Influence of a circuit-training programme on health-related fitness and quality of life in sedentary women of over 70 years

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ABSTRACT: Influence of a circuit-training programme on health-related fitness and quality of life in sedentary women of over 70 years. Objectives. The aims of this study were: i) to determine the influence of a circuit training programme on health-related fitness and quality of life; and ii) to determine the relationship between health-related fitness and quality of life. Methodology. A total of 23 women (72.6±5.4 years) who formed part of a circuit-training programme of two 60-minute sessions per week for 16 weeks participated in the study. Health-related fitness was assessed before and after the programme by means of an modified version of the AFISAL-INEFC battery and quality of life using the SF-36 questionnaire. Results. Significant improvements were found in lower limb strength and upper limb flexibility. With regard to quality of life, improvements were seen in general health and mental health. We show that a relationship exists between health-related fitness and quality of life variables, in particular in agility and physical role. Conclusion. A twice-weekly circuit-training programme improved to some extent health-related fitness and quality of life. A clear relationship between health-related fitness and quality of life it existed in practically all dimensions.

Keywords: aging, physical activity, health, SF-36

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INTRODUCTION

The aging is a complex and inherent process of all the structures and functions of the organism that produces a progressive slope in the functional capacity. This way, the passing of the time affects all of the organs and tissues that try to diminish deterioration, although the affection degree and its importance vary in the individuals' function. Are several the components of the physical condition implicated in the explanatory models of the aging and the incapacity associated to the age, being the most common: deterioration and the muscular weakness, deterioration of the neurological and the balance functions; the loss of the capacity associated to the age, being the most common: condition implicated in the explanatory models of the aging and individuals' function. Are several the components of the physical although the affection degree and its importance vary in the organs and tissues that try this deterioration, affects all of the organs and tissues that try to diminish, in a satisfactory way.

In the same way, at the present time are known the positive effects of the moderate physical exercise in the maintenance of the general health. The practice of physical activity is a factor that predicts the morbosity and the mortality of the general population. This way, to maintain a healthy physical condition links with a smaller risk of premature mortality. In a direct and specific way, the regular practice of physical activity in senior people improves the cardiorespiratory capacity, the force, especially in the inferior member, and the flexibility, besides improving the neurological function. All these aspects in an united way increase the functional capacity and the autonomy.

Consequently, the importance of the accomplishment of physical activity in the senior people roots in their capacity to lessen, in certain measure, the retreat of the physical and psychic capacities. In spite of, this slowness of the aging, influences on the life quality related with the health, understanding this as subjective well being and the capacity to relate and to adapt to the atmosphere in a satisfactory way.

The objectives of the present study were: (i) to know the influence of a training program in circuit over the healthy physical condition and the life quality and (ii) to know the existent relationship between the healthy physical condition and the life quality.

MATERIAL AND METHODS

Subject

Participated in the research 23 sedentary women (72.6 ± 5.4 years), that had never intervened in activities of sporting character or programs of physical activity and, residents in the place of Malpartida de Cáceres (Cáceres-Spain). All of them accomplished an agreement and they completed the program with a minimum of attendance of 90% of the sessions. The inclusion criterion was that they didn't have any pathology and that overcame the aptitude questionnaire for physical activity (EQUAL-Q / C-AAF) that assured that were capable to accomplish the program of physical activity and the evaluations.

Palavras-chave: Síndrome do Impacto, dor, fototerapia.

Palabras clave: envejecimiento, actividad física, salud, SF-36

RESUMO

Influência de um programa de treinamento em circuito sobre a condição física saudável e a qualidade de vida de mulheres sendentárias com mais de 70 anos.

Os objetivos do presente estudo foram (i) conhecer a influência de um programa de treinamento em circuito sobre a condição física saudável e a qualidade de vida e (ii) conhecer a relação existente entre a condição física saudável e a qualidade de vida. Metodologia. Participaram um total de 23 mulheres (72,6±5,4 anos) que fizeram parte de um programa de treinamento com 16 semanas com uma frequência semanal de 2 sessões de 60 minutos de duração. Foram avaliadas, antes e depois do programa, a condição física saudável através de uma versão ampliada da bateria AFISAL-INIEF e a qualidade de vida mediante o questionário SF-36. Resultados. Foram encontradas melhorias significativas na força do membro inferior e na flexibilidade do membro superior. A qualidade de vida mostrou melhorias na saúde geral e mental. Podemos comprovar que existe relação entre as variáveis de condição física saudável e qualidade de vida, especialmente na agilidade e rol físico. Conclusão. Um programa de treinamento em circuito de duas sessões semanais melhora em certo grau a condição física saudável e a qualidade de vida. Existe relação clara entre a condição física saudável e a qualidade de vida em quase todas as suas dimensões. O presente estudo foi aprovado pela Comissão de Bioética da Universidade de Estremadura e respeitou os princípios da Declaração de Helsinque.

Palavras-chave: Síndrome do Impacto, dor, fototerapia.

RESUMEN

Influencia de un programa de entrenamiento en circuito sobre la condición física saludable y la calidad de vida en mujeres sedentarias mayores de 70 años.

Objetivos. Los objetivos del presente estudio fueron (i) conocer la influencia de un programa de entrenamiento en circuito sobre la condición física saludable y la calidad de vida y (ii) conocer la relación existente entre condición física saludable y la calidad de vida. Metodología: Participaron un total de 23 mujeres (72,6±5,4 años) que formaron parte en un programa de entrenamiento en circuito durante 16 semanas con una frecuencia semanal de 2 sesiones de 60 minutos de duración. Se valoraron, antes y después del programa, la condición física saludable a través de una versión ampliada de la batería AFISAL-INIEF y la calidad de vida mediante el cuestionario SF-36. Resultados: Se encontraron mejoras significativas en la fuerza del miembro inferior y en la flexibilidad del miembro superior. La calidad de vida mostró mejoras en la salud general y mental. Hemos podido comprobar que existe relación entre las variables de condición física saludable y calidad de vida, en especial en la agilidad y rol físico. Conclusión: Un programa de entrenamiento en circuito de dos sesiones semanales mejora en cierto grado la condición física saludable y la calidad de vida. Existe relación clara entre la condición física saludable y la calidad de vida en casi todas sus dimensiones.

Palabras clave: envejecimiento, actividad física, salud, SF-36
The program lasted 16 weeks (March to June of 2006) with a weekly frequency of 2 sessions in alternate days (Tuesday and Friday) and a duration of 60 minutes (10:00 at 11:00 hours). Each session had the following structure: a) Warming (15 minutes) consisted of walking in circle at moderate rhythm while they accomplished mobility exercises of all the articulations. b) Main Part (35 minutes) consisted in a circuit of exercises that alternated the march at high rhythm (2 minutes) with exercises of concentric strength (1 minute) that strength exercises were used without resistance, resistances of 1 kg and elastic rubbers. In all of the sessions developed the main muscular groups of the body: flexor and extending of the superior and inferior members and torso. c) Returning to the calm (10 minutes) consisted in walking in circle at moderate rhythm (1 minute) alternating with exercises of active stretchings of the main muscular groups (1 minute). One day before the beginning and one day after the finalization of the program, all the subjects were appraised (pretest and posttest), in the variables of healthy physical condition and life quality.

### Evaluation of the healthy physical condition

The different components of the healthy physical condition were evaluated through a modified version of the AFISAL-INEFC battery with validity and reproducibility demonstrated in Table 1.

#### Table 1. Basic Descriptive (mean and typical deviation), values of T of Wilcoxon for independent samples and level of significance of the components of the healthy physical condition, analyzed in the pre and posttest.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pretest</th>
<th></th>
<th>Posttest</th>
<th></th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>D.T.</td>
<td>Mean</td>
<td>D.T.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.51</td>
<td>0.06</td>
<td>1.51</td>
<td>0.06</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>66.93</td>
<td>12.71</td>
<td>66.50</td>
<td>13.61</td>
<td>-1.164</td>
<td>0.259</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>29.21</td>
<td>5.03</td>
<td>29.15</td>
<td>5.58</td>
<td>-1.043</td>
<td>0.310</td>
</tr>
<tr>
<td>Dinamometry (kg)</td>
<td>20.87</td>
<td>5.73</td>
<td>19.04</td>
<td>4.14</td>
<td>2.142</td>
<td>0.055</td>
</tr>
<tr>
<td>F.-R. inferior member (n° repetitions)</td>
<td>13.39</td>
<td>2.76</td>
<td>15.74</td>
<td>3.53</td>
<td>-3.181</td>
<td>0.005</td>
</tr>
<tr>
<td>Torso Flexibility (cm)</td>
<td>6.39</td>
<td>7.66</td>
<td>2.03</td>
<td>10.10</td>
<td>2.152</td>
<td>0.052</td>
</tr>
<tr>
<td>superior member Flexibility (cm)</td>
<td>-8.04</td>
<td>9.34</td>
<td>-5.08</td>
<td>8.15</td>
<td>-2.724</td>
<td>0.013</td>
</tr>
<tr>
<td>Agility (s)</td>
<td>6.89</td>
<td>2.81</td>
<td>6.36</td>
<td>1.79</td>
<td>-1.396</td>
<td>0.184</td>
</tr>
<tr>
<td>R. cardiorespiratory (s)</td>
<td>1597.45</td>
<td>320.03</td>
<td>1573.88</td>
<td>204.39</td>
<td>-0.611</td>
<td>0.563</td>
</tr>
</tbody>
</table>

*F = Strength; R = Resistance

#### Table 2. Basic Descriptive (mean and typical deviation), values of T of Wilcoxon for independent sample and significance levels of the life quality dimensions, analyzed in the pre and posttest.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>T.D.</th>
<th>Mean</th>
<th>T.D.</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Function</td>
<td>68.56</td>
<td>28.71</td>
<td>70.53</td>
<td>26.61</td>
<td>0.127</td>
<td>0.900</td>
</tr>
<tr>
<td>Physical List</td>
<td>77.27</td>
<td>34.42</td>
<td>77.63</td>
<td>35.25</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Body Pain</td>
<td>71.23</td>
<td>20.60</td>
<td>74.74</td>
<td>16.09</td>
<td>0.327</td>
<td>0.748</td>
</tr>
<tr>
<td>General Health</td>
<td>67.86</td>
<td>19.12</td>
<td>72.53</td>
<td>17.22</td>
<td>-3.561</td>
<td>0.002</td>
</tr>
<tr>
<td>Vitality</td>
<td>72.65</td>
<td>22.52</td>
<td>78.42</td>
<td>17.80</td>
<td>-1.821</td>
<td>0.085</td>
</tr>
<tr>
<td>Social Function</td>
<td>82.95</td>
<td>20.97</td>
<td>84.87</td>
<td>17.47</td>
<td>-1.229</td>
<td>0.235</td>
</tr>
<tr>
<td>Emotional List</td>
<td>84.85</td>
<td>32.08</td>
<td>94.74</td>
<td>16.72</td>
<td>-0.622</td>
<td>0.542</td>
</tr>
<tr>
<td>Mental Health</td>
<td>78.73</td>
<td>17.25</td>
<td>84.00</td>
<td>13.06</td>
<td>-2.565</td>
<td>0.019</td>
</tr>
</tbody>
</table>

#### Table 3. Relation between the different physical condition and life quality variables, analyzed after the training in circuit program (Rho of Spearman and Significance level).

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Function</td>
<td>-0.445*</td>
<td>-0.197</td>
<td>0.399</td>
<td>0.090</td>
<td>0.453*</td>
<td>0.157</td>
<td>0.401</td>
<td>-0.699**</td>
<td>-0.718*</td>
</tr>
<tr>
<td>Physical List</td>
<td>-0.552**</td>
<td>-0.314</td>
<td>-0.515**</td>
<td>-0.041</td>
<td>0.480*</td>
<td>0.060</td>
<td>0.510*</td>
<td>-0.605**</td>
<td>-0.551</td>
</tr>
<tr>
<td>Pain</td>
<td>-0.506*</td>
<td>-0.176</td>
<td>-0.461*</td>
<td>0.048</td>
<td>0.206</td>
<td>0.310</td>
<td>0.229</td>
<td>-0.515*</td>
<td>-0.341</td>
</tr>
<tr>
<td>General Health</td>
<td>-0.354</td>
<td>-0.265</td>
<td>-0.454*</td>
<td>0.116</td>
<td>0.589**</td>
<td>0.250</td>
<td>0.219</td>
<td>-0.686**</td>
<td>-0.429</td>
</tr>
<tr>
<td>Vitality</td>
<td>-0.531**</td>
<td>-0.226</td>
<td>-0.316</td>
<td>-0.052</td>
<td>0.256</td>
<td>0.129</td>
<td>0.180</td>
<td>-0.738**</td>
<td>-0.38</td>
</tr>
<tr>
<td>Social Function</td>
<td>-0.383</td>
<td>-0.01</td>
<td>-0.120</td>
<td>0.160</td>
<td>0.367</td>
<td>0.005</td>
<td>0.198</td>
<td>-0.549*</td>
<td>-0.599</td>
</tr>
<tr>
<td>Emotional List</td>
<td>-0.236</td>
<td>-0.373</td>
<td>-0.148</td>
<td>-0.147</td>
<td>0.251</td>
<td>0.169</td>
<td>0.228</td>
<td>-0.365</td>
<td>-</td>
</tr>
<tr>
<td>Mental Health</td>
<td>-0.117</td>
<td>-0.322</td>
<td>-0.095</td>
<td>-0.386</td>
<td>0.036</td>
<td>-0.066</td>
<td>0.162</td>
<td>-0.264</td>
<td>0.471</td>
</tr>
</tbody>
</table>

1 = age; 2 = height; 3 = weight; 4 = dynamometry; 5 = strength-resistance of inferior member; 6 = torso flexibility; 7 = flexibility of inferior member; 8 = agility; 9 = resistance.

*p<0.05; **p<0.01.
Spanish population\textsuperscript{22,23,24}. The supplied tests were the following ones: height and weight. Starting from these measures was made calculations of the body mass index\textsuperscript{25}. Manual Dynamometry\textsuperscript{26} that evaluated the pressure strength of both hands. To get up and to sit down in a chair for 30 seconds\textsuperscript{27}, esteemed the strength-resistance of the inferior member. Modified Sit and reach\textsuperscript{38} evaluated the flexibility of the extending musculature of the torso and of the ischiotibial musculature. The test of flexing elbows to the back\textsuperscript{37} evaluated the flexibility of the superior members since the subject passed a hand over the same shoulder and the other behind the back trying to touch the medium axis of the body. Go and return\textsuperscript{37} esteems the agility, since the subject starting from the seating position, should get up, walk to a located cone at 2.44 m, rotate and sit down again. The test of 2 km (UKK-test)\textsuperscript{39,40} esteems the cardiorespiratory resistance.

For the evaluation of the components of the healthy physical condition the following instruments were used: anthropometer (he/she Dries, Frankfurt, Germany), scale (SECA, Berlin, Germany), manual dynamometer (Takei-5001, Tokyo, Japan), no expandable metric belt (Holtain, Crymych, United Kingdom), “sit and reach” flexibility box and (Psymtec-LA01285, Barcelona, Spain) chronometer (Namaste 898, Barcelona, Spain).

**Evaluation of the life quality**

The life quality was evaluated through the self-administration in a presence of a researcher of the SF-36 Health Survey questionnaire\textsuperscript{41}. The Spanish version was translated\textsuperscript{42} and it showed high values of legitimacy\textsuperscript{43}. SF-36 evaluates eight dimensions of the life quality related to the health (WARE & SHERBOURME, 1992): physical function, physical list, corporal pain, general health, vitality, social function, emotional list and mental health. The quantification of the mentioned dimensions there are in values varying from 0 to 100, where 0 correspond to “worse health” and 100 to “better health.”

**Data Analysis**

Were calculated the basic descriptive (mean and typical deviation). Took place an investigative analysis and since nor all the variables accomplished the normality, made calculations through the test of Kolmogorov-Smirnov, a non parametric analysis of tests was used. T of Wilcoxon was used for related samples to know the differences between the pretest and posttest. The Rho of Spearman statistician was calculated to know the relationship between the variables of healthy physical condition and life quality.

**RESULTS**

In the table 1 appear the basic descriptives (mean and typical deviation), values of T of Wilcoxon and the level of significance (p) of the components of the healthy physical condition. Significant changes were observed in the strength-resistance of the inferior member and in the flexibility of the superior member.

The table 2 removes the basic descriptive (mean and typical deviation), values of T of Wilcoxon and level of significance (p) of the dimensions of the life quality. Were obtained significant improvements in the general health and the mental health.

In the table 3 display the relationship between the different variables of healthy physical condition and life quality (Rho of Spearman and significance level). The agility is the most related component of the healthy physical condition with the variables of the life quality, while the physical list is the most related component of the life quality with the healthy physical condition.

**DISCUSSION**

Among the studied components of the healthy physical condition, it was found a significant increase in the levels of strength-resistance of the inferior member (17.6%; p=0.005) and in the flexibility of the superior member (63.1%; p=0.013). These data are opposed to the exposed by American College of Sports Medicine\textsuperscript{44} that maintains that programs of physical activity with a reduced weekly frequency (two sessions), are insufficient for the improvement of the components of the healthy physical condition. However, our data agree with studies that showed improvements of the physical condition with a reduced number of sessions\textsuperscript{14}.

The difference of the present study in which the improvements in the physical condition are limited by strength of the inferior member and the flexibility of the superior member, a program of physical activity of similar characteristics to the used in the present work (two weekly sessions for 12 weeks) got to reduce the body mass index and to improve the agility, the levels of strength and other functional abilities, as walk in stairways\textsuperscript{45}. Other programs of physical activity as the yoga, get great improvements in the balance (75.2%), in the flexibility (46.6%) and in the strength of the inferior member (25.2%) by a program of yoga of 12 weeks of duration and a weekly frequency of 3 sessions of 60 minutes\textsuperscript{46}.

Similar results offer studies accomplished in patients with arthritis\textsuperscript{47} that with a program that seeks the improving of physical in the aquatic way with a duration of eight weeks, show significant improvements in totality practice of the components of the physical condition evaluated, detaching the improvement in the strength of the superior member and in the agility.

In spite of, even if these works\textsuperscript{14,45,47} affirm that could be obtained satisfactory results accomplishing two weekly sessions of physical activity, the right is that with a larger frequency, larger the benefits\textsuperscript{48}. In what concerns the life quality, was found a non significant improvement in six of the eight dimensions and a significant increase in the other two: general health (6.68%; p = 0.002) and mental health (6.69%, p=0.19), the one that seems indicate that this program type indicates an improvement of the quality of their participants’ life. Other programs of physical activity, which SF-36 is used to evaluate the life quality, got better results, increasing significantly four of the eight dimensions: mental health, physical function, vitality and social function\textsuperscript{49}. Besides, a program of aquatic physical activity of two weekly sessions or a program of tai-chi of two weekly sessions improved the vitality and the
mental health in senior people\textsuperscript{50}. This way, our data coincide with previous studies\textsuperscript{49,50} that evidence the importance of the physical exercise over the senior people’s mental health, could affirm that the physical activity is decisive in the life quality in the senior people\textsuperscript{51}.

For the relationship between the different variables of the healthy physical condition and the life quality, we detached the relationship between the agility and almost all of the dimensions of the life quality. It was told that, the improvement in the strength of the inferior member indicates a very important factor in the maintenance of the functional capacity since it allows the people’s general mobility\textsuperscript{22}; our results seem to suggest that it is not the strength, but the agility, the capacity that has a larger influence in the life quality in these people. Maybe due to that, this life quality dimension is the one that allows in measured adult to accomplish activities of the daily life, and the one that is a complex capacity that includes, besides the strength of the inferior member, the balance and the coordination. In spite of this, it is necessary to emphasize that the resistance is the component of the healthy physical condition that had higher relationship with the physical function, evidencing the relevance of this capacity that supposes the sustenance of the rest of physical capacities. In the same way, it is necessary to emphasize that the physical list is the dimension of the life quality that most links with the variables of the healthy physical condition, maybe because this dimension of the life quality is the one that links most with the work\textsuperscript{41}.

In what refers to the limitations of the present study, we should say that did not exist a control group, this fact could be minimized by being the sample of sedentary subjects and to act for themselves as control group. In spite of it, is necessary to keep researching in this line, using control group and different training programs.

As conclusions, we can affirm that a training program in circuit of two weekly sessions gets better in certain degree the healthy physical condition, indicating an increase in the strength of the inferior member and the flexibility of the superior member. In the same way, an improvement of the life quality exists in all their dimensions, being just significant in the general and mental health. In addition, the relationship between the variables of healthy physical condition and life quality is elevated, detaching the agility and the physical list as main variables related with the other group of variables.

Acknowledgement

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