139 - THE INFLUENCE OF VARIABLES OF RESISTANCE TRAINING ON OSTEOPOROSIS.

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INTRODUCTION

Osteoporosis is a disease characterized by reduced bone mineral density (BMD) and deterioration of the microarchitecture of bone tissue that leads to the increase of its fragility, increasing the risk of fractures (ACSM, 1995; MAIOR, 2008), considered the disease most common metabolic bone around the world (MORAIS et al., 2005), affecting mainly the elderly, and such condition has a higher incidence in women, especially after menopause (ACSM, 1995; JOVINE et al., 2006).

BMD can be measured by X-ray dual-energy (DXA - dual x-ray absorptiometry), able to assess the trabecular and cortical bone. This method is quick, noninvasive, has high accuracy (error of 1% - 4%) and negligible radiation (BRUNIERA & AMADIO apud MOTTINI et al., 2008).

In the Brazilian population, IBGE data indicate that osteoporosis would have doubled from 1980, with about 7.5 million to 15 million in 2000, expected to reach about 32 million in 2020 (Matsuda & MATSUDO, 1991).

The prevention literature suggests that physical activity is mainly exercises that trigger muscular contractions against some form of external resistance, commonly referred to: strength training, or weight, or resistance exercises (SANTAREM apud JOVINE et al., 2006). because when practiced regularly can generate effective response to the increase in BMD (VICENT & BRAITH, 2002; KEMMLER et al., 2005; KEMMLER et al., 2003, NELSON et al., 1994; MADDALOZZO & SNOW, 2000; CUSSLER et al., 2003), reducing the risk factors related to osteoporosis.

Zehnacker & Dougherty (2007) to conduct a review on osteoporosis in women after menopause, 7 reported that studies have found increased BMD, but 3 studies found no difference between the exercise group and control. However, the difference in results may be attributed to variables of resistance training (RT): type of training, intensity, duration, type of exercise, weekly frequency, volume and order of exercises. Where there are no sufficient studies that compare different variables of RT on BMD. Therefore, the objective of this review was to analyze the influence of the varieties of resistance training on osteoporosis.

METHODOLOGY

The type of research used was a literature review, using articles and books from 1990 to 2009.The first consultation was held in the database of the American College of Sports Medicine (ASCM - American College of Sport Medicine) through its journal Medicine & Science in Sport & Exercise.

The second consultation was held in the Virtual Health Library (BIREME) using the database LILACS, MEDLINE and SCIELO.

The survey was conducted from February to October of 2009 through the following terms: osteoporosis, bone mineral density, bone mass, weight training, exercise or resistance training, weight training and exercise. To search using the English language were used: osteoporosis, bone density, bone mineral density, weight training, resistance training, resistance exercise and exercise.

At the end of the search, 21 articles were critically analyzed. The criteria for inclusion and exclusion are described below.

Criteria for exclusion of studies in the two databases.

We excluded studies that did not include resistance training.

Criteria for inclusion of studies in the two databases.

We included studies that utilized the measurement of BMD by DXA - (dual x-ray absorptiometry) sites: the spine, femur (neck / trochanter), total hip, wrist (forearm) and percent change in BMD the whole body. Samples who used adult or older without gender restriction.

RESULTS.

We reviewed 11 studies that examined the direct influence of RT on BMD, and analyzed the results showed that 6 studies found an increase in BMD after training (VICENT & BRAITH, 2002; KEMMLER et al., 2005; KEMMLER et al., 2003; NELSON et al., 1994; MADDALOZZO & SNOW, 2000; CUSSLER et al., 2003). However, 5 studies found no difference in BMD, suggesting that the training led to only maintain BMD (BEMBEN et al., 2000; HUMPHIRIES et al., 2000, KEMPER et al., 2009, WARREN et al., 2008; BRENTANO et al., 2008). Where the inconsistency of results may be the variables of the TR.

Type of training.

Brentano et al., (2008) studied two types of TR: series and circuit, and observed that both the type of training did not generate differences in BMD in postmenopausal women with bone loss. However, the study period was relatively short, only 24 weeks. Indeed, this may have influenced the result.

And much of the research that had great answers bone used the TR series (VICENT & BRAITH, 2002; KEMMLER et al., 2005; KEMMLER et al., 2003, NELSON et al., 1994; MADDALOZZO & SNOW, 2000; CUSSLER et al., 2003). Thus, it is suggested that if the goal is to prevent osteoporosis is susceptible to use resistance training series.

Intensity.

There are many studies that involve different levels of intensity on BMD (VICENT & BRAITH, 2002; MADDALOZZO & SNOW, 2000; BEMBEN et al., 2000), where the results show that the group trained with greater intensity had a significant increase in BMD (VICENT & BRAITH, 2002; MADDALOZZO & SNOW, 2000).

Nelson et al., (1994) to conduct a survey of postmenopausal women, using the TR load to 80% of 1RM (about 8 repetitions), found an increase in BMD at the femoral neck and lumbar spine respectively 0.9% + / - 4.5% and 1.0% + / - 3.6%. While in the control group there was a decline in BMD.

Resistance training with fewer repetitions, about 8 to 10 repetitions per set, with charges to 80% of 1RM results in greater improvements in BMD than weight training (load) and light with a large number of repetitions (BEMBEN & FETTERS apud

FLECK & SIMÃO; 2008).

Zehnacker & Dougherty (2007) argue that the TR involving 70% to 90% of 1RM, performing 8 to 12 repetitions per session, increasing the bone mass. Therefore, if the main objective of the training program is the increase in BMD would be more appropriate to increase the load that the number of repetitions.

Duration.

Regarding the time needed for training, some studies found positive results in BMD after 12 months of training (NELSON et al., 1994; KEMMLER et al. 2005; KEMMLER et al. 2003; CUSSLER et al., 2003). Still others have used only 6 months of training, also found increases in BMD (VICENT & BRAITH, 2002; MADDALOZZO & SNOW, 2000), however the work mentioned above both sexes participated in the survey, a fact that may have influenced the outcome.

Research that involved only premenopausal and postmenopausal women in short periods of training (6 months) found no significant differences in BMD (BEMBEN et al., 2000; HUMPHIRIES et al., 2000, KEMPER et al., 2009), just short periods of training would promote only maintenance of BMD.

Kerr et al. Apud Kemper et al. (2009) report that both achieve significant results, and to minimize bone loss in women after menopause, it would be necessary to perform the RT for at least 12 months.

According Fleck & Simão (2008), the bone does not respond so quickly to physical activity and muscle. The TR may result in increased muscle strength in a few months or even weeks after the start of the program, while the effects of BMD would require months to one year of training. Therefore, if the goal is to increase the BMD, the training should be implemented consistently over a long period.

Type of exercise (weight x free machine).

Maddalozzo & Snow (2000) conducted a research on the different types of exercise (free x machines) BMD in men and women. And the results suggested that individuals who trained with free weights had higher osteogenic response in the group that trained only with machines. Men who trained with free weights and high intensity obtained an increase of about 2% in BMD of the spine compared with men who trained only with machines and intensity.

However, the group that practiced the TR with free weights, held training with more intensity in the group that used only the machines. Therefore, this fact may have influenced the result.

And according to the authors, this was the first work on the different types of exercise on BMD in men and women. Thus, it is suggested that further research involving this variable are carried out.

Frequency Weekly.

According to the studies with results maintained or increased BMD, RT was carried out between 2 to 3 times per week (BEMBEN et al., 2000; HUMPHIRIES et al., 2000, KEMPER et al., 2009, WARREN et al., 2008, NELSON et al., 1994; KEMMLER et al., 2005; KEMMLER et al., 2003; CUSSLER et al., 2003; VICENT & BRAITH, 2002; MADDALOZZO & SNOW, 2000), where the inconsistency of results may be attributed to other variables of resistance training. Thus, the TR can be practiced between 2 to 3 times a week, if the goal is to prevent or increase BMD.

Sets.

Despite not having been found no study comparing different series on BMD, the work that had an increase in BMD used in around 2 to 3 sets per exercise (KEMMLER et al. 2005; KEMMLER et al., 2003, NELSON et al., 1994; MADDALOZZO & SNOW, 2000; CUSSLER et al., 2003). However, Vincent & Braith (2002) found an increase in BMD using only 1 set per exercise, but both sexes participated in the research, a fact that might have affected the result.

Some evidence also suggests that the stimulus is more important than the frequency of the same, that is, the greater the training intensity greater stimulus for bone formation (VICENT & BRAITH, 2002, BRENTANO et al., 2008).

Zehnacker & Dougherty (2007) argue that most studies used for bypass surgery 2 to 3 sets of exercise to increase or maintain BMD. Fleck & Simon (2008) suggest that progression can occur over time, with gradual increase up to multiple sets of each exercise.

Order of exercises.

The order of exercises, the literature suggests that exercise involving large muscle groups are recommended at the beginning of the training session, however the evidence that the available recommendations are insufficient (MONTEIRO et al., 2005; SIMÃO et al. 2005 , 2007, Dias et al., 2009). Kraemer and Ratamess cited by Dias et al. (2009) report that the order of the exercises can be modified depending on the objectives in the training program.

Simão et al. (2007) investigated the effects on the ordering of exercise and its influence on the number of repetitions in trained women. The results showed that the number of repetitions per set, was always lower when the exercise was located between the last sequence. In another study, Simon et al., (2005) found similar results when analyzing the effects of the exercise order and its influence on the number of repetitions involving men and women. Therefore, if the goal of practicing for prioritizing specific muscle group, would be effective starting the training session for him.

So, if a patient has osteoporosis in the lumbar region, why not start a training session for exercises involving the lower back? However, Simão et al., (2005, 2007) carried out their studies with young adults in relation to muscle strength, so there are gaps to be investigated regarding the order of exercises on the BMD.

Conclusions.

The studies included in this review showed that the TR is able to generate effective response to the increase in BMD, preventing or reducing the effects of osteoporosis. And this research found that the variables of TR may influence BMD in men and women. So if objective of the training program for the increase in BMD would be more susceptible to use the TR series, involving 70% to 90% of 1RM, around 8 to 12 repetitions per session, 2 to 3 sets per exercise, performing training 2 to 3 times a week regularly for a long period (up to 12 months).

Therefore, based on the results presented we can conclude that resistance training, when properly prescribed and directed, contributes to the prevention and treatment of osteoporosis. However, there are gaps to be investigated in relation to different combinations of variables of resistance training to increase bone mineral density.

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THE INFLUENCE OF VARIABLES OF RESISTANCE TRAINING ON OSTEOPOROSIS.

SUMMARY

Resistance exercises are presented as an effective stimulus for maintaining and increasing bone mineral density. The benefits of this type of training depend on the combination of the type of training, intensity, duration, type of exercise, weekly frequency, volume and order of exercises. However, there has been very clear what would be the best combination of these variables for a good bone response. Therefore, the aim of this study was to analyze the influence of the variables of resistance training on osteoporosis. The methodology used was to literature. The results showed that resistance training, when properly prescribed and directed, contributes to the prevention and treatment of osteoporosis. However, there are gaps to be investigated in relation to different combinations of resistance training on bone mineral density. Suggesting that more studies be conducted to compare experimentally the effects of variables of resistance training on osteoporosis.

KEYWORDS: variable resistance training, resistance training, osteoporosis.

L'INFLUENCE DES VARIABLES DE LA RESISTANCE DE FORMATION SUR L'OSTEOPOROSE.

SOMMAIRE

Les exercices de résistance sont présentés comme un stimulant efficace pour maintenir et accroître la densité minérale osseuse. Les avantages de ce type de formation dépendra de la combinaison du type de formation, intensité,durée, type d'exercice, hebdomadaire fréquence, le volume et l'ordre des exercices. Cependant, il a été très clair quelle serait la meilleure combinaison de ces variables pour une réponse bonne ossature. Par conséquent, l'objectif de cette étude était d'analyser l'influence des variables de l'entraînement en résistance sur l'ostéoporose. La méthodologie utilisée est à la littérature. Les résultats montrent que l'entraînement en résistance, lorsqu'il est correctement prescrit et réalisé, contribue à la prévention et le traitement de l'ostéoporose. Toutefois, il existe des lacunes à être examinée par rapport à différentes combinaisons de l'entraînement en résistance sur la densité minérale osseuse. Suggérant que d'autres études soient menées pour comparer expérimentalement les effets des variables de l'entraînement en résistance sur l'ostéoporose.

MOTS-CLÉS: formation à résistance variable, la formation de résistance, l'ostéoporose

LA INFLUENCIA DE VARIABLES DE RESISTENCIA DE FORMACIÓN SOBRE LA OSTEOPOROSIS.

RESUMEN

Los ejercicios de resistencia se presentan como un estímulo eficaz para mantener y aumentar la densidad mineral ósea. Los beneficios de este tipo de formación que dependen de la combinación del tipo de entrenamiento, intensidad, duración, tipo de ejercicio, la frecuencia semanal, el volumen y el orden de los ejercicios. Sin embargo, no ha sido muy claro cuál sería la mejor combinación de estas variables para una respuesta buena estructura ósea. Por lo tanto, el objetivo de este estudio fue analizar la influencia de las variables de entrenamiento de resistencia sobre la osteoporosis. La metodología utilizada fue a la literatura. Los resultados mostraron que el entrenamiento de resistencia, cuando estén debidamente prescritos y las instrucciones, contribuye a la prevención y el tratamiento de la osteoporosis. Sin embargo, existen lagunas que deben investigarse en relación con las diferentes combinaciones de entrenamiento de resistencia en la densidad mineral ósea. Lo que sugiere que más se realicen estudios para comparar experimentalmente los efectos de las variables de entrenamiento de resistencia sobre la osteoporosis

PALABRAS CLAVE: entrenamiento de resistencia variable, entrenamiento de resistencia, la osteoporosis.

A INFLUÊNCIA DAS VARIÁVEIS DO TREINAMENTO RESISTIDO SOBRE A OSTEOPOROSE.

RESUMO

Os exercícios resistidos apresentam-se como um estímulo eficaz para a manutenção e aumento da densidade mineral óssea. Os benefícios deste tipo de treinamento dependem da combinação do tipo de treinamento, intensidade, duração, tipo de exercício, freqüência semanal, volume e ordem dos exercícios. Entretanto, não se tem muita clara qual seria a melhor combinação dessas variáveis para uma ótima resposta óssea. Logo, o objetivo deste estudo foi analisar a influência das variáveis do treinamento resistido sobre a osteoporose. A metodologia utilizada foi à pesquisa bibliográfica. Os resultados demonstraram que o treinamento resistido, quando bem prescrito e orientado, contribui para a prevenção e o tratamento da osteoporose. Contudo, existem lacunas a serem investigadas no que se refere às diferentes combinações das variáveis do treinamento resistido sobre a densidade mineral óssea. Sugerindo-se que mais estudos sejam realizados para comparar experimentalmente os efeitos das variáveis do treinamento resistido sobre a osteoporose.

PALAVRAS-CHAVE: variáveis do treinamento resistido, treinamento resistido, osteoporose.

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