Flexibility on the Functional Autonomy of Independent Elderly Women

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ABSTRACT: The study aimed at investigating the evolution of flexibility through a dynamic flexibility method and its influence over the functional autonomy of 14 elderly women (aged 60-87 years/C=66.4±7.3). A flexibility training program from the Academia Capacidade Vital (Vital Capacity fitness center, in English), in Araruama, Rio de Janeiro State was applied during 16 weeks, frequency of 2 days a week, during 30 minutes for each session. In the initial and final phases, tests of goniometric flexibility were conducted according to LABIFE protocol (Dantas, 1997), using a 360° steel goniometer (trademark Cardiomed, Brazil), and movements of shoulder abduction, hip flexion and extension, knee flexion, ankle extension and flexion, lumbar spine flexion, and C10m, USP, UVDP and TUG tests of autonomy (Aragão, 2002), where the timing of gauged in seconds, timed by a chronometer (trademark Casio, Malayasi). A descriptive statistical treatment was used, with mean and standard deviation, minimum and maximum values, and a T test. The individuals presented a significant improvement (p<0.01) of all the articulated movements considered. On the autonomy tests, there was a reduction in all the times that were marked, but only the C10m and USP (p<0.01) were seen in an expressive way.

Keywords: Flexibility, dynamic flexibility; life quality; functional autonomy; aging.
The aging is not simply the passing of time, but the manifestations of biological events which occur during the lifetime. This has been defined as a progressive loss of physiological capacities, fatally culminating with death (Robergs & Roberts, 2002).

As the mean life expectancy in Brazil has been increasing, according to the last census, it was observed that its current mean value is at 68.6 years, seeing that 72.6 years for women and 64.8 men (IBGE, 2000). This fact makes evident for the society the importance of the elderly health and welfare.

The physical quality, flexibility, is intimately related to the joint mobility and muscular elasticity, and thus, to the elder autonomy and their life quality, for their stimulation is essential for the promotion of health, in general, mainly when it comes to human motricity.

Its classical definition, according to Hallman and Hettinger, quoted in Dantas (1999:57) is the “physical quality responsible for the voluntary completion of a given movement of maximum angular amplitude, by means of a joint or a set of joints, within the morphological limits, without the risk of causing an injury.”

Hence, this quality should be stimulated during the infancy, in the adolescence and during the whole life, contributing then with the promotion of autonomy in the people’s daily activities, especially in the advanced age, as a result delaying the reduction of joint amplitudes.

It is not found in the literature the age limit to begin flexibility training; however, this physical quality can be improved in any age through exercises which promote soft tissue elasticity (Robergs; Roberts, 2002).

The aim is not to achieve the plastic components to increase the flexibility, but achieve the elastic elements (Achour Júnior, 1999), what demonstrates coherence with Dantas observations (1999), which suggest that they are due to the loss of this physical quality during the aging process plus the decrease of muscular elasticity that the joint mobility.

It cannot be forgotten that the aging process is often related to diseases and functional incapacities, provided by tissue wear itself in the course of time.

The conjunctive tissue becomes more rigid and the joints less mobile. There is a formation of crossed joint between adjacent collagen fibrils, reducing the elasticity and favoring mechanical injuries of the affected tissue. The blood vessels grow progressively affected by atherosclerosis and arteriosclerosis, decreasing this manner, the oxygen supply to all body organs. The bone mass decreases approximately at 10% in the peak of bone mass up to the age of 65 years, and approximately 20% around the age of 80 years (Achour Júnior, 1999; Nieman, 1999; Robergs, 2002).

The flexibility loss in the course of time can also be the result of processes of neurodegenerative diseases, such as arthritis, for the amplitude reduction of joint movements result in a contracture of tendon, muscles and other encircling tissue (Nieman, 1999; Robergs, 2002).

These studies corroborate the major possibilities of falls and its serious consequences in this population, which may cause irreparable harm.
Knapik’s reports (2001) reinforce this reality, as low levels of flexibility are also considered risk factors for injuries, which may then cause harm to the individual’s life quality at issue.

Although the bone mineral density in this group age is reduced, it is possible that the active flexibility may be improved for the joints which need to move unobtrusively in mean amplitude, as well as the static flexibility, for the ample range of movements (Maglischo; Achour Júnior, 1999).

According to Mateev (1986), quoted by Achour Júnior (1999), the static stretching exercise does not assure optimum level of active flexibility. This should be only part of the training, and thus, this fact suggests the needs of developing both types of flexibility in a training program.

It is important to draw the attention to this type of active flexibility training in elderly populations, for during a flexing work the tendons on the bones increase a lot and this type of activity will be only conducted with previous preparation and carefully (Dantas, 1999).

The very author clearly differentiates the flexibility work in: stretching, which provides the flexibility maintenance, for it is the sub-maximum level of the joint limit; passive flexing, which is important to the joint mobility, acting in the joint and plastic components; and the active flexing, which acts mainly in the muscular elasticity, i.e., in the myofilaments, in the parallel elastic and in series component, where it is found the major cause of shortening of this physical quality for this group age.

Kell (2001) considers that an aspect of physical health is the musculoskeletal system, which consists of three components: muscular strength, endurance and flexibility, what evidences the importance of this physical quality.

The same authors affirm that if the strength, endurance and flexibility are not kept, the musculoskeletal adaptation is compromised and may cause a significant impact on the physical health and welfare. And thus, to put into practice some programs of exercises which include these qualities is of great importance for the health maintenance.

The corroboration of this study, among so many, clearly appoints which benefits in the flexibility are kept for at least three weeks after the stretching program (Rubley, 2001). The authors also showed that two sets of three repetitions for the sitting and reaching test are stimuli enough for inducing benefits of flexibility for longer; therefore there is no need of tiring working sessions.

With the aging process, the flexibility shortening is progressively increasing, and this is inevitable. The physical training is within reach of everyone, aiming at diminishing this loss of accentuated form, for the individuals who do physical activities when young and still do exercises regularly are able to delay it.

Avoiding this shortening is the common sense among the professionals which work in this area. Taking the elderly as more independent in their daily activities is the purpose of fundamental relevance for the society.

This fact has proved to be promising, because the adult in the advanced age can be motivated to do exercises regularly which promote the development of strength, endurance and flexibility. The acceptance of the program of exercises evolves considerably in older adult populations (Chin A Paw, 2001).

**OBJECTIVE**

This study aims at investigating the evolution of flexibility through the method of dynamic flexing, and its influence over the autonomy of a group of female retired people. These individual seemed to be apparently healthy and were participants of flexibility program at a fitness center, situated in the city of Araruama, Rio de Janeiro State.

**METHODOLOGY**

**Sample features**

The researched population comprised the group age covering 60 to 87 years old, female gender, physically independent, according to Spirduso, withdrawn from Matsudo (2001). Fourteen individuals were randomly selected with age mean T°C=66.44±7.3 to comprise the sampling group of it.

**Procedures**

It was used an angular test of flexibility evaluation by the Labife protocol of goniometrics (Dantas, 1997), in the following movements: shoulder abduction, hip flexion and extension, knee flexion, dorsal and plantar ankle flexion and lumbar flexion, and a 10m walking anatomy test (C10m) (Aragão, 2002), upraising the seated position 5 times repeatedly (USP), upraising the ventral decubitus position (UVDP) and upraising seated positions, walking 3m and sitting again (TUG), in which the time completion was timed in seconds. The pre-test and post-test were conducted after 16 weeks of flexibility training, using the dynamic flexibility method, with frequency of two days a week, during 30 minutes each session.

The statistic treatment of data used for the obtained result analysis was of the descriptive nature, with mean, standard deviation, minimum and maximum, and inferential, with the paired t student test.

The participants signed a document authorizing their participation in it, according to the norms of Brazilian laws on health.

**Instruments**

It was used a 360° iron goniometer (Cardiomed, Brazil), a timekeeper (Casio, Malaysia), a tape-measure (Sanny, Brasil), a portable mattress and 2 feet high chair, and for the data treatment a SPSS 10.00 for Windows computer program.

**RESULTS AND DISCUSSION**

The results of the present study are presented in four distinct groups: goniometric evaluation (pre- and post-tests), autonomy evaluation (pre- and post-tests), comparison of the goniometric

**Goniometric evaluation (pre- and post-tests)**

The found mean in the participants of the study demonstrated chronic improvement in all evaluated movements, obtaining some increase in the joint amplitudes, and still with some important shortening of standard deviations, characterizing a tendency to approximation of individual levels and homogeneity of the sample. Only the lumbar flexion and ankle dorsal flexion, which although they have not had some improvement in the means, did not reduce their respective standard deviations, as can be noticed in the Table 1 and Figure 1.

This proposed method of stretching in this study provided positive results in the amplitude of movements of the sample, producing then a divergence as for its application to the age group at issue, since the recommendation of ACSM (2003) for the flexibility development in the elderly be it for the use of static method, due the frailty of tissues and tendons.

**Autonomy Evaluation**

After 16 weeks of training, the individuals showed some chronic improvement of mobility and agility for the completion of daily life activities (DLAs), for there was some shortening of timed time means of all the tests, and still reduction of the standard deviations, as well as characterizing a tendency to homogeneity and to the approximation to the individual limits of the sample group, which can be better analysed in the Table 2 and Figure 2.

**Autonomy tests**

As was expected, this type of training, for being active, make the dynamic flexibility advance, and thus it develops the daily movement specificity (Alter, 1999), therefore some improvement in the DLAs.

**Goniometric evaluation vs. reference standards of AAOS**

Comparing the angular amplitude of evaluated movements for the female elderly participants, after the completion of flexibility training program, with suggested means by the reference standards

![Figure 1 - Flexibility evaluation graph](image)

Table 1 – Sample goniometric evaluation

<table>
<thead>
<tr>
<th>Movements</th>
<th>AO</th>
<th>FP</th>
<th>FD</th>
<th>FL</th>
<th>FQ</th>
<th>EQ</th>
<th>FJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test mean</td>
<td>183.1</td>
<td>71.8</td>
<td>20.4</td>
<td>22.7</td>
<td>96.7</td>
<td>20.3</td>
<td>143.6</td>
</tr>
<tr>
<td>Post-test mean</td>
<td>191.8</td>
<td>85.8</td>
<td>26.5</td>
<td>33.3</td>
<td>106.9</td>
<td>30.2</td>
<td>147.4</td>
</tr>
<tr>
<td>Pre-test SD</td>
<td>6.99</td>
<td>10.45</td>
<td>6.32</td>
<td>7.05</td>
<td>12.82</td>
<td>8.40</td>
<td>8.01</td>
</tr>
<tr>
<td>Post-test SD</td>
<td>5.80</td>
<td>8.25</td>
<td>7.01</td>
<td>8.14</td>
<td>12.49</td>
<td>7.55</td>
<td>7.20</td>
</tr>
<tr>
<td>Pre-test Minimum</td>
<td>172</td>
<td>58</td>
<td>16</td>
<td>12</td>
<td>77</td>
<td>6</td>
<td>132</td>
</tr>
<tr>
<td>Post-test Maximum</td>
<td>182</td>
<td>72</td>
<td>18</td>
<td>22</td>
<td>92</td>
<td>18</td>
<td>139</td>
</tr>
<tr>
<td>Pre-test Maximum</td>
<td>194</td>
<td>94</td>
<td>37</td>
<td>36</td>
<td>122</td>
<td>28</td>
<td>156</td>
</tr>
<tr>
<td>Post-test Maximum</td>
<td>202</td>
<td>100</td>
<td>39</td>
<td>46</td>
<td>128</td>
<td>46</td>
<td>158</td>
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</tbody>
</table>

\(p<0.01 \; Ŕ_{pre} = 3.106\)

Table 2 – Autonomy Test

<table>
<thead>
<tr>
<th>TESTS</th>
<th>C10M</th>
<th>USP</th>
<th>UVDP</th>
<th>TUG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre</td>
<td>post</td>
<td>pre</td>
<td>post</td>
</tr>
<tr>
<td>Mean</td>
<td>6.52</td>
<td>5.44</td>
<td>10.69</td>
<td>7.70</td>
</tr>
<tr>
<td>SD</td>
<td>1.27</td>
<td>0.82</td>
<td>1.53</td>
<td>0.79</td>
</tr>
<tr>
<td>Minimum</td>
<td>4.91</td>
<td>4.39</td>
<td>7.81</td>
<td>6.34</td>
</tr>
<tr>
<td>Maximum</td>
<td>8.38</td>
<td>7.89</td>
<td>14.75</td>
<td>8.40</td>
</tr>
<tr>
<td>Ŕ Test</td>
<td>4.091</td>
<td>4.696</td>
<td>1.424</td>
<td>1.646</td>
</tr>
</tbody>
</table>

\(p<0.01 \; Ŕ_{pre} = 3.012 \) timing in seconds
of AAOS adapted by Norkin and White (1995), and taken from Dantas (1999), it could be noticed that the results were positive for movements of shoulder abduct, plantar flexion, ankle dorsal flexion, knee flexion and hip extension, for they are above the suggested means. The movements of lumbar flexion and hip flexion are under these referred means, demonstrating the great difficulty for the elderly to have mobility in these joints (cf. Table 3 and figure 1).

The ACSM (2003) indicates that specific movements of lumbosacral and hip region are more difficult of being used by individual in senescence, what justifies these results below the standard. Dantas (2002) points out that the movement of hip flexion is the sixth movement to suffer from limitations with the increase of the number of lived years, reinforcing the difficulties of movements which involve this joint.

However, Maron-Klibansky and Dory (2002) suggest that the regular attendance at a flexibility training program reduces the functional decline associated with aging and increases the life quality, because it improved the levels of joint amplitude of movements. As a consequence of these found increases, the probabilities of falls and injuries are reduced, as the stability of these movements is re-established in function of the training (Fleck, Figueira Júnior; 2003).

CONCLUSION

Initially, it was observed an amplitude reduction of some joint movements through the collected evaluations in the pre-test. For this reason, it was justified the regular physical flexibility activities, which could be noticed that the results were positive for movements of shoulder abduct, plantar flexion, ankle dorsal flexion, knee flexion and hip extension, for they are above the suggested means. The movements of lumbar flexion and hip flexion are under these referred means, demonstrating the great difficulty for the elderly to have mobility in these joints (cf. Table 3 and figure 1).

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Autonomy evaluation vs. reference standards

Aragão (2002)

The span of time presented by the sample was considered positive in all the tests, within the category “very good,” according to Aragão’s reference standards (2002), as the found means were in smaller time of completion in relation to the referenced standards. Considering that the sample group is physically independent, and even so there was some progression of the results, i.e., reduction of time completion of autonomy tests, which are shown (cf. Table 4 and Figure 2)

These results suggest that the functional autonomy of this group suffered positive alterations, which can reflect on physical aspects with better performance of DLAs and risk fall shortening and diseases related to aging, and on the psychological aspects with the improvement of self-image and self-esteem, making the elderly feel useful and independent in the social context in which they live (Silva, Matsuura, 2002).

According to the observation of the Table 5, it is reported that there was no significative correlation of the evaluations of movement amplitude conducted by the goniometric protocol with the autonomy tests. Therefore, this present study suggests further investigations on the approached theme, because it was not expected to find some relations among these variables, what did not occur.

However, the sample reported some positive changes in the life conditions and daily life activities, improving the functional autonomy levels and life quality levels, and as well as the aspects related to the social life.

Table 3 – Sample mean vs. AAOS means

<table>
<thead>
<tr>
<th>Movements</th>
<th>AO</th>
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<td>7.01</td>
<td>8.14</td>
<td>12.49</td>
<td>7.55</td>
<td>7.20</td>
</tr>
<tr>
<td>AAOS mean</td>
<td>0 – 180</td>
<td>0 – 50</td>
<td>0 – 20</td>
<td>0 – 80</td>
<td>0 – 120</td>
<td>0 – 30</td>
<td>0 – 135</td>
</tr>
</tbody>
</table>

Table 4 – Mean sample vs. autonomy standard means

<table>
<thead>
<tr>
<th>TESTS</th>
<th>C10M</th>
<th>USP</th>
<th>UVDP</th>
<th>TUG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre mean</td>
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<td>10.69</td>
<td>3.63</td>
<td>6.53</td>
</tr>
<tr>
<td>Pre SD</td>
<td>1.27</td>
<td>1.53</td>
<td>2.12</td>
<td>1.94</td>
</tr>
<tr>
<td>Post mean</td>
<td>5.44</td>
<td>7.70</td>
<td>2.90</td>
<td>5.22</td>
</tr>
<tr>
<td>Post SD</td>
<td>0.82</td>
<td>0.79</td>
<td>1.19</td>
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<tr>
<td>Standard Ref.</td>
<td>&lt; 6.8</td>
<td>&lt; 10.9</td>
<td>&lt; 4.1</td>
<td>&lt; 7.3</td>
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<tr>
<td>Category</td>
<td>Very good</td>
<td>Very good</td>
<td>Very good</td>
<td>Very good</td>
</tr>
</tbody>
</table>

Time in seconds
which in this study was restricted to the dynamic flexing method, as it is able to interfere more in the muscle elasticity than in the joint mobility, where it is found the major cause of loss of this physical quality with the aging (Achor Júnior, 1999; Dantas, 1999; Robergs, 2002).

After the completion of this flexibility training program for this sample, it was noticed, according to the tests and having done the inferential statistic treatment for p<0.01, that there was a significant increase of angles for the analyzed movements, contributing this manner for greater easiness in the daily life activities, lessening and delaying the aging process, and still increasing the life expectancy during the old age.

The researched group tended to come near its limit and homogeneity with some reduction of standard deviations and improvement of angle means. However, by using the lumbar flexion movement, it did not obtain a significative reduction of standard deviation, although it has improved the angle mean of movement. Due to this, there were high level of osteopenia and osteoporosis in the lumbar spines, especially in L2-L4 (ACSM, 2003).

In relation to the autonomy tests, the program was efficient, because it was also made a inferential statistical treatment for p<0.01. It was reported a significant reduction in the time of C10m and USP tests, corroborating for an accentuated improvement in the functional capacity and for the completion of DLAs.

However, the autonomy tests UVDP and TUG did not obtain a relevant increase due to the great proximity to the individual limits of the sample, but also classified as “very good,” as Aragão’s classification (2002).

Therefore, the present study suggest further investigations on the subject matter, specially concerning with the limitations of movements of lumbo-sacral and hip region, because of the relevance of it, and which it was not found significant correlations between the movement amplitudes and autonomy tests.

However, a training program which aims at developing the physical quality, quotes in it, certainly comes to provide some hope to a better life quality and with more quality for elderly individuals, for the autonomy and self-esteem are reestablished, and thus, the life quality is significantly achieved.

REFERENCES


Table 5 – Goniometry correlation vs autonomy tests

<table>
<thead>
<tr>
<th>Goniometry Tests</th>
<th>AO</th>
<th>FP</th>
<th>FD</th>
<th>FL</th>
<th>FQ</th>
<th>EQ</th>
<th>FJ</th>
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</thead>
<tbody>
<tr>
<td>C10m</td>
<td>-0.092</td>
<td>-0.342</td>
<td>-0.398</td>
<td>-0.341</td>
<td>-0.002</td>
<td>-0.343</td>
<td>0.504</td>
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<td>USP</td>
<td>0.444</td>
<td>-0.245</td>
<td>-0.304</td>
<td>-0.508</td>
<td>-0.012</td>
<td>-0.108</td>
<td>-0.082</td>
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<tr>
<td>TUG</td>
<td>-0.162</td>
<td>0.348</td>
<td>-0.530</td>
<td>-0.481</td>
<td>-0.262</td>
<td>-0.277</td>
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<tr>
<td>UVDP</td>
<td>0.029</td>
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<td>-0.655</td>
<td>-0.527</td>
<td>-0.240</td>
<td>-0.477</td>
<td>-0.468</td>
</tr>
</tbody>
</table>

p < 0.05


