Effects of indoor cycling in body composition, muscular endurance, flexibility, balance and daily activities in physically active elders

Rodrigo Vilarinho1 didasurf@hotmail.com
Wanessa Ysis Garcez de Souza2 wanessaysis@gmail.com
Tatiana Cristina Rodrigues3 shark@usp.br
Jenny Valentino Ahlin1 jennyahlin@hotmail.com
Dilmar Pinto Guedes Junior3,2 ciadofisicodilmar@uol.com.br
Fabricio Madureira Barbosa3,4,5 shark@usp.br

ABSTRACT

Introduction: To investigate the effects of indoor cycling in body composition, lower limb muscular endurance, flexibility and daily activities in physically active elders. Materials and Methods: The sample consisted of ten volunteers (seven females and three males), with ages between 60 and 74 years old (64.6±5.1 years), who participated in an indoor cycling program during 12 weeks. Evaluated measures included body composition, lower limb muscular endurance, balance and daily activities, before and after training. Wilcoxon signed-rank and Student’s t-test were used for paired samples. Results: The tests of daily activities showed a significant improvement (p ≤ 0.05) in: getting up from the floor (-14.3%); total time for 800-meter walk (-13.5%); total time for climbing up stairs (-15.2%). Lower limb muscular endurance was increased by 23.7% and total time for the Stork (Balance) Standing test was increased in 59.3%. Other variables showed no significant improvements. Discussion: In spite of the limited sample size, indoor cycling showed positive results in the daily activities, muscular endurance and balance in physically active elders.

KEYWORDS

Bicycling; Aged; Muscular Strength; Pliability; Activities of Daily Living.

1 Universidade Metropolitana de Santos – UNIMES – Faculdade de Educação Física de Santos – FEFIS – Santos/SP – Brazil
2 Universidade Santa Cecilia – UNISANTA – FEFESP – São Paulo/SP – Brazil
3 Centro de Estudos de Fisiologia do Exercício – CEFE – São Paulo/SP – Brazil
4 Universidade Paulista – UNIP – Santos/SP – Brazil
5 Centro Universitário Monte Serrat – UNIMONTE – Santos/SP – Brazil
INTRODUCTION

The process of population aging has been happening in several countries of the world\(^1,5,6\), however in a really fast way in Brazil. The population census by the Instituto Brasileiro de Geografia e Estatística (IBGE) in 2007\(^3\) shows that Brazil has 183,987,291 inhabitants, but 16.7 million people have an age superior to 60 years old, representing about 9% of the whole population. Furthermore, there is an estimate that in 2020 Brazil will be the sixth developing country with more than 30 million elders.

The population aging phenomenon raises important questions from a personal and socioeconomic point of view. One of them is related to the possibility of living a healthy life cycle with quality, autonomy and independence\(^2,4,5\).

The increase of life expectancy provides people with a larger period of time to synthesize and culminate the realization of life projects\(^6\). In order for this to happen, however, it is necessary that aging be lived with quality\(^2,4,5\).

As aging is a natural and progressive process that happens to all human beings, it is defined as the sum of all biological, psychological and social alterations that, after reaching adult age and surpassing maximum performance age, lead to a gradual reduction of adaptation and psychophysical performance capacities of the subject\(^5\).

These effects can be delayed with regular physical activity practice, and the practitioner can obtain many benefits, such as the increase of social contacts, physical and emotional health improvement, reduced risk of chronic diseases, maintenance of the locomotor system\(^7,8\).
Furthermore, this practice can have many important effects in daily activities performance and in the independence and autonomy degree of the elderly. A study carried out with 16 elderly women showed improvements in the anthropometric variables, in the lower limbs strength, and decrease of the subcutaneous adipose tissue after 12 weeks of aerobe training and muscular strength.

In a review article published in 1999, it was concluded that through an appropriate physical exercises program, there is the possibility of changing many factors that occurred by the aging process, such as balance and flexibility, which are important factors for a better functional ability. The lower limbs strength is an influence factor in the static balance tests, besides being very important to maintain dynamic balance, to walk and to prevent falls.

Recently, there are many new modalities in gyms that are highly sought due to the several benefits they provide. Among them, it can be mentioned the indoor cycling, which is defined as an activity administered by a Physical Education professional for a group of subjects of diverse ages, genders and physical aptness, in a stationary bicycle, with variation of aerobe and anaerobe endurance training, with an optional musical rhythm to be followed.

Indoor cycling has arisen as a new alternative for aerobe activity inside gyms, by a continuous or interpolated training program, aiming at the maintenance and improvement of the cardiovascular system. According to Deschamps and Domingues Filho, the reasons that lead men and women to practice indoor cycling are: pleasure in physical activity, aesthetics, acquisition of a better physical conditioning and quality of life. Besides that, the indoor cycling practice is related to promotion and maintenance of physical and psychological well-being for providing a socialization and leisure moment, when a visualization technique to simulate a virtual road is used.

Cycling does not require very much from the locomotor and support system, since it is practiced seated and by statics slackness from the hip, knee and tarsus joints. Therefore, it is interesting for overweight subjects and those who present degenerations in these joints. Another advantage of indoor cycling is the fact that it is a kind of training that can be applied to people of different ages and conditioning levels, so it is only necessary to respect the biological individuality. Furthermore, for the elderly, aerobe physical activity with music is stimulative and promotes a better performance in tasks, which can be extended, because this age group tends to lose the exact notion of time, living a “shutdown” that amplifies pleasant sensations.

However, there are a few studies that investigate the effects of indoor cycling training in elderly. From the exposed, this study aimed at investigating the effects of indoor cycling in body composition, muscular endurance of lower limbs, balance, flexibility and daily activities in physically active elders.

MATERIALS AND METHODS

Sample
The sample was composed of ten volunteers (seven women and three men), with ages between 60 and 74 years old (64±5 years old) who practiced gymnastic for the third age three times a week for more than six months, i.e., who were classified as physically active.

For the development of this research, the following inclusion criteria were respected: a) age equal to or higher than 60 years old; b) regular practice of physical activity for at least six months; c) presentation of recent medical report; d) signature of the Informed Consent Form; e) approval from the Ethics and Research Committee from Universidade FEFIS-UNIMES, protocol 071/2008 UNIMES. The volunteers who presented some heart or pulmonary infirmity that could be aggravated with exercises practice, and those who had participation frequency inferior to 75% in the sessions were excluded.

Data collection
Volunteers underwent a battery of tests in two alternate days in the beginning, middle and end of the program. On day 1, anthropometric evaluations were carried out: weight, height, leg circumference, thigh, hip and abdomen and body mass index (BMI); muscle endurance evaluations located in lower limbs, constituted by the test which required sitting and standing up from the chair in 30 seconds; balance, with the “standing stork test” and flexibility, as the Wells bank test.

On day 2, daily life activity tests for the elderly were carried out: walking 800m, climbing the stairs, raising from the soil and putting on socks.

Procedures
The study lasted 12 weeks, and a 60-minute session was carried out twice a week. Classes took place in a climatized room, with room temperature of about 22°C, in stationary bicycles of the brand SCHWINN. In the first day of class, instructions about the bicycles and support system, since it is practiced seated and by statics slackness from the hip, knee and tarsus joints. Therefore, it is interesting for overweight subjects and those who present degenerations in these joints. Another advantage of indoor cycling is the fact that it is a kind of training that can be applied to people of different ages and conditioning levels, so it is only necessary to respect the biological individuality. Furthermore, for the elderly, aerobe physical activity with music is stimulative and promotes a better performance in tasks, which can be extended, because this age group tends to lose the exact notion of time, living a “shutdown” that amplifies pleasant sensations.

However, there are a few studies that investigate the effects of indoor cycling training in elderly. From the exposed, this study aimed at investigating the effects of indoor cycling in body composition, muscular endurance of lower limbs, balance, flexibility and daily activities in physically active elders.

MATERIALS AND METHODS

Sample
The sample was composed of ten volunteers (seven women and three men), with ages between 60 and 74 years old (64±5 years old) who practiced gymnastic for the third age three times a week for more than six months, i.e., who were classified as physically active.

For the development of this research, the following inclusion criteria were respected: a) age equal to or higher than 60 years old; b) regular practice of physical activity for at least six months; c) presentation of recent medical report; d) signature of the Informed Consent Form; e) approval from the Ethics and Research Committee from Universidade FEFIS-UNIMES, protocol 071/2008 UNIMES. The volunteers who presented some heart or pulmonary infirmity that could be aggravated with exercises practice, and those who had participation frequency inferior to 75% in the sessions were excluded.

Data collection
Volunteers underwent a battery of tests in two alternate days in the beginning, middle and end of the program. On day 1, anthropometric evaluations were carried out: weight, height, leg circumference, thigh, hip and abdomen and body mass index (BMI); muscle endurance evaluations located in lower limbs, constituted by the test which required sitting and standing up from the chair in 30 seconds; balance, with the “standing stork test” and flexibility, as the Wells bank test.

On day 2, daily life activity tests for the elderly were carried out: walking 800m, climbing the stairs, raising from the soil and putting on socks.

Procedures
The study lasted 12 weeks, and a 60-minute session was carried out twice a week. Classes took place in a climatized room, with room temperature of about 22°C, in stationary bicycles of the brand SCHWINN. In the first day of class, instructions about the bicycles and support system, since it is practiced seated and by statics slackness from the hip, knee and tarsus joints. Therefore, it is interesting for overweight subjects and those who present degenerations in these joints. Another advantage of indoor cycling is the fact that it is a kind of training that can be applied to people of different ages and conditioning levels, so it is only necessary to respect the biological individuality. Furthermore, for the elderly, aerobe physical activity with music is stimulative and promotes a better performance in tasks, which can be extended, because this age group tends to lose the exact notion of time, living a “shutdown” that amplifies pleasant sensations.
the program. On the second and third days, all the above-mentioned tests were effectuated.

During classes, the exercise intensity was controlled based on the Effort Subjective Perception BORG\textsuperscript{21} and OMNI\textsuperscript{22} scales, as well as frequencimeters of the Polar\textsuperscript{®} brand, F11 model. The training method used was intervals, in which the heart frequency (HF) should be maintained between 60 and 85% of the maximum HF, foreseen by the formula: $\text{HF}=(\text{HF}_{\text{rest}}+ \text{Effort \%} \cdot (220-\text{age}-\text{HF}_{\text{rest}}))$. Progressive loads cycles were used: light (OMNI 5; HF from 60 to 70% of the HF\textsubscript{max}), moderate (OMNI 7; HF from 70 to 80% of HF\textsubscript{max}) and strong (OMNI 8; HF from 80 to 85% from HF\textsubscript{max}).

During the first two weeks, the class was divided into 15 minutes of initial stretching outside of the indoor cycling classroom, 20 minutes of transition and bicycle adjustments and 20 minutes pedaling in the stationary bicycle, emphasizing perception and learning in quantification of different loads used. The duration time of the light, moderate and strong loads was, respectively, from three minutes, one minute and one minute, accomplishing fours series in each stage.

In the beginning of the second training month, volunteers already demonstrated domain in bicycle adjustments, which provided a reduction of ten minutes in the time spent to regulate the bicycle and an increase of 20 to 30 minutes pedaling. Training passed to five series with light, moderate and strong loads with durations of two minutes, two minutes and one minute, respectively.

In the third and last months, the stretching time decreased to five minutes and the pedaling time increased to 40 minutes. The light, moderate and strong loads had the following duration: 4 minutes and 30 seconds; 2 minutes and 30 seconds and 1 minute and 30 seconds.

The technique that was used to pedal in the stationary bicycle was seated with simulations of plane and slope places, when the bicycle’s load was altered. In this study, no overload with body weight sustainment was used over the pedal (to pedal on foot).

### Statistical procedure

To verify the presupposed normality in observations distribution between the several variables, the Shapiro’s Wilk statistical test was applied, verifying the quartiles graphic behavior.

The notes in the tests of rising and seating; of flexibility; abdominal, waist, hip, thigh and leg circumferences; and BMI presented normal distribution. Thus, the mean and standard deviation were used as means of central tendency and dispersion measure, respectively. On the other hand, the notes in the tests of body mass, getting up from the floor, waist-hip ratio, balance, walking, getting up from stairs and putting on socks did not present a close to normal distribution. Therefore, the median and the interquartile interval were calculated to estimate the central tendency and dispersion values, respectively. In order to verify the significance of the difference between pre- and post-training in the variables with normal distribution, the Wilcoxon’s statistical test was applied for the variables that did not follow normal distribution. Besides the punctual estimates, the confidence interval was calculated, with confidence coefficient defined in 95%, as uncertain measure in respect to the alterations observed in the median and mean. Statistical significance of $p<0.05$ was adopted.

### RESULTS

In Table 1, in which results concerning anthropometric variables are presented, it can be seen that although the indoor cycling program proposed for the studied group has not provided any statistically significant change, there was a reduction in the variables: body mass, BMI, abdomen and waist circumference and waist-hip ratio.

In the same table, it is verified that leg, thigh and hip circumferences had a descriptive increase, but not statistically significant.

In Table 2, by the observation of the results that concern the neuromuscular variables, a mean increase of 29.3% in flexibility is seen, a non-significant statistically value. However, observing the confidence interval, it is verified that one of the analyzed subjects obtained an improvement of 93.2%. The hypothesis for this variable not presenting statistically significant improvement is that the development and improvement of the variable “flexibility” were not objectives of the study, since stretching exercises were proposed as warm-up and relaxing, and there was not a height variation of the bicycle’s saddle and handlebar, which perhaps may provide a higher increase of flexibility.

For the statically balance test – standing stork test – there was a statistically significant improvement of 59.3%. In the lower limbs located muscular endurance test (sitting and standing up from a chair in 30 seconds), a significant improvement of 23.7% was observed, representing an increase of about three repetitions. This datum is very important, because an increase of the muscular endurance of lower limbs can promote more efficacies in many daily activities (Table 2).

In Table 3, in which the results related to daily activities are presented, it is observed that, from the four analyzed variables, only one did not present statistically significant improvements: putting on socks.
DISCUSSION

Balance is associated with several factors, among them, lower limbs strength, a factor many times determinant in static balance tests. The body’s stability depends on the appropriate reception of sensorial, cognitive (orientation of the transient space; memory; calculus capacity; planning and decision capacity; language), central integrative (cerebellum) and musculoskeletal components, in a highly integrated manner.

A study carried out in 2004 concluded that a physical activity program, involving aerobic and lower limb exercises, was efficient to improve the torque of extensor knee muscles, the balance and quality of life of osteoporotic women.

In indoor cycling, the subject uses mainly the musculature of lower limbs with overloads; therefore, the improvement in the balance test is probably related to this factor.

The fall, defined as the non-intentional dislocation of the body to a level that is inferior to the initial position with correction incapacity in apt and determined time for multifactorial circumstances that comprise stability, can be considered one potential marker of the functions’ decline or a new pathology symptom in elderly people. Its number increases progressively with age in both sexes and in all ethnical and racial groups. It is estimated that 75 to 84-year-old elders who need help in daily activities (to eat, take a shower, intimate hygiene, to dress, to leave bed) have a 14 times higher probability of falling, compared to people of the same age independently, and about 5% of the falls result in fractures.

For the putting on socks test, there was no statistically significant difference between the pre and post. The hypothesis is that lumbar column flexibility and of the thigh’s posterior muscles might have influenced this.

### Table 1 - Comparative table of results before and after 12 weeks of training in indoor cycling for the anthropometric variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre</th>
<th>Post</th>
<th>Δ_abs</th>
<th>Δ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM (kg)*</td>
<td>70.75 (13.65)</td>
<td>69.80 (14.33)</td>
<td>-0.30 [-1.10; 0.50]</td>
<td>-0.4 [-1.7; 0.6]</td>
</tr>
<tr>
<td>BMI (kg.m⁻²)**</td>
<td>29.01 (6.44)</td>
<td>28.88 (6.45)</td>
<td>-0.13 [-5.13; 4.87]</td>
<td>-0.5 [-15.6; 17.3]</td>
</tr>
<tr>
<td>LG (cm)**</td>
<td>35.25 (3.84)</td>
<td>36.69 (3.83)</td>
<td>1.44 [-1.53; 4.41]</td>
<td>4.1 [-4.3; 13.3]</td>
</tr>
<tr>
<td>ABC (cm)**</td>
<td>98.58 (12.37)</td>
<td>97.66 (14.18)</td>
<td>-0.92 [-11.25; 9.41]</td>
<td>-1.2 [-10.8; 9.5]</td>
</tr>
<tr>
<td>TC (cm)**</td>
<td>51.07 (5.55)</td>
<td>53.1 (7.61)</td>
<td>2.03 [-3.16; 7.22]</td>
<td>3.6 [-6.1; 14.3]</td>
</tr>
<tr>
<td>HC (cm)**</td>
<td>102.04 (11.32)</td>
<td>103.11 (12.80)</td>
<td>1.07 [-3.81; 10.45]</td>
<td>0.97 [-7.8; 10.5]</td>
</tr>
<tr>
<td>WC (cm)**</td>
<td>91.66 (12.23)</td>
<td>84.09 (18.17)</td>
<td>-7.57 [-20.42; 5.59]</td>
<td>-10.0 [-24.2; 6.9]</td>
</tr>
<tr>
<td>WHR*</td>
<td>0.88 (0.04)</td>
<td>0.87 (0.04)</td>
<td>-0.02 [-0.05; 0.02]</td>
<td>-1.7 [-7.1; 1.2]</td>
</tr>
</tbody>
</table>

*Mean (standard deviation); **Median (interquartile interval).

The fall, defined as the non-intentional dislocation of the body to a level that is inferior to the initial position with correction incapacity in apt and determined time for multifactorial circumstances that comprise stability, can be considered one potential marker of the functions’ decline or a new pathology symptom in elderly people. Its number increases progressively with age in both sexes and in all ethnical and racial groups. It is estimated that 75 to 84-year-old elders who need help in daily activities (to eat, take a shower, intimate hygiene, to dress, to leave bed) have a 14 times higher probability of falling, compared to people of the same age independently, and about 5% of the falls result in fractures.

For the putting on socks test, there was no statistically significant difference between the pre and post. The hypothesis is that lumbar column flexibility and of the thigh’s posterior muscles might have influenced this.

### Table 2 - Comparative table of results before and after 12 weeks of training in indoor cycling for the neuromuscular variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre</th>
<th>Post</th>
<th>Δ_abs</th>
<th>Δ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLEX (cm)**</td>
<td>18.90 (8.81)</td>
<td>22.80 (8.25)</td>
<td>3.90 [-2.72; 10.52]</td>
<td>29.3 [-13.5; 93.2]</td>
</tr>
<tr>
<td>BAL (s)*</td>
<td>1.63 (0.74)</td>
<td>2.50 (0.62)</td>
<td>0.88 [0.37; 1.40]</td>
<td>59.3 [22.7; 111.9]</td>
</tr>
<tr>
<td>L. Seat (rep)**</td>
<td>13.00 (2.45)</td>
<td>15.90 (1.66)</td>
<td>2.90 [1.26; 4.54]</td>
<td>23.7 [9.3; 40.1]</td>
</tr>
</tbody>
</table>

*Mean (standard deviation); **Median (interquartile interval).

### Table 3 - Comparative table of results before and after 12 weeks of training in indoor cycling for the daily activities

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre</th>
<th>Post</th>
<th>Δ_abs</th>
<th>Δ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. Soil (s)*</td>
<td>3.04 (1.56)</td>
<td>2.83 (1.22)</td>
<td>-0.36 [-1.01; -0.05]</td>
<td>-14.3 [-28.1; -4.3]</td>
</tr>
<tr>
<td>W800 (s)*</td>
<td>555 (115)</td>
<td>490 (139)</td>
<td>-79.0 [-184.0; -17.5]</td>
<td>-13.5 [-24.4; -3.3]</td>
</tr>
<tr>
<td>R. Stair (s)*</td>
<td>5.56 (1.00)</td>
<td>5.11 (1.13)</td>
<td>-0.48 [-1.21; 0.08]</td>
<td>-15.2 [-18.7; -9.1]</td>
</tr>
<tr>
<td>SOCKS (s)*</td>
<td>4.97 (1.14)</td>
<td>4.44 (1.30)</td>
<td>-0.5 [0.7; 0.97]</td>
<td>-0.3 [-15.2; -28.0]</td>
</tr>
</tbody>
</table>

*Mean (standard deviation).

The fall, defined as the non-intentional dislocation of the body to a level that is inferior to the initial position with correction incapacity in apt and determined time for multifactorial circumstances that comprise stability, can be considered one potential marker of the functions’ decline or a new pathology symptom in elderly people. Its number increases progressively with age in both sexes and in all ethnical and racial groups. It is estimated that 75 to 84-year-old elders who need help in daily activities (to eat, take a shower, intimate hygiene, to dress, to leave bed) have a 14 times higher probability of falling, compared to people of the same age independently, and about 5% of the falls result in fractures.

For the putting on socks test, there was no statistically significant difference between the pre and post. The hypothesis is that lumbar column flexibility and of the thigh’s posterior muscles might have influenced this.

*Mean (standard deviation).

FLEX: flexibility; L. Seat: raise and seat; R. Stair: raise stairs; SOCKS: put on socks. Δ_abs: absolute alteration; Δ %: percentage alteration.

# Indicates statistically significant difference between before and after p ≤ 0.05.
test, since tasks such as this — putting on shoes or getting down to catch an object —, involve an aptness that, as previously discussed, was not a priority in this study.

The daily life activity tests are important to evaluate functional ability of elderly. The test “walking 800m” simulates routine activities, as going to the supermarket, visiting a relative or going out. The test “going up the stairs” simulates activities as going up the steps from the bus and from stairs, and the test “raising from the floor” simulates a change from lay down position to be on foot, generally noticed when the subject gets up from the bed. With a 13.5% improvement in the first mentioned test, 15.2% in the second and 14.3% in the third, it can be discussed the possibility that indoor cycling, as other modalities, can maintain a level of appropriate functional capacity, which is of fundamental importance to maintain quality of life.

Changes in physiological systems (somatosensorial, vestibular and visual) related to aging contribute to the maintenance of aged balance. These changes, with muscular and bony alterations, concur with the increase of falls risk between population. The practice of regular exercises can serve as a prevention against falls and fractures related to them.

The study concluded that 12 training weeks of indoor cycling were enough to cause adaptations and improvements in balance and routine activities: raising from the floor, putting on shoes and walking 800m. This modality can be, therefore, an efficient and safe alternative to minimize the negative effects of aging and to potentiate the functional capacities of the elderly, collaborating to the independence and, consequently, the quality of life of this population.

It is important that future controlled and randomized researches try to investigate the same or different effects of indoor cycling training in the elderly.

REFERENCES