Entrenamiento continuo vs. interválico corriendo en piscina profunda: efectos sobre la salud de las mujeres obesas

S.R. Pasetti a, A. Gonçalves b and C.R. Padovani c

aSchool of Physical Education. University of Campinas (UNICAMP). Campinas, SP, Brasil.
bSchool of Physical Education. University of Campinas (UNICAMP). Campinas, SP, Brasil.
cSão Paulo State University. Botucatu. Department of Biostatistics. Campus Rubião Junior, Botucatu, SP, Brasil.

Resumen

Objetivos. Investigar los efectos del entrenamiento continuo versus el entrenamiento intermitente corriendo en piscina profunda para el control y la prevención de la acumulación excesiva de adipocitos sin restricción alimenticia, así como para una mejora del condicionamiento físico y de la calidad de vida.

Métodos. Estudio experimental con treinta mujeres entre 34 y 58 años de edad, durante 12 semanas, tres sesiones por semana, 47 minutos cada una. Se consideraron la composición corporal, la condición cardiorespiratoria y la calidad de vida mediante la evaluación de criterios del WHOQOL-Abreviado. Se aplicaron la prueba estadística t de Student y la no paramétrica de Wilcoxon.

Resultados. Con la única excepción del dominio social de la calidad de vida, todas las variables investigadas reflejaron un mejoramiento en ambos grupos para IT en comparación con CT.

Conclusión. El correr en piscina profunda contribuye a la reducción de la grasa corporal, la evolución de la aptitud física y mejora de los indices contemplados en el WHOQOL-Abreviado.
Introduction

Nowadays, obesity is considered a major public health problem worldwide, as it is increasing at a very fast pace and is associated to diabetes mellitus type II, hypertension, endometrial and colorectal cancer, cardiovascular diseases, sleep apnea, degenerative articular processes and implications on quality of life (QL). Studies show an inverse relationship between the sedentarism rate and QL; the higher the weight, the lower the QL. Systematic physical activities (SPA) cause significant changes in the cardiorespiratory, immunologic, endocrinologic systems, allowing the reduction of body fat, gain of muscle and bone mass, besides preventing chronic degenerative diseases. Other contributions to QL should also be considered such as reduction of anxiety, improvement of sleep and self-esteem.

Technically, there are two training types for SPA: the continuous (CT) which involves rhythmical exercises with 60-80% of VO\textsubscript{2max} intensity for extended time and the one with intervals (IT), which refers to repetition of exercise turns alternated with recovery periods. The first is widely applied as a resource to improve health and to reduce body fat; the second is used for high sports performance. However, IT can be also recommended for those in search of health improvement and reduction of adipocytes concentration. IT results in VO\textsubscript{2max} gains and reduction of fat percentage in a more significant way than CT, besides allowing weight maintenance and reduction of cholesterol levels.

The practice of exercises in water environments may be interesting for obese people, as they increase energy consumption when compared to running training on land, besides reducing injury risks. Among the SPAs performed in water, there is the deep water running (DWR). The practitioner uses a floater attached to the waist allowing the running movements without contacting the pool floor. It is an easy-to-learn activity as the practitioner does not need to know how to swim and there is no impact.

Considering the SPA benefits for health and QL, the purpose of this study was to investigate the CT and IT effects through SPA for the control and prevention of excessive body fat accumulation and improvement of QL in 30 obese women, aged between 34 and 58 years for 12 weeks, with three 47-minute sessions per week.

Methods

Subjects

Initially, 35 women participated; 30 of them (85.71%) concluded the study in two groups (one with IT comprised 18 volunteers and the other with CT composed of 12) and five were excluded due to excess of absences. Mean age of 46.1±0.78 years (45.33±0.63 years for CT and 46.61±0.88 years for IT). Four (13.3%) were submitted to Menopausal Hormone Therapy, one (3.33%) had diabetes mellitus type II and two (6.66%), mild hypertension. No incidents were registered throughout the intervention.

The selected women met the following criteria: be obese (28 to 35% of body fat), aged between 34-58 years old, having not practiced SPA over the last three months, and have medical authorization or recommendation for physical exercise practice. Training participation
was not allowed for women who showed: consumptive, hepatic or endocrine disorders, unbalanced renal function or severe dysfunction, chronic obstructive pulmonary disease; pregnancy, neurological or psychiatric problems, abnormal or atypical cardiac response during SPA, use of beta-blockers or anti-obesity drugs, severe hypertension and decompensated diabetes mellitus.

**Procedures**

The study, characterized as being experimental with two groups, had initial and final assessments and was approved by the Research Ethics Committee of the School of Medicine Science from the University of Campinas (UNICAMP), under the number 640/2005. As dependent variables, physical fitness, reduction of body fat and improvement of QL were considered; the systematic and guided DWR practice was considered as independent variable.

The volunteers’ perception of QL was evaluated by using the WHOQOL-Brief (Portuguese version) from the World Health Organization. This tool has 26 standard and closed questions with five response levels, whose answers should be the most appropriate response for the assessments regarding physical, psychological, social relations and environment domains. These are considered as a set of subjective perceptions from the participation in the production, circulation and goods consumption processes.

After the WHOQOL-Brief had been filled out, the assessment of the body composition (BC) was started on an individual and systematized basis, which met the following sequence:

a) Body mass (kg), the volunteers being weighted in the standing position, barefoot and wearing a bathing suit; and the balance was calibrated before each weighing.

b) Skinfold (mm), measured in three consecutive times (tricipital, supra-iliac and mid-thigh) all on the right side.

Data obtained in item ii) were used to find body density, a necessary variable to determine body fat percentage (BFP) by using Siri equation:

\[
\text{Body Density} = 1.099421 - 0.0009929 \times X_1 + 0.0000023 \times X_1^2 - 0.0001392 \times X_2
\]

\[
\%\text{GC} = \frac{495}{\text{Body Density}} - 450
\]

Table 1

Comparison between mean and standard deviation for continuous and interval training, of fitness variables studied and respective results of statistical test according to assessment times after deep water running practice in obese women

<table>
<thead>
<tr>
<th>Variable</th>
<th>Continuous Training Group</th>
<th>Interval Training Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assessment</td>
<td>p value</td>
</tr>
<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
</tr>
<tr>
<td><strong>Body Composition and Anthropometry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>83.86±09.86</td>
<td>82.60±09.67</td>
</tr>
<tr>
<td>Tricipital skinfold (mm)</td>
<td>25.77±04.20</td>
<td>24.44±03.00</td>
</tr>
<tr>
<td>Supra-iliac skinfold (mm)</td>
<td>30.38±04.76</td>
<td>28.05±04.33</td>
</tr>
<tr>
<td>Mid-thigh skinfolds (mm)</td>
<td>33.55±04.12</td>
<td>30.80±03.41</td>
</tr>
<tr>
<td>Sum of skinfolds (mm)</td>
<td>89.69±12.35</td>
<td>83.30±09.57</td>
</tr>
<tr>
<td>Body density (g/cm³)</td>
<td>1.023±0.007</td>
<td>1.027±0.006</td>
</tr>
<tr>
<td>Body fat percentage</td>
<td>33.96±03.33</td>
<td>32.19±02.65</td>
</tr>
<tr>
<td><strong>Fitness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhythm (# of right leg elevations/min)</td>
<td>68.83±03.18</td>
<td>74.66±07.13</td>
</tr>
<tr>
<td>Test duration (min)</td>
<td>07.83±01.99</td>
<td>11.65±03.76</td>
</tr>
<tr>
<td>HR at rest (bpm)</td>
<td>90.83±08.22</td>
<td>83.75±08.56</td>
</tr>
<tr>
<td>HR at peak (bpm)</td>
<td>143.91±13.60</td>
<td>142.41±17.55</td>
</tr>
</tbody>
</table>

HR: Heart rate.
**Second to third:** eight sprints, allocated in two moments.  
**Fourth to sixth:** ten sprints, distributed in three sequences.  
**Seventh to ninth:** twelve at top intensity repetitions, available in three series.  
**Tenth to twelfth:** fifteen repetitions in three series.  

The interval exercises, always considering motion, were distributed into two or three stimuli sets specifically numbered. After checking the initial heart rate (HR \( \text{In} \)), the evaluated women practiced the exercises in the proposed intensity, i.e. 70-75% HRR for 10 minutes and immediately after they started the first of maximum effort activities, and later returned to the defined target effort. Two sets of sprints were carried out between the second and sixth training weeks. For other sessions, high intensity stimuli were allocated in three stages, with a five-minute interval between them. The participants included in the CT and IT groups were monitored during all classes, regarding the heart rate at three-minute intervals, from the end of warm-up up to two minutes after stopping the activity, in order to follow the effort HR individually established for each session. At the end of the 12-week program, new assessments were made in order to compare the data obtained between the beginning and the end of this study.

**Statistical analysis**

As per the analytical assessment, Student’s \( t \) test and Wilcoxon’s non-parametric test were applied. Data normality was assessed through the Kolmogorov–Smirnov test. Statistical significance was set at \( p < 0.05 \) and values were given as mean ± standard deviation.

**Results**

Table 1 shows results for BC and physical fitness, considering the initial and final times, according to the training type. The reduction of body mass, in spite of having occurred in CT and IT, was significant for only CT (\( p<0.05 \)), while the sum of skinfolds (\( p<0.05 \)) expressed this behavior in both groups.

Body density of \( p<0.001 \) indicates improvement in IC and CT; as for the benefits of the continuous and intermittent effort for changes in body composition, it is noticeable that IT has produced twice as much fat reduction as CT (\( p<0.01 \)).

The increase in rhythm (\( p<0.005 \)) indicates the cardiorespiratory fitness level improved in both groups, being more significant in the IT group (\( p<0.001 \)).

The results in Table 2 show the contributions of both training types for improvement of QL. The ANOVA test revealed differences among the continuous and intermittent training groups (\( p<0.05 \)), while the sum of stimuli in CT and IT expressed the tendency in both groups. Table 2 shows the contributions of both training types for improvement of QL, which were similar for both groups. At the end of both training types, the participants reported similar levels of satisfaction, indicating that the proposed program was effective in improving QL. The data were analyzed using the non-parametric test, and the results showed significant differences between the initial and final assessments, indicating that the program had a positive impact on QL. In addition, the participants reported no significant differences in the QOL between the two training groups, suggesting that both training types were equally effective in improving QL.
volunteers were excluded due to the excessive number of absences and all belonged to the CT group. According to the participants, the high intensity stimuli were more interesting and motivating than those of the CT, regarded as more monotonous, and this could be the reason for the training interruption.

Considering this, it is well known that exercise practice aiming at weight loss contributes to the favorable evolution of emotional aspects such as humor, self-esteem and body image\(^\text{21}\). In fact, behavior changes towards physical activities and personal relationships were reported in a six-month study on food control and seven weekly 30 to 40-minute long, especially regarding those submitted to high intensity efforts sessions\(^\text{22}\).

When considering BC, the deep water running practice allowed the reduction of concentrations of localized and general fat, as Assis\(^\text{23}\) had already reported in a 15-week study on women with fibromyalgia submitted to stationary DWR.

Body density as well as rhythm were improved, showing respectively increase in body mass\(^\text{24}\) and cardiorespiratory evolution.

The physical domain in the World Health Organization questionnaire shows improvement and further possibility to be improved with physical activity practice\(^\text{25}\). The second domain, which involves psychological aspects, includes positive feelings, body image, self-esteem and appearance positively favoring the BC changes\(^\text{26}\). Probably, people socialization with similar characteristics promoted exchange of experiences and stories with consequent influence on the evolution of social relationships by obese women after DWR\(^\text{27}\).

Data related to the environment domain call our attention, since they are associated with the essentially economic reality of nature\(^\text{28}\) as opportunities for recreation and leisure, education, residence, physical environment and satisfaction at work\(^\text{29}\), on which SPA has little direct interference\(^\text{30}\). It is believable that such responses are somewhat related with the growing economic trend in Brazil at the time of this intervention. On the other hand, these results were not affected in a similar study conducted by Pasetti; Gonçalves; Padovani\(^\text{31}\), in a period when the country was beginning to change with a strong social proposal, originating great positive personal expectations.

Studies emphasize that continuous resistance or aerobic exercises are beneficial to QL of different populations as, for instance, those with fibromyalgia\(^\text{32}\) or cardiopathy\(^\text{33}\) and people with chronic renal problems\(^\text{34}\). Data obtained with DWR confirm these findings and indicate that interval training can also contribute to the increase of expressive body fat reduction, besides improving QL of obese women.

In conclusion deep water running has been shown to contribute to body fat reduction, physical fitness evolution and improvement of WHQOL-Brief domains, regardless of the training type conducted.

References