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Lifestyle and its correlations with osteoporosis and loss of body balance

Estilo de vida e suas relações com osteoporose e perda do equilíbrio corporal

Estilo de vida y sus relaciones con la osteoporosis y pérdida del equilibrio corporal

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This is a cross-sectional study with a quantitative approach, which aims at evaluating the relationships between lifestyle and bone mineral density. The research involved 13 women between 40 and 75 years of age. The participants answered the following questionnaires: International Physical Activities Questionnaire (IPAQ), short version; the Individual Lifestale Profile Scale; and a questionnaire regarding the sociodemographic profile. All participants also went through the bone densitometry test and the Time Up and Go test. The average age was 60.7 years old (sd±10.3), with an BMI of 26.9kg/m2 (sd±4.3). 8% of them had smoking habits and 18% consumed alcohol. Most of them had diabetes mellitus (38.4%), dyslipidemia. In the group with a negative lifestyle there were two people with osteoporosis and one with osteopenia, while the group with a positive lifestyle, just one person with osteopenia. The individuals with a negative lifestyle had higher alterations in their body balance than those who had a positive lifestyle. It can be concluded that the loss of bone mass is more common among individuals with a negative lifestyle. The same can be said for the loss of postural balance.
Descritores: Osteoporose; Equilíbrio postural; Estilo de vida.

Este é um estudo transversal com abordagem quantitativa e que tem como objetivo avaliar as relações entre estilo de vida e a densidade mineral óssea. A pesquisa se deu com 13 mulheres com idade de 40 a 75 anos. As participantes responderam os seguintes questionários: Questionário Internacional de Atividade Física versão curta (IPAQ); Escala Perfil de Estilo de Vida Individual (NAHAS); e um questionário acerca do perfil sociodemográfico. Todas pesquisadas também realizaram o exame de densitometria óssea e teste de Time Up Go. A idade média foi de 60,7 anos (dp±10,3), com IMC de 26,9kg/m2 (dp±4,3). Tinham hábito tabágico e consumiam álcool 8% e 18% respectivamente; tinham diabetes mellitus (38,4%), dislipidemia (30,7%) e hipertensão arterial (84%). No grupo com estilo de vida negativo havia duas pessoas com osteoporose e uma com osteopenia, e no grupo com estilo de vida positivo, apenas uma pessoa com osteopenia. Os indivíduos com estilo de vida negativo tinham maior alteração do equilíbrio corporal em relação aos que tinham estilo de vida positivo. Conclui-se que a perda de massa óssea está mais presente em indivíduos com estilo de vida negativo assim como, a perda do equilíbrio postural.
Descritores: Osteoporose; Equilíbrio postural; Estilo de vida.

Este es un estudio transversal con abordaje cuantitativo que tiene como objetivo evaluar las relaciones entre estilo de vida y la densidad mineral ósea. La investigación se dio con 13 mujeres con edad de 40 a 75 años. Las participantes respondieron a los siguientes cuestionarios: Cuestionario Internacional de Actividad Física versión corta (IPAQ); Escala Perfil de Estilo de Vida Individual (NAHAS); y un cuestionario acerca del perfil sociodemográfico. Todas las investigadas también realizaron el examen de densitometría ósea y test de Time Up Go. La edad promedio fue de 60,7 años (dp±10,3), con IMC de 26,9kg/m2 (dp±4,3). Tenían hábito de tabaquismo y consumían alcohol 8% y 18% respectivamente; tenían diabetes mellitus (38,4%), dislipidemia (30,7%) e hipertensión arterial (84%). En el grupo con estilo de vida negativo había dos personas con osteoporosis y una con osteopenia y en el grupo con estilo de vida positivo, solo una persona con osteopenia. Los individuos con estilo de vida negativo tenían una mayor alteración del equilibrio corporal en relación a los que tenían estilo de vida positivo. Se concluye que la pérdida de masa ósea está más presente en individuos con estilo de vida negativo así como la pérdida del equilibrio postural.
Descriptores: Osteoporosis; Balance postural; Estilo de vida.

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INTRODUCTION

Osteoporosis is the reduction of bone mass density and the deterioration of the microarchitecture of the bone tissue, leading to decrease strength of the bones and, consequently, to an increase in the risk of fractures[1]. Osteoporosis is increasingly recognized as a disease that limits the quality of life. The loss of independence that stems from the inability to ambulate leads to the worsening of the illness, and increases even more the risks of falls and further fractures[2].

Osteoporosis is seen as an important issue for public health around the world, due to its high prevalence and to its devastating effects in physical and psychosocial health. It can cause disabilities due to deformities and impairments, bringing serious financial losses, due to the long treatment demanded by fractures generated by the disease. Although many treatments have been being used for the lack of bone mass, there is no absolute cure for the osteoporosis.

The benefits brought by changes in lifestyle habits, though they are an important modifiable factor related to bone health, have not yet been established. The same is true for the prevention of the loss of bone mass, and the possibility that it can be done with well-balanced diets and regular practice of physical activities[3].

However, it has already been demonstrated that people who consume alcohol, coke-based soft drinks, and who use tobacco, present bone mass impairments as they age[4].

Scientific evidences indicate that the individuals with osteoporosis have diminished muscular strength and mobility, changes in the curvature of their spine and poor motor coordination[5,6].

Other studies demonstrate that individuals with osteoporosis show a deteriorated postural control, not to mention diminished functional capabilities. That leads, consequently, to falls. The deficit in their balance results in difficulties in the execution of most activities of daily life, which undermines the health and the quality of life of these individuals[7,8].

Therefore, it is worth to ask: What are the correlations between lifestyle, and the quality of bone muscular masses? Thus, the objective of this study was to evaluate the relationship between lifestyle and mineral bone density.

METHOD

This is a cross-sectional, quantitative study, conducted at the Adventist University Center of São Paulo - UNASP, in the period from April to November, 2015, with a group of women.

All voluntary participants of the research have signed the Free Informed Consent Form. This study is in accordance to the propositions of the Resolution of the National Council of Health - CNS nº 466/12, of the Ministry of Health.

The participants answered the following questionnaires: International Physical Activities Questionnaire (IPAQ)[9], short version; Individual Lifestyle Profile Scale[10], and a sociodemographic questionnaire.

The population of the study was constituted by 13 women, aged between 40 and 75 years of age, all of them patients of the hydrotherapy sector of the university polyclinic.

The individuals involved in this study were selected according to the following inclusion criteria: they must have had a bone densitometry test conducted at most one year prior to the beginning of the study, be older than 40 years old, and be females. However, individuals with a prior diagnosis of depression, schizophrenia or any mental condition that prevents them from continuing their work, as well as any individuals who used corticosteroids frequently due to rheumatic diseases, were excluded.

The first two questionnaires were validated for the Brazilian population. The participants also underwent the Time UP and GO test, in order to evaluate their dynamic balance, and a static balance test, conducted with the use of a Nintendo Wii® device, with a Base Balance Board. All patients presented the bone densitometry exam.

The International Physical Activity Questionnaire (IPAQ), short version, aims at verifying what kinds of physical activity do people do in their daily lives. The IPAQ has a long and a short version, and it can be applied through the phone or even by the respondents themselves; it can be used to remind one about the last seven days, or to consider a normal/regular week.

The IPAQ was developed due to the difficulty to obtain rates of physical activities that could be internationally compared. It is an instrument that allows for the generation of estimates of weekly energetic expenditure by physical activities related to work, transportation, household chores and leisure. It considers activities that are done for at least 10 minutes, with moderate to strong intensity[11]. The IPAQ is a tool that has been being used by several research organs, with the aim to improve, validate, reproduce, and later compare the levels of physical activities of different populations[12].

The Individual Lifestyle Profile Questionnaire10 is an instrument to evaluate an individual's lifestyle, based on "Nutrition", "Physical activity", "Preventive behavior", "Social relationships" and "Stress control". The Brazilian version of this test consists of self-administered questionnaires, that consider the behavior of the individuals throughout the previous month. Its results allow for the determination of the correlations between lifestyle and health.

The questionnaire is 15-question long, and in each question, one can obtain a result from 0 to 3 points. At the end of the questionnaire, the results are summed up; if the interviewee obtains a score of 15 points or less, their lifestyle is considered to be negative, and requires urgent change. A score from 16 to 30 is compatible with a regular lifestyle, while a score above 30 indicates a good or positive lifestyle.

The bone densitometry exam is used to measure bone density, diagnose osteoporosis and evaluate the risk of fractures. An advanced X-ray technology is used, commonly known as Dual Energy X-ray Absorptiometry, or DEXA, to detect osteoporosis. The DEXA is the established method to measure mineral bone density (MBD) nowadays. It is a fast and painless procedure to measure MBD. With it, this measurement is conducted in the inferior part of the vertebral column and in the hips.

Body balance evaluation

The Nintendo Wii® is a non-immersive virtual reality device, that is, one that does not place the entire body being inside a virtual system. It is a video game console that has been being used in motor and cognitive treatments as a therapeutic tool.

Its interface involves several games that offer motor benefits and entertainment, encouraging the patients to continue their therapy for long periods of time13. It detects both movements and acceleration in three dimensions through a manual remote control (Wii Remote) and a receptor which is positioned above or below the television. To evaluate their balance the patients positioned their toes and their heels on drawing traced for this purpose, their arms extended along their body, and were instructed to maintain an upright posture, stable and motionless during 32 seconds, in each of eight sensory conditions: 1st) face forward, eyes open, looking steadily at a target on the wall opposite to the platform, on a stable surface (NO); 2nd) face forward, eyes closed, on a stable surface (NC); 3rd: eyes closed, head with a 45º rotation to the right, on a stable surface (HR); 4th) eyes closed, head with a 45º rotation to the left, on a stable surface (HL); 5th) eyes closed, head leaning 30º backwards, on a stable surface (HB); 6th) eyes closed, head leaning 30º forward, on a stable surface (HF); 7th) face forward, eyes opened, looking steadily at a target in the wall opposite the platform, on an unstable surface, upon a pillow (PO); 8th) face forward, eyes closed, on an unstable surface, upon a pillow (PC)[14].

Time Up and Go test (TUG)

This is a fast and easy to apply test, that does not require special equipment, and its inclusion in the routine of clinical exams is recommended. It presents a good correlation to more profound balance measure, walking

speed and functional abilities. The patient begins the test sitting on an armed chair. He is asked to get up, walk for three meters, turn around, go back to the chair, turn around, and sit again. A standardized chair is recommended, 46 cm high and with 65 cm long arms. The test begins after the verbal command "go" is uttered. The timing of the test is concluded only when the elder is back at the original position, sitting with their back resting against the chair.

The test is interpreted according to the time it takes the patient to do it. The risk of fall is considered normal for adults who finish the test in 11 seconds or less; results between 11.01 and 16 seconds, in elders who tend to be independent in most activities of daily life, are considered weak; however, when more than 20.1 seconds are spent in the test, it is necessary to further evaluate the individual to verify the degree to which her or him are functionally compromised. This test has been used as a good predictor of falls among elders[15].

Statistical analysis

The data presented are the averages and standard deviations, and the analysis was conducted through descriptive statistics. To compare the proportion among the groups, the exact Fisher test was used, considering $p<0.05$ as a statistically meaningful result.

RESULTS

13 patients were evaluated, and distributed in two groups. Group I consisted of the patients with a negative lifestyle, and group II of the individuals with a positive lifestyle. They were all females. In 61% of them, the weight distribution in the lower limbs were 4% different; they presented balance alterations.

Average age was 60,7 years of age (sd±10,3), with a BMI of 26,9kg/m2 (sd±4,3). From this sample, 8% were smokers, 18% consumed alcohol regularly, 38.4% were diabetic, 30.7% had dyslipidemia, and 84% presented arterial hypertension.

The proportion of participants with a negative lifestyle who said that their health was worse than that of other people their age was meaningfully higher than that of the women whose lifestyle was positive. That was also true when they were asked if their health was worse than it was in a previous year: $p=0.01$ and $p=0.02$, respectively.

Most women with no balance changes were considered to have a positive lifestyle, and the score of this group was higher than 30, as measured by the NAHAS questionnaire. For those with balance changes, the score was lower than 30, and their lifestyle was classified as negative (Table 1).

Table 1. Demographic data and lifestyle of women who use the UNASP Clinic. 2015.

		Negative lifestyle	Positive lifestyle
Variables	Global N (13)	N (8)	N (5)
Age (years)	60.7±10.3	65.2±12.5	61.5±11.3
BMI (Kg/m2)	26.9±4.3	26.3±3.7	28.8±2.4
Hours of sleep	7.1±1.4	7.3±0.6	6.5±1.2
Physically active	8	4	4
Diabetes	5	4	1
DLPs	4	3	1
HAS	11	6	5
NAHAS Total	28.2±7.1	24.8±6.7	31.1±5.5

Mineral bone density and the t-score for the lumbar column, the head and the body of the femur, were similar to all groups. However, in the group with a negative lifestyle, there were two people with osteoporosis and one with osteopenia. In the group with a positive lifestyle, there was only one person with osteopenia (Table 2).

Table 2. Bone composition of the group of women who use the UNASP clinic. 2015.

Variables	Negative lifestyle group (MBD)	Positive lifestyle group (MBD)	Negative lifestyle group (T-score)	Positive lifestyle group (T-score)
Lumbar column	0.99	0.99	-1.2	-1.05
Head of the femur	0.88	0.86	-1.13	-0.68
Etire femur	0.92	0.99	-0.57	0.58

The static balance was evaluated through a test with the Nintendo Wii, and the dynamic balance through the Up and Go test, for both groups. The group with a positive lifestyle managed a higher score in the static balance evaluation, showing, therefore, to have less balance alterations. When the TUG was conducted, the score of the group with a negative lifestyle was 15.3±2.7, and that of the gruop with a positive lifestyle was 13.1±2.2. Thus, they showed a lesser alteration of body balance.

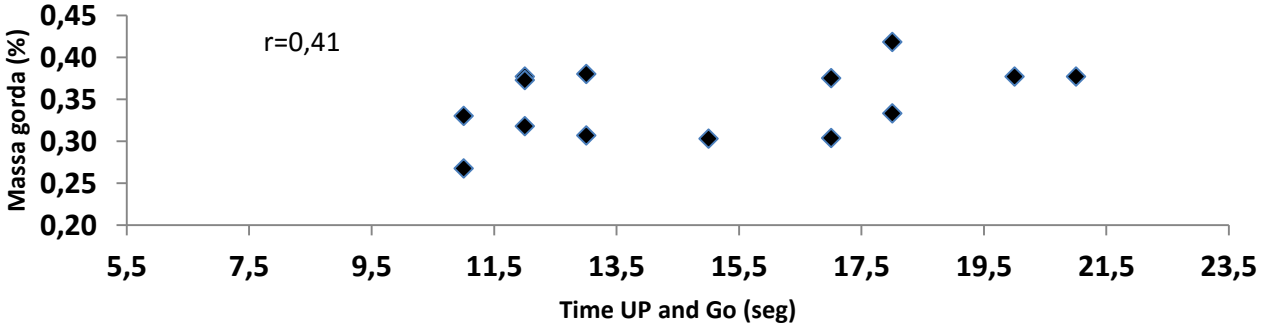
In the correlation among mineral bone density, T-score, Z-score, and the lifestyle data from the Nahas questionnaire, no significant correlations were found, as table 3 indicates.

Table 3. Correlation between mineral bone density (MBD), T-score, Z-score, and the full Nahas questionnaire of Lifestyle, and all domains. Female users of the UNASP Clinic. 2015.

Variables	Nahas Total	Nutrition	Physical Activity	Preventive behavior	Relationships	Stress control
	r (p)	r (p)	r (p)	r (p)	r (p)	r (p)
Lumbar column MBD	-0.15 (0.30)	-0.07 (0.7)	-0.29 (0.3)	0.12 (0.6)	-0.01 (0.9)	-0.3 (0.2)
T-score	-0.42 (0.06)	-0.22 (0.45)	-0.02 (0.9)	-0.44 (0.1)	-0.48 (0.08)	-0.13 (0.6)
Z-score	-0.35 (0.1)	-0.28 (0.32)	-0.24 (0.04)	-0.30 (0.2)	-0.38 (0.1)	0.26 (0.3)
Total femur MBD	0.2593(0.18)	0.30 (0.3)	0.48 (0.07)	0.06 (0.8)	0.1 (0.7)	-0.09 (0.2)
T-score	0.09 (0.37)	0.07 (0.81)	0.28 (0.3)	0.20 (0.5)	0.04 (0.8)	-0.34 (0.4)
Z-score	0.07 (0.4)	-0.06425	0.2 (0.5)	0.23 (0.4)	-0.03 (0.9)	-0.2 (0.4)

The percentage of lean body mass was found to be positively correlated to the dynamic balance, that is, the higher the amount of fat body mass, the longer was the time to perform the TUG, as Image 1 indicates.

Figure 1. Correlation between fat body mass and dynamic balance. Female users of the UNASP Clinic. 2015.



DISCUSSION

This study analyzed the mineral bone density of patients older than 40 years old, and their relationship to the changes in balance.

Among the main results, it can be highlighted that patients with more mineral bone density have a more positive lifestyle. The patients with a negative lifestyle presented more changes in their bodily balance. There was a higher proportion of patients with diabetes in the group of patients who experienced changes in their body balance.

In this study, the negative lifestyle was a risk factor for a diminished MBD and for changes in balance. The lifestyle corresponds to the usual group of actions that reflect the attitudes, values and opportunities of people. These actions are highly influent upon general health and quality of life.

Lifestyle is related to behaviors: adequate and balanced diet, regular practice of physical activities, reduction in the use of tobacco, preventive behavior, satisfactory social relationships and stress control. Such behavior, when practiced in a negative way in one's life, may reduce the bone mass and promote a loss in the changes of body balance[1].

A good nutritional state and adequate eating habits are related to a higher level of bone mass density during growth and to the protection against losses of calcium by the skeleton over time. The highest levels of bone mass are known to be reached between adolescence and 35 years of age. Up to 20 years of age, there is a calcium accumulation of 150mg per day. In maturity, calcium remains constant[16].

Daily mechanical stimulus, especially with overloading, must also be considered as a determinant factor to a higher level of MBD. Some studies have shown that the bones of physically active individuals use to be more dense, and therefore, more mineralized than those of sedentary individuals of the same age[17].

Osteoporosis has a multifactorial etiology. Genetic factors contribute for the MBD, from 50 to 62%, while lifestyle contributes from 38 to 54%. The lifestyle can be influenced by factors such as the level of physical activities and nutrition. Thus, it is important to highlight that an efficient way to treat osteoporosis is to have good habits in life, such as good eating habits and practicing physical activities. Behaviors such as the use of tobacco, alcohol, refined sugars as a whole, and the consumption of substances containing coke, should all be avoided[18].

Cigarettes and caffeine are considered moderate risk factors for osteoporosis, once their chemical components, among which is nicotine, act as depressors of the activity of osteoblasts, both directly and hormonaly[19,20].

The participants with a negative lifestyle had more changes in both their static and dynamic body balance. In a study which evaluated the body balance[21] with the same method used in this study, it was noted that patients with a low MBD have changes in their body balance. The loss of bone mass, which can be related to the age, seems to be a factor that contributes to the loss of balance, and it can increase the frequency of falls, consequently affecting the quality of life of people.

The loss of bone strength is characterized as one of the factors responsible for the deterioration of mobility and functional capabilities[9]. For elders to perform everyday activities, they must have balance, joint mobility, and strength[16].

The changes in balance in the elder population, especially among those who are overweight and obese, are relatively common problems, and lead to important limitations in their ability to perform everyday life activities. They are the main causes of falls among these individuals[22]. As they have a multifactorial origin, it is paramount to understand the changes in balance and what factors are associated to them, in an attempt to prevent falls and the bone fractures that may result from them. One of the most effective ways to prevent falls is to have a positive lifestyle, including especially healthy diets and physical activities[22].

The individuals with balance changes not only presented a higher rate of diminished bone mass, but also of diabetes.

Peripheral sensitivity is the most important sensory system to maintain balance[23]. That explains while the group of patients with diabetes presented a higher oscillation magnitude. A similar result was found in a study[24] that observed the changes in balance related to the changes in tactile sensitivity.

Postural stability among diabetic patients was evaluated in another investigation[25] through computerized dynamic posturography, and significant differences were found in the static balance between diabetic and non-diabetic patients. However, in dynamic conditions, there was no significant difference between the groups; these results may reflect that these patients' somatosensory system is more compromised than the vestibular and/or visual systems when it comes to the balance of diabetic patients.

CONCLUSION

The clinical implications of this study are related to the fact that there is an association between lifestyle, the loss of MBD, and changes in balance.

This study suggests, therefore, the implantation of programs that encourage healthy lifestyles and body balance training, for the use of people with diminished MBD, as this type of training can contribute to diminish the risk of future falls and fractures.

It was observed, thus, that the loss of bone mass is more common among individuals with a negative lifestyle, and that it can lead to alterations in balance. It was also possible to note that there is an association among the variable "functional capability", measured by the TUG test, and the static body balance of women.

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CONTRIBUTIONS
All authors contributed equally in the design of the study, data analysis, and in the final writing of the article.

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