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Research Article

Analysis of The Static Posture In Elderly

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ABSTRACT

Objective: To evaluate static postural changes in elderly in the Vale do Sinos / RS region. Method: A total of 112 subjects, aged between 60 and 89 years, were divided into 2 groups. Group I, composed of 55 individuals who practicing hydrogymnastics, and group II composed of 57 elderly participants of an informatic program. For the data collection was used: Postural Assessment Software (SAPO). Subsequently, the collected data was classified and descriptive and correlation studies were done. Results: Statistical analysis showed 84.8% had head asymmetry, 83% acromial asymmetry and 93.8% varus knee. In the lateral views, the following findings were found: 100% of the sample showed anteriorization of the head, 93.8% anterior femur trochanter in relation to acromion, 97.3% pelvis asymmetry and 70% knee flexion. When comparing the two groups, it was observed that the frontal angle of the left lower limb, right Q angle, trochanter of the femur anterior to the acromion and the angle of the thoracic kyphosis showed a significant correlation (p = 0.000). Conclusions: At the end of the study, it is possible to conclude that the main static postural alterations found were head anteriorization, horizontal asymmetry of the pelvis, vertical asymmetry of the trunk and varus knee. It is worth mentioning that the group of hydrogymnastics presented more misalignments. With these results, it is possible to promote preventive methods to static postural changes and, thus, to reduce the negative impact that these misalignments cause in elderly life.

Keywords: Elderly. Posture. SAPO.

1. Introduction

As the years advance, biological, psychological and social changes are perceived, affecting the individual as a whole. Biologically, there is a reduction in physiological functions, including changes in the tissues surrounding the joints. At 70 years of age, there may be a decrease of up to 50% in the amplitude of some movements, affecting mainly the spine, hips and knees. These modifications can result in discomfort, pain and, in some cases, functional incapacity, negatively influencing the autonomy of the elderly[1-3].

Regarding spine, one of the main alterations perceived in old age is the accentuation of curvatures, visible in the sagittal, frontal and/or transverse planes. These misalignments influence body sway, making balance and gait difficult, predisposing the elderly to fall. A fall can result in functional incapacity, directly affecting the individual's quality of life[2,4,5].

Therefore, this article aims to analyze the static postural changes present in elderly people.

2. Method

To participate in the study, the elderly should be between 60 and 89 years old, belong to water aerobics and computer science groups for the elderly, not be institutionalized or hospitalized. It was also necessary to have mental and health conditions to be independent and autonomous and to sign the Informed Consent Form, in accordance with the norms of Resolution No. 466/2012 and Resolution No. 510/2016 of the National Health Council of the Ministry of Health, which deals with research involving human beings. Exclusion criteria were presenting

dementia processes, frailty syndrome, being hospitalized or institutionalized.

The sample of this study consisted of 112 subjects, of both sexes and over 60 years old. The group I was composed of 55 individuals who practiced water aerobics and group II was composed of 57 elderly participants in a computer program.

The assessment instruments were applied in stages, respecting the willingness of the elderly, the conditions of secrecy, luminosity and accessibility. The research stages were carried out and monitored by qualified professionals in the field of gerontology. The duration of the interviews was defined by each elderly person according to their conditions.

To analyze the variables of static posture the following instrument was used:

Postural Assessment Software (SAPO) - The SAPO is a software that allows the import and calibration of images, the marking of points on the photograph according to the protocol, and the free marking of points to determine linear measurements, angular values, distance measurements and body angles. To carry out the postural assessment in this software, the following materials and procedures were used: black TNT fabric (2.0 m high by 1.40 m wide) at the bottom of the photograph site in order to facilitate the subsequent analysis in Postural Assessment Software; plumb line fixed to the TNT fabric (two 15mm styrofoam balls) at a distance of 1 meter between them, with the aim of later calibrating the image in the software; black cardboard mat for positioning the individual at the time of photography; digital camera (Sony Cyber-shot DSC-W690 16.1mp Digital Camera) with tripod; anatomical markers (8 15mm styrofoam balls applied to the subject with double-sided tape); white chalk to outline the subject's right and left foot on black cardstock. To ensure the same support base in the photographs in the different views (anterior view, right side view and left side view) a black cardboard mat was used, on which the individual is positioned freely for the first photograph. The verbal command was: "you will stand on this black cardboard in a position that is familiar and comfortable for you, position your feet in the way that is most comfortable for you". The camera was positioned 3 meters away from the individual and at a height of about half of their height[6-8].

The anatomical markers were located through the palpatory surface anatomy, in the subject's orthostatic position. The points selected follow the Postural Assessment Software protocol. This protocol was suggested by the initial program development project team and their choice was based on clinical relevance, scientific basis, methodological feasibility and applicability. This protocol is used as a standard for postural assessment that generates values for the posture database. To assess thoracic kyphosis, an anatomical marker was added to the protocol, applied under the spinous process of the twelfth thoracic vertebra (T12)[6].

In the anterior view were evaluated:

1. The horizontal alignment of the head: relationship between the line of the tragus of the ears and the horizontal line.
2. The horizontal alignment of the acromions: relationship between the acromions and the horizontal line.
3. Varus knee.
4. Knee valgus.

In the right and left side view were evaluated:

1. The vertical alignment of the head: relation of the ear tragus with the acromion.
2. The vertical alignment of the trunk: relationship of the trochanter of the femur with the acromion.
3. The horizontal alignment of the pelvis: relationship between the anterior superior iliac spines with the posterior superior iliac spines and the horizontal line.
4. Knee flexion.
5. Thoracic kyphosis: angle between the seventh cervical vertebra (C7) and the twelfth thoracic vertebra (T12).

At the time of the photography, the subject's image was framed together with the plumb line. Then, with a white chalk, the outline of the individual's right and left foot was drawn on black cardboard. After taking the photo in a particular view, the cardboard was rotated through 90 degrees and the subject was instructed to position himself on top of the cardboard with his feet on the drawing made with chalk. With the photographs ready, it was already possible to transfer them to the computer and start the evaluation at Postural Assessment Software. After installing the program, the images were imported and calibrated in the software. This procedure adjusted the vertical direction of the image and the transformation of distances in the image in pixels to real object distances (measured in meters), as shown in the postural assessment report issued by Postural Assessment Software[6].

3. Results

A total of 112 elderly people participated in this study, 24 (21.6%) men and 87 (78.4%) women, with a mean age of 70.86 years. Of these, 55 practiced water aerobics and 57 were participants in a computer program for the elderly **(Table 1,2 and 3)**.

Table 1: Comparison of the postural analysis of the anterior view of the elderly participants in the study.

Postural analysis - anterior view	Computer program (n)	Water aerobics (n)	TOTAL n (%)
Horizontal head alignment	49	46	95 (84,8%)
Alignment of the acromions	49	44	93 (83%)
Varus knee	51	54	105 (93,8%)
Valgus knee	6	1	7 (6,2%)

As shown in **Table 1**, 84.8% of the sample had head asymmetry, 83% acromial asymmetry and 93.8% knee varus.

Table 2: Comparison of the postural analysis of the lateral view of the elderly participants in the study.

Postural analysis - side view	Computer program (n)	Water aerobics (n)	TOTAL n (%)
Head forward	57	55	112 (100%)
Vertical trunk alignment (trochanter of the femur more anterior, in relation to the acromion)	56	49	105 (93,8%)
Horizontal alignment of the pelvis (relationship between ASIS* and PSIS**)	54	55	109 (97,3%)
Knees in flexion	42	36	78 (70%)
Angle of thoracic kyphosis	32,89º	48,23º	

*ASIS: anterior superior iliac spines. **PSIS: posterior superior iliac spines.

As shown in **Table 2**, 100% of the sample had anterior head position, 93.8% had the trochanter of the femur more anterior in relation to the acromion, 97.3% had pelvic asymmetry, and 70% had knee in flexion.

Table 3: Comparison of postural analysis averages of the elderly participants in the study.

Postural changes	Computer program (mean)	Water aerobics (mean)	≤
Angle of thoracic kyphosis	32,89	48,23	0,000.
Trochanter of femur anterior to acromion	-6,85	-5,02	0,006.
Frontal angle of the left lower limb (Trochanter of the femur, joint line of the knee and lateral malleolus)	3,89	10,91	0,000.
Right Q angle (Knee varus)	-16,69	-33,13	0,000

Comparing the two groups, using the Mann-Whitney test, a significant difference was observed in the frontal angle of the left lower limb, right Q angle, trochanter of the anterior femur in relation to the acromion and angle of the thoracic kyphosis. These data indicate greater misalignments in the hydrogymnastics group, which presented a greater angulation of the thoracic kyphosis, and varus knees.

4. Discussion

The results found by Aikawa, Bracciali, Padula[9] and Valduga et al[10]. are in line with the findings of the present study, in which 100% of the elderly assessed had shoulder asymmetry. In the study by Tavares et al.[11], 67.5% of the participants showed elevation of the left shoulder and 55% elevation of the left scapula. This fact is justified by the increase in the electrical activity of the upper trapezius muscle and inhibition of the lower trapezius muscle.

In a study carried out with 70 elderly women, 94.3% had a forward head position, in agreement with the results of the present study. However, contrary findings were found in other studies. In a survey carried out with people over 60 years old, 37.5% of the elderly had this postural alteration and in the other 32.4% had this alteration. Head forward is associated with shortening of the cervical extensor muscles, upper trapezius and scapula elevator[9-12].

Regarding the angle of thoracic kyphosis, a difference of 15.35º can be observed between groups. The group that practiced water aerobics had a higher index of this curvature. According to Bandeira et al.[1], the angle of thoracic kyphosis can vary between 20º and 40º in the general population; however, in the elderly, angles of up to 56º are considered normal. Considering these values, it can be seen that the elderly participants in this study did not have thoracic hyperkyphosis, contrary to the literature that claims this is a common condition in individuals aged 60 years or older, due to osteoporosis, sarcopenia and increased of body fat, among others factors.

In osteoporosis, there is a reduction in bone mineral density, resulting in changes in the shape and composition of the bones. In sarcopenia, the muscles generate less strength and flexibility. In the specific case of increased thoracic curvature, weakness of the spinal extensor muscles and shortening of the anterior trunk muscles are observed. In the research by Tavares et al.[11], 82.5% of the elderly had shoulder protrusion. This alteration may be a consequence of increased thoracic kyphosis, resulting from retraction of the pectoralis major and minor, serratus anterior and intercostal muscles[5].

It is noteworthy that the increase in body fat, mainly abdominal and waist, also contributes to thoracic hyperkyphosis. In this case, the center of gravity is shifted forward, favoring the elderly to fall. Furthermore, the increase in body fat can affect the alignment of the pelvis, and as a consequence, compensations in the lower and upper limbs and lumbar hyperlordosis[5,11].

Pachioni et al.[13] found results contrary to those of the present study, where photogrammetry associated with SAPO was used to assess the posture of thirty elderly people of both sexes, divided into two groups. Group I consisted of 15 individuals with Chronic Obstructive Pulmonary Disease (COPD), and Group II (control) comprised 15 individuals without respiratory disease. At the end of the study, it was possible to conclude that group I presented more postural alterations than group II. Among the modifications studied, posterior pelvic unevenness stands out, with an incidence of 93.3%, and thoracic kyphosis with 73.3%.

In the research by Oi et al.[12] similar findings were found when evaluating the spinal curvatures of 71 elderly people, 52 women and 25 men, through the photogrammetry method. The results showed that 52.1% of the elderly had thoracic hyperkyphosis.

Finally, the study by Takahashi et al.[14], showed different results from the findings found in the present study, in which, 46.2% of the participants had vertebral curvatures within the normal range, while 19.9% presented thoracic hyperkyphosis, 17.4% lumbar curvature inversion, 11.9% thoracic and lumbar straightening and 4.7% lumbar hyperlordosis.

For the pelvis, similar results were found by Tavares et al.[11], where 97.5% of the elderly had pelvic anteversion. Valduga et al.[10] also agree with the findings found in the present study, where 87.1% of the participants had this postural alteration. While in the study by Camargo et al.[15] only 33% of the sample had pelvic anteversion, before the pilates method intervention, and after 30 sessions, this number increased to 50%. This alteration is usually associated with increased lumbar lordosis, which occurs as a result of weakened abdominal and gluteal muscles, making the lumbar muscles and hip flexors shorten. It is important to emphasize that the weakness of the pelvic muscles, in a compensatory way, can cause bilateral flexion of the knees, as shown by the findings of the present research, as well as in the study by Tavares et al.[11], where 52.5% of the elderly evaluated showed flexion on the knees.

5. Conclusion

In aging, there is a reduction in the functions of the tissues that cover the joints, resulting in changes in posture and limiting the elderly to carry out their tasks.

Therefore, this research demonstrated that anterior head posture, horizontal asymmetry of the pelvis, vertical asymmetry of the trunk and knee varus were the main postural modification found in the studied groups. These changes can result in discomfort/pain and interfere on the static and dynamic balance, predisposing elderly to fall. Falls can have serious consequences in old age, directly affecting the quality of life of the elderly and their families and/or caregivers.

Thus, with the results of this study, it is possible to develop methods that aim to prevent these misalignments and thus reduce the negative impact that these changes cause in the lives of individuals aged 60 years or more.

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