INTRODUCTION: Flexibility reduces with age due to insufficient activity of the neuromuscular system, disuse of the skeletal muscles, and a lack of physical conditioning. Therefore, resulting in decreased autonomy and inability to perform daily activities. OBJECTIVE: To evaluate the effects of Isostretching in aquatic environment on muscle flexibility of elderly people.

METHODS: A longitudinal, nearly experimental, uncontrolled study conducted with 26 individuals of both sexes, average age 67.5 ± 7 years, evaluated in terms of lower limb flexibility through the “sit and reach” test before and after a 12-week session of Isostretching in aquatic environment. The sample was tested for normality using the Shapiro-Wilk test, and the pre and post practice results were compared using the Wilcoxon test, considering $p < 0.05$. RESULTS: When comparing pre and post results of Isostretching in aquatic environment, a significant improvement ($p < 0.05$) was observed in the posterior chain flexibility (12.5 cm) of lower limbs in the studied group. CONCLUSION: Isostretching performed in aquatic environment improved the posterior chain flexibility of lower limbs in a group of elderly people.

KEYWORDS: elderly; hydrotherapy; muscle stretching exercises.
INTRODUCTION

Muscle flexibility can be defined as the ability of a muscle to lengthen, allowing a joint to move through its range of motion. It is an individual capacity that depends on factors such as genetics, gender, age, muscle volume, and adipose tissue, and may also be influenced by external factors such as ambient temperature and physical exercise.

Flexibility decreases with age due to insufficient activity of the neuromuscular system, disuse of the skeletal muscles, and a lack of physical conditioning. According to Sandoval, after the age of 17 years flexibility tends to decrease progressively without difference between the genders, declining 20–30% up until 70 years of age. After 80 years, the percentage increases.

The loss of flexibility, especially in the articulations of the spine, hip, and knees, limits the autonomy of elderly individuals and inhibits their ability to perform daily activities. It may therefore be the main cause of discomfort and disability in this population. It is a limiting factor to adequate motor performance, as it often provokes musculoskeletal injuries and falls.

Adequate levels of flexibility enable movements to be performed efficiently with greater range of motion and greater fluency, which favors good musculoskeletal functioning and preservation of the joints.

It is believed that flexibility can be increased through the application of various stretching techniques, of which the Isostretching method is an option to maintain or improve the muscular length of elderly individuals.

Isostretching is a physiotherapeutic method that enhances range of motion, muscular strength, and body awareness. It is also a global postural gymnastics method which aims at strengthening and increasing the flexibility of muscles by working the state of contraction and stretching of its various segments.

Another feature that can promote maintenance and/or improvement of flexibility is the aquatic environment. According to Carregaro and Toledo, Caromano et al., and Alves et al., heated water promotes superficial vasodilation, which provides increased blood supply thereby improving the flexibility of tendon muscle tissue. The combination of decreased joint impact by the muscle flotation and relaxation component may further assist in gaining flexibility and mobility.

Given the benefits of the aquatic environment and the Isostretching method and the changes that occur in flexibility as we age, this study aims at evaluating the effects of the Isostretching method in aquatic environment on the muscular flexibility of the elderly population.

METHODS

This study is a longitudinal, quasi-experimental, uncontrolled study, approved by the Ethics Committee on Human Research (CEP) under opinion 983.278, and carried out in accordance with Resolution 466/2012 in a higher education institution in the city of Curitiba (PR).

The inclusion criteria consisted of individuals of both sexes, aged 60 years and above, active, able to understand simple verbal commands, and who had signed the Informed Consent Form (ICF). Exclusion criteria were individuals who presented hydrotherapy restrictions (open sores, skin diseases, fear of water, infection, or urinary incontinence), two consecutive absences during the treatment program, non-attendance in one of the stages of evaluation, pain, use of medicines for pain, and finally any muscle, joint, or bone injuries.

Sample

Twenty-six elderly individuals from the higher education institution where the study was carried out participated in the investigation. These participants represented both sexes and had a mean age of 67.5 ± 7 years. They were selected according to the inclusion and exclusion criteria and no sample loss occurred during the study. All participants performed the treatment program for 12 consecutive weeks with no absences.

Evaluation

The selected participants were evaluated to determine the flexibility of lower limbs before and after 12 weeks of the execution of Isostretching method in aquatic environment.

The assessment of lower limb flexibility was performed using the “sit and reach” test according to the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD). In order to achieve this, an adhesive tape 50.8 cm in length was taped to the floor. A metal tape measure was placed perpendicular to the tape, with the 63.5 cm mark affixed directly on top of the tape. Two equidistant marks were made at 15.2 cm from the center of the measuring tape (Figure 1).

Participants sat on the ground barefoot with their lower limbs extended, feet 30.4 cm apart, toes pointed upward, and heels centered on the markings on the tape. The zero of the tape measure pointed to the participant. With hands one on top of the other, the participants slowly slid their hands over the tape measure as far as they could, remaining in the final position for at least two seconds. The evaluator held the participants’ knees in order to prevent them from flexing. Two practice attempts were offered, followed by two trials. The final result was the better of the two scores.
Exercise protocol

After the initial evaluation, the participants underwent a three-stage exercise program for 12 consecutive weeks. They performed the 50-minute sessions twice a week in a therapeutic pool measuring approximately 6-m wide by 4-m long and 1.20-m deep, at a temperature of 31°C.

The first stage lasted five minutes and consisted of group warm-up, with walking exercises performed in different directions.

The second stage lasted 40 minutes and consisted of eight exercises of the Isostretching method performed in the standing posture and adapted to the aquatic environment. The postures used sought to lengthen the posterior chain of lower limbs and column. They were repeated three times and were performed in accordance with the self-growth of the individuals and respecting their expiration time. The difficulty of each posture was increased using sticks and balls, which were added every two weeks.

The third stage lasted 5 minutes and consisted of exercises of slow movement of the joints to promote the relaxation of the musculature.

Statistical analysis

The normality of the sample was evaluated using the Shapiro Wilk test. As the data did not present normal distribution, the results obtained before and after were compared using the Wilcoxon nonparametric test, considering statistically significant values with p <0.05.

RESULTS

The sample consisted of 26 participants, 24 women and 2 men, mean age 67.5 ± 7 years, mean body mass of 69.5 ± 6.9 kg and mean height of 1.57 ± 0.07 m.

The values obtained in relation to posterior limb muscle flexibility obtained in the pre (AV1) and post (AV2) periods of application of the Isostretching method in the aquatic environment are shown in Table 1.

When comparing the results obtained before and after the application of the exercise protocol, there was significant improvement (p =0.05; z = 3.87) in the posterior chain flexibility of the lower limbs of the studied group – an improvement of 12.5 cm.

DISCUSSION

The effects of the Isostretching method when applied in aquatic environment are still unknown. However, the results of this study show that when paired with hydrotherapy, the Isostretching method provides a significant positive result regarding the posterior chain muscular flexibility of elderly individuals.

This result may be related to the decrease in contractile resistance, which occurred mainly at the extremes of movement during exercise. When performing the Isostretching method in the water, non-abruptly and respecting the expiration time, the reflex response mediated by the muscle spindle was probably decreased, thus favoring the flexibility of the tissues.

Another factor that may have played a role was the viscoelastic component of the muscle, a mechanical factor that limits the passive and active stretching of the contractile and elastic tissues. According to Candeloro et al. and Rizzi et al., the heated water favors the decrease of the number of collagen cross-bridges, reducing the viscoelasticity of the connective tissue and thus promoting a greater degree of elasticity.

It is believed that the association between water temperature and fluctuation also contributed to the improvement of flexibility, as it favored a decrease in joint stiffness, a reduction in joint compression and a decrease in pain sensitivity. Thus, there was greater tolerance of the stretching exercises, which allowed the maximum deformation of the muscular structures.

The lower tissue elasticity presented by the elderly may also have favored the flexibility of the muscles of the posterior

Table 1 Median values obtained in relation to posterior limb muscle flexibility in the pre (AV1) and post (AV2) periods of application of the Isostretching method in the aquatic environment.

<table>
<thead>
<tr>
<th>Variable</th>
<th>AV1 (n = 26)</th>
<th>AV2 (n = 26)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>64 – 90</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>25 – 75%</td>
<td>64 – 90</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

AV1: initial assessment; AV2: final evaluation; *Wilcoxon nonparametric test.
chain of lower limbs. It is known that muscle deformation is greater in muscles with lower elasticity coefficient. According to Coelho, the more elastic the body is, the lower the tissue deformation and the greater the permanent gain of amplitude.

In the researched literature, the study by Palacio et al. applied the Isostretching method in an aquatic environment in individuals with Parkinson’s disease in order to evaluate balance, lung capacity, functional capacity, and quality of life of these patients. The other studies used the floor method, which makes it difficult to compare the results obtained.

Studies on the floor method demonstrate its beneficial effects on functional capacity and postural balance in both young and old populations, in minimizing balance changes in transfemoral amputees and in treatment of lower back pain.

With regard to flexibility, the method has also been shown to be efficient in improving posterior chain flexibility, thus corroborating the results obtained.

Wilhelms et al. applied four sessions of the method over the course of 2 weeks in 11 women with a mean age of 20 years, and found a significant increase in flexibility of the posterior chain of 4.52 cm, which was maintained after 2 weeks.

Hespanhol Jr. et al. and Silva et al. also found improvements in flexibility of the posterior chain in elderly people and healthy young people in their studies. They applied the method for 5 weeks totaling three sessions per week in 14 healthy sedentary individuals aged between 18 and 45 years, and were able to verify that the Isostretching method was effective for the gain of flexibility of flexion/extension of trunk and muscle length of lower limbs.

Qualitative gains were also observed with this study. According to the participants, there was postural improvement, greater aerobic capacity and spine mobility, and a reduction in pain, all of which had positive effects on daily activities, social interactions, and depressive state.

This study has limitations, such as the absence of a control group, which would ensure that the gains obtained were a consequence of the program applied. Moreover, this was not a blind study; therefore, it is not possible to prove that the researchers did not intervene in the tests applied. Other factors, such as water temperature control and pool depth, may also have influenced the results. Despite the limitations presented, utmost methodological care was taken in order to guarantee the validity of the study.

CONCLUSION

This study verifies that when performed in an aquatic environment the Isostretching method improves flexibility of the posterior chain of lower limbs of the elderly people. It is therefore a viable option for physiotherapeutic treatment for this population. However, studies performed over a longer time period with the inclusion of a control group and an evaluation after a period of suspension of the exercises can better demonstrate the benefits of the method for the elderly population.

CONFLICT OF INTERESTS

The authors declare that there was no conflict of interest.