there is significant correlation with the bones that support weight (MATSUDO & MATSUDO, 1991; BALM et al., 20001). Starting from the results involving the forearm area, which didn't demonstrate a significant difference in the water aerobics participants' BMD in relation to the sedentary ones, it is supposed that, in the programs of physical exercises of the water aerobics classes, enough movements of flexing and extension of the fist and manual prehension should not be being accomplished for an osteogenic necessary incentive in that area.

CONCLUSION

The water aerobics participants, in the post-menopause, in use of TRH, have a larger DMO than the sedentary, in the post-menopause, in use of TRH, in the sites of the lumbar column

Table 2 - Results of the water aerobics participants and of the sedentary ones densitometry (g/cm²)

BMD (g/cm ²)	Water aerobic n = 22 (Mean ± DP)	Sedentary n = 26 (Mean ± DP)
L2-L4	1.294 ± 0.112*	1.081 ± 0.110
Lap	0.982 ± 0.075	0.927 ± 0.081
QT	1.049 ± 0.089*	0.943 ± 0.129
RUD	0.365 ± 0.031	0.345 ± 0.045
R33%	0.690 ± 0.032	0.655 ± 0.660
Rtotal	0.547 ± 0.031	0.519 ± 0.054

Where: * $p < 0.05$ among water aerobics and sedentary
 DP = Pattern Deviation
 L2-L4 = lumbar vertebrae
 Lap = Lap of the femur

QT = total hip
 RUD = ultra-distal radio
 R33% = radio 33%
 Rtotal = total radio

(L2-L4) and total hip. In agreement with the results of this study, it suggests that the health professionals in the area of the water aerobics intensify the incentive in the forearm area (radio - RUD, R33% and Rtotal) and of femur lap, because it was verified, in that sample, that those areas, in the clinical aspect and in the physical aspect, they need larger attention. This way, there are more necessary researches, so that it can evaluate with clarity the effects of the water aerobics in BMD, because the same can also be a good strategy for the maintenance of the bone mass and possible treatment of the osteoporosis. Besides, it is necessary that the health professionals are aware that intense, specific and frequent incentives are necessary to stimulate the osteogenesis, as much the muscular contraction as the impact stimulate the increase of BMD.

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