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ORIGINAL ARTICLE

Cardiovascular benefits independent of body mass loss in overweight individuals after exercise program

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Abstract

The purpose of this study was to analyze the changes which occurred after a supervised aerobic exercise program in the blood pressure (BP), cardiorespiratory fitness and body mass in overweight individuals. Sixty-one individuals (65.6 ± 6.5 years, 31.16 ± 4.76 kg/m^2) performed an exercise program consisting of 1 h sessions of aerobic exercises, three times/week for 6 months. Resting systolic and diastolic BP, cardiorespiratory fitness [6-min walk test (6MWT)] and body mass were measured three times; at baseline (T0), after 3 months (T1) and after 6 months (T2). Results showed significant ($p < 0.05$) changes in systolic BP, diastolic BP and the 6MWT at T2. Small and statistically no significant changes were observed in body mass. Greater significant changes were observed in BP measures and the 6MWT at T1 compared to measurements at T2. A significant relationship between changes in resting systolic BP and diastolic BP ($r = 0.47$) was found but not between changes in other variables. It could be concluded that a 6-month exercise program based on aerobic exercise has beneficial effects on cardiovascular risk factors regardless of body mass loss. These findings highlight the importance of lifestyle interventions focusing on increasing physical activity rather than focusing on body mass loss alone.

Keywords Exercise program · Physical activity · Cardiovascular benefits · Obesity · Body mass loss

Introduction

Non-communicable diseases are the leading cause of global mortality and along obesity place a significant burden on society. However, risk factors related to these diseases such insufficient physical activity could be prevented [1]. Wide evidence supports the beneficial impact of physical activity against chronic diseases such as cardiovascular disease, stroke, hypertension, colon and breast cancer, and type 2 diabetes [2]. In addition, physical activity increases energy expenditure and stimulates lipolysis, reducing fat mass and/or increasing lean tissue mass, which is of great importance in the prevention and management of obesity [3].

Despite the fact that obesity prevention strategies and health promotion interventions often encourage participation in physical activity [4] supervised exercise programs seldom achieve significant long-term body mass loss [5]. The current recommendations of 150 min/week of moderate physical activity may control body mass or assist on maintenance of body mass loss [6, 7]. However, changes in body mass and body composition without a reduction in calorie intake seem to be minimal at this exercise volume and intensity [8, 9]. Nevertheless, emerging evidence supports the belief that an increase in physical activity can reduce the risk of obesity-related comorbidities and improve risk factors related to obesity regardless of minimal or no body mass loss [6, 8].

Among others, these risk factors include reductions in resting systolic and diastolic BP [5, 10–12] and improvements in cardiorespiratory fitness [13, 14] both highly important cardiovascular risk factors and related not only with obesity but with the decrease and improvement of many other chronic disorders [3].

In the same direction, Heitmann et al. [15] suggested that body mass index (BMI) is related with increased mortality in sedentary individuals but not in active individuals meaning that physical activity may modify the health risk of BMI. For this reason, it seems important to examine not only body mass changes but also other adaptations provoked by

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lifestyle changes when assessing the effectiveness of different interventions targeted to overweight or obese individuals [5].

Therefore, the purpose of this study was to analyze the changes occurred after a 6-month exercise program in the cardiovascular parameters, such as BP and cardiorespiratory fitness, and in the body mass, in overweight individuals, using easy, rapid, inexpensive and unintrusive methods with the objective of ensuring appropriate prescription, follow-up and individualization of exercise by any physical activity professional working in public sport facilities which usually exhibit large group sizes and sparse budget.

Methods

Participants

Participants were recruited from a therapeutic exercise health program publicly supported by the city council designed to improve different chronic disorders. Sixty-one individuals above 55 years of age (65.6 ± 6.5 years, 57% women and 43% men, 31.16 ± 4.76 kg/m^2) were selected to participate in this study. Inclusion criteria included overweight or moderate obesity (BMI 25–40 kg/m^2) and an individual assessment by the sports doctor responsible for the program. Exclusion criteria included recent myocardial infarction or any severe cardiovascular disease, morbid obesity, severe physical handicap, uncontrolled hypertension, type 1 diabetes or uncontrolled type 2 diabetes and psychiatric disorders or inability to collaborate.

Experimental design

The total length of the program was 6 months. All measurements were performed three times; at baseline (T0), after 3 months (T1) and at the end of the program, at 6 months (T2). The measurements included body anthropometric measures (height, body mass, BMI), resting systolic and diastolic BP and cardiorespiratory fitness which were all undertaken by the same trained nurse and physical activity professionals. The instruments for measurement were chosen taking into account cost and feasibility, considering the program's public and large sample size characteristics. Participants were instructed to continue with their usual diet and medication intake. For data analysis and comparison purposes, groups according to sex (women/men), age (≤ 65 years/>65 years) and BMI [overweight (BMI 25–30 kg/m^2)/obese (BMI ≥ 30 kg/m^2)] were created. In addition, to ensure that the physiological changes observed were reflective of the exercise volume, only data of participants with > 70% adherence were analyzed.

Anthropometry

Measurements were conducted with participants wearing light clothing and no shoes. Body mass (kg) was measured to the nearest 0.1 kg (Digital SECA scale, Germany) and height (cm) to the nearest 0.5 cm (SECA stadiometer, Germany). BMI was calculated as body mass (kg) divided by the square of height (m^2).

Blood pressure

Both resting systolic and diastolic BP were measured at the same time and place by the same trained nurse in seated position at rest using a digital electronic tensiometer (OMROM, Japan).

Cardiorespiratory fitness

Cardiorespiratory fitness was assessed by the 6-min walk test (6MWT) which consists in walking around a course covering as much distance as possible in 6 min. This test is believed to be a good indicator of aerobic endurance in young and older adults and appropriate for detecting intervention induced changes both in healthy individuals and in patients with different disorders [16].

Exercise program

The exercise program consisted in 1 h sessions performed three times a week for 6 months. The sessions included a warm-up (10′) with stretching and mobility exercises, a main part (40′) of moderate aerobic exercise and a cool down (10′) with stretching and relaxation exercises. The main part consisted in stationary bike (25′) and an aerobic circuit (15′) that included upper and lower body movements simultaneously. Intensity of the sessions was monitored by a heart rate monitor (Polar FT7M, Finland) set between 40–60% of the heart rate reserve (HRR) of each individual, as recommended by the ACSM exercise prescription guidelines for overweight and obese individuals, and calculated following the Karvonen's formula [Target HR = $((HR_{max} - HR_{rest}) \times \%\ \text{intensity}) + HR_{rest}$] for estimating exercise intensity using heart rate [17]. In the initial 4 weeks, participants exercised at 40% HRR and were familiarized with the execution of the different exercises involved in the program. After this adaptation and learning phase, intensity was increased 5% every 4 weeks and the execution difficulty and number of exercises were also augmented. In the last part of the program (8 weeks), participants exercised at 60% HRR. All sessions were supervised by physical activity professionals who ensured

appropriate intensity, progression and individualization of the exercises.

Statistical analysis

Data analysis was performed using IBM Statistical Package for Social Sciences (SPSS-21.0). The normal distribution of the variables was tested using the Kolmogorov–Smirnov test. Most variables did not have a normal distribution, thus, non-parametric tests were used for analysis. Data are presented as mean, standard deviations and percentage of changes between T0–T1, T1–T2 and T0–T2. Changes in physical measures along the program were analyzed using Friedman's ANOVA. Wilcoxon's signed rank test was used to follow-up significant ANOVAs, performing pairwise comparison between T0–T1 and T0–T2. Effect size was measured by Cohen's *d* to assess if changes were large (0.8), medium (0.5) or small (0.2) [18]. Differences in changes between groups (sex, age, BMI) were analyzed using Mann–Whitney's test. Spearman's correlation coefficient was used to examine the relationship between changes in body mass, systolic and diastolic BP and the 6MWT. In all cases, statistical significance was established at $p < 0.05$.

Results

Table 1 illustrates changes from baseline (T0) to post-exercise (T1 and T2) for anthropometric measures, systolic and diastolic BP and the 6MWT. Significant ($p < 0.05$) changes were observed in all variables at the end of the program. However, when following up these findings performing pairwise comparisons between T0–T1 and T0–T2, significant changes were observed only in systolic, diastolic BP and the 6MWT at T1 and T2. On the other hand, the changes observed in body mass and BMI did not reach statistical significance in neither T1 nor T2.

The significant changes at the end of the program showed small effect sizes in systolic BP (0.18) and small-medium effect sizes (0.30) in diastolic BP and the 6MWT.

Examining the percentage of changes (Table 2), greater significant ($p < 0.05$) changes were observed in BP measures and in the 6MWT between T0–T1 if compared to measurements between T1–T2. A similar trend was observed in body mass but it did not reach statistical significance.

Analyses of changes along the program for different subgroups (Table 3) revealed significant ($p < 0.05$) changes in anthropometric measures only in women and participants aged ≤ 65. However, very small effect sizes (< 0.05) were observed in all subgroups in both body mass and BMI. Regarding systolic BP, even though only overweight individuals showed significant ($p < 0.05$) decreases along the program, men, obese, and individuals > 65 years of

Table 1 Changes in anthropometric measures, blood pressure and the 6-min walk test (6MWT) along the program

	T0	T1	T2	X^2_F	*d*
Body mass (kg)	81.56 ± 14.34	81.28 ± 14.28	81.13 ± 14.10	< 0.05	0.02
BMI (kg/m^2)	31.16 ± 4.76	31.05 ± 4.69	31.00 ± 4.65	< 0.05	0.03
Systolic BP (mm Hg)	154 ± 16	149 ± 15*	149 ± 17*	< 0.05	0.18
Diastolic BP (mm Hg)	87 ± 9	83 ± 8**	83 ± 9**	< 0.05	0.30
6MWT (m)	476 ± 62	496 ± 61**	502 ± 65**	< 0.001	− 0.30

Data are presented as mean values and standard deviations

T0, baseline; T1, 3 months; T2, 6 months; X^2_F Friedman's ANOVA; *d* Cohen's *d* between T0–T2

*$p < 0.05$ significant differences compared to T0 (Wilcoxon's signed rank test)

**$p < 0.001$ significant differences compared to T0 (Wilcoxon's signed rank test)

Table 2 Percentage of changes of measures at different moments of the program

	% change T0–T1	% change T1–T2	% change T0–T2	*p* value
Body mass	− 0.34 ± 1.73	− 0.16 ± 1.58	− 0.49 ± 2.50	0.48
BMI	− 0.34 ± 1.73	− 0.16 ± 1.58	− 0.49 ± 2.50	0.48
Systolic BP	− 3.00 ± 7.39	0.86 ± 10.08	− 2.44 ± 9.94	0.02*
Diastolic BP	− 3.62 ± 8.13	0.04 ± 10.26	− 3.84 ± 10.43	0.03*
6MWT	4.84 ± 8.92	1.33 ± 5.78	6.12 ± 9.67	0.01*

Data are presented as mean values and standard deviations

*$p < 0.05$ significant differences in % changes between T0–T1and T1–T2 (Wilcoxon's signed rank test)

Table 3 Changes in anthropometric measures, blood pressure and the 6-min walk test (6MWT) along the program according to sex, age and body mass index

	Sex				Age				BMI			
	Women ($n=35$)		Men ($n=26$)		≤65 years ($n=31$)		>65 years ($n=30$)		Overweight ($n=33$)		Obese ($n=28$)	
	X^2_F	d	X^2_F	d	X^2_F	d	X^2_F	d	X^2_F	d	X^2_F	d
Body mass	<0.05*	0.04	0.27	0.03	<0.05*	0.04	0.27	0.02	0.1	0.05	0.11	0.04
BMI	<0.05*	0.04	0.27	0.03	<0.05*	0.04	0.27	0.02	0.1	0.05	0.11	0.04
Systolic BP	0.07	0.13	0.11	0.44	0.08	0.17	0.4	0.43	<0.05*	0.22	0.53	0.34
Diastolic BP	<0.05*	0.44	<0.05*	0.53	<0.05*	0.5	0.12	0.42	0.19	0.25	<0.05*	0.55
6MWT	<0.001*	−0.38	<0.001*	−0.51	<0.05*	−0.43	<0.001*	−0.43	<0.001*	−0.52	<0.05*	−0.32

X^2_F Friedman's ANOVA, *$p<0.05$ significant changes along the program, d Cohen's d (effect size) between T0–T2 (Wilcoxon's signed rank test)

Table 4 Percentage of changes of measures at the end of the program (T0–T2) according to sex, age and body mass index (BMI)

	Sex			Age			BMI		
	Women ($n=35$)	Men ($n=26$)	p value	≤65 years ($n=31$)	>65 years ($n=30$)	p value	Overweight ($n=33$)	Obese ($n=28$)	p value
Body mass	−0.54 ± 2.58	−0.43 ± 2.44	0.94	−0.74 ± 2.83	−0.24 ± 2.13	0.68	−0.54 ± 2.27	−0.44 ± 2.79	0.81
BMI	−0.54 ± 2.58	−0.43 ± 2.44	0.94	−0.74 ± 2.83	−0.24 ± 12.13	0.68	−0.54 ± 2.27	−0.44 ± 2.79	0.81
Systolic BP	−0.70 ± 10.69	4.08 ± 8.45	0.11	−1.83 ± 9.29	−3.08 ± 10.68	0.51	−2.37 ± 10.49	−2.53 ± 9.43	0.80
Diastolic BP	−3.11 ± 11.50	−4.82 ± 8.92	0.38	−3.82 ± 10.57	−3.86 ± 10.47	0.89	−2.49 ± 9.77	−5.43 ± 11.13	0.34
6MWT	5.28 ± 8.15	7.26 ± 11.48	0.51	6.09 ± 10.28	6.16 ± 9.17	0.98	6.40 ± 8.01	5.81 ± 4.76	0.73

Data are presented as mean values and standard deviations

$p<0.05$ significant differences in percentage of changes between groups (Mann–Whitney's test)

Table 5 Relationship between percentage of changes

	Body mass	Diastolic BP	6MWT
Systolic BP	$r_s=0.14$	$r_s=0.47$**	$r_s=0.07$
Diastolic BP	$r_s=0.17$	–	$r_s=-0.11$
6MWT	$r_s=0.08$	–	–

r_s Spearman's correlation coefficient, **$p<0.001$ significant correlation

age showed small to medium effect sizes (0.22–0.44). Similarly, all subgroups except overweight and individuals > 65 years of age showed statistically significant decreases in diastolic BP along the program but small to medium effect sizes (0.25–0.55) were observed in all subgroups. All subgroups increased significantly the score in the 6MWT with small to medium effect sizes (0.32–0.52).

As shown in Table 4, no significant differences in percentage of changes were found at the end of the program (T0–T2) between women or men, between different age groups (≤65/>65 years) or BMI groups (overweight vs. obese).

A significant ($p<0.05$) relationship between changes in resting systolic BP and diastolic BP ($r=0.47$) was found but not between changes in other variables (Table 5).

Discussion

The aim of this study was to analyze the changes occurred in cardiovascular parameters (BP and cardiorespiratory fitness) and body mass in overweight individuals after a 6-month aerobic exercise program performed three times a week. The main results from our study show that improvements in cardiovascular parameters were achieved without body mass loss. In particular, resting systolic BP was decreased by 2.5% (5 mmHg), diastolic BP by 4% (4 mmHg) and the 6MWT was improved by more than 6% (26 m). Small reductions on body mass were observed but not statistically significant.

In regard of BP, our findings are in agreement with reviews which described reductions of 3–8 mmHg in systolic BP and 2–6 mmHg in diastolic BP [19]. In more detail, Paoli et al. [11] and Skrypnik et al. [20] observed reductions of 5–7 mmHg in systolic BP and decreases of 3–5 mmHg in diastolic BP after aerobic exercise interventions performed 3 days a week for 3 months and at a similar intensity to our

program (40–60% HRR). In accordance, in our program, the greatest changes in BP were also observed after 3 months. Surprisingly, even 1 month moderate (65% VO_{2max}) aerobic exercise interventions performed three times a week for only 30 min a day, have induced significant reductions (3–4 mmHg) in both systolic and diastolic BP [21]. This could be explained by the fact that the aerobic exercise was performed in a treadmill which could have guaranteed a strict supervision by professionals and therefore an appropriate and constant intensity control. This rigorous protocol and expensive intervention due to the cost of equipment, may be feasible with their small sample size ($n = 30$), however, it is not considered viable for larger, community-based intervention programs where budget could be an issue.

On the other hand, low-intensity aerobic exercise (33% HRR) performed 3 days a week for 2.5 months induced slightly smaller reductions (4 mmHg) in systolic BP compared to our study [10]. However, these authors observed higher decreases in systolic BP (6 mmHg) in the high-intensity (66% HRR) group compared to their low-intensity group. In the same line, Nemoto et al. [22] reported smaller reductions than in our program in systolic and diastolic BP (3 and 2 mmHg, respectively) in the moderate-intensity continuous walking group but significantly higher reductions (9 and 5 mmHg, respectively) in the high-intensity interval walking group, after a 5-month walking program performed 4 days a week. These results suggest that exercise intensity might play a more important role than duration or frequency in the beneficial impact of exercise in BP. This could highlight the importance of supervised programs, as non-supervised programs might not reach desirable intensities to induce changes in BP due to the difficulty for the individuals to control and regulate exercise intensity on their own. Nevertheless, an unsupervised pedometer-based walking program where participants walked 10.000 steps daily for 6 months [12] similar decreases to our intervention in systolic (5 mmHg) and diastolic BP (4 mm Hg), which highlights the fact that simple and inexpensive programs can still have a favorable impact on the health status of individuals.

In terms of sex differences, a lower effect of exercise in BP has been suggested in women [19] and greater BP reductions have been observed in men after dynamic endurance training [10]. In our study, greater effect sizes were observed in systolic BP in men (0.44) and individuals > 65 years of age (0.43) compared to women (0.13) and individuals ≤ 65 years of age (0.17). However, as other studies have described [23–25], these differences between sex and age groups were not observed in diastolic BP. In addition, no differences in percentage of changes were observed between subgroups in any of the variables. As the ACSM [17] has stated, minor reductions of 2 mmHg have the potential of considerably reducing the risk of stroke and of coronary artery disease in addition to decreasing risk of cardiovascular mortality and all-cause mortality [26]. Therefore, our findings have relevant implications in the health status of subjects with hypertension.

Regarding cardiorespiratory fitness, improvements of around 26 m (6%) were observed in the 6MWT. These results are in line with improvements observed in other exercise interventions (4.5–6%) following 6- [27], 9- [14] and 12-month programs [28]. Conversely, other investigators have reported more pronounced increases of 10.5% [29] and 13.4% [30] after even shorter interventions, 3 months and 9 weeks, respectively, possibly explained by a higher exercise intensity (50–70% HRR) in the former study [29] or the combination of endurance and resistance training in the latter study [30]. A lower baseline physical fitness of the participants could have also explained these greater increases.

Even though light to moderate exercise might be appropriate for deconditioned patients, moderate to vigorous exercise is recommended to improve cardiorespiratory fitness in healthier individuals [17]. In accordance to this notion, Nemoto et al. [22] observed significant changes in cardiorespiratoy fitness after a high-intensity walking intervention but the moderate continuous walking group from the same intervention did not achieve significant improvements. Similarly, Soroush et al. [12] did not observe significant changes in the 6MWT after an unsupervised pedometer-based walking intervention, underlining the importance of intensity in the achievement of significant cardiorespiratory fitness improvements when performing aerobic exercise and in consequence the value of professional supervision to ensure the aforementioned appropriate intensity. Nevertheless, increases in 6MWT distance of 20 m have been related to small meaningful clinical changes and increases of 50 m related to moderate improvements in healthy older adults [31]. However, others have claimed an increase in 6MWT distance of more than 50 m as clinically meaningful in individuals with some sort of disease [32]. As other authors have reported [20, 29, 30] in our study, improvements in cardiorespiratory fitness were already apparent at 3 months, emphasizing the short-term benefits of physical activity and the effective impact of supervised and individualized exercise.

Regarding body mass, reductions of 0.4 kg (0.5%) were observed in our study. In contrast, other authors observed reductions of 1.5–1.75 kg after similar intensity programs performed 120 min a week but 8 weeks longer in duration (8 months) [33–35]. In the same line, several aerobic exercise interventions performed at the same frequency (3 days/week) and duration (6 months) [36] and even with a shorter duration (3 months) [11, 20] reported greater reductions in body mass ranging from 3.2 to 2.2 kg. This disparity could be due to differences in intensity considering the aforementioned interventions performed the aerobic exercise at a higher intensity than ours (50–80 vs. 40–60% HRR).

In contrast, Park et al. [37] reported even greater decreases in body mass (4.7 kg) after a 6-month moderate aerobic exercise program. This discrepancy could be explained by the greater frequency of the program which was performed 6 days a week. However, Davidson et al. [38] observed smaller decreases (2.7 kg) after a 5 day a week intervention performed at the same intensity and duration. These results are comparable to the ones observed in interventions performed three times a week, suggesting that intensity may play a more important role than exercise frequency in body mass loss.

Similar to our results, other authors also observed small changes in body mass (0.8 kg) after an even longer aerobic exercise intervention (9 months) possibly due to energy expenditure compensation or an increase in lean mass induced by exercise [34]. Furthermore, inter-individual variation in body mass loss seems to be a fundamental factor to be considered, as the analysis of the group mean body mass loss could lead to incorrect conclusions since it does not account for individual metabolic and behavioral compensatory mechanisms such as changes in non-exercise activity among others [39]. In the same line, Swift et al. [40] observed that despite the fact that moderate aerobic exercise programs could induce modest body mass loss up to 2 kg, individual body mass loss levels were found to be considerably heterogeneous.

Several authors support the fact that moderate physical activity might be appropriate for body mass control or maintenance of body mass loss [6, 7] which could be of great importance for individuals with difficulties exercising at high intensities. However, the effectiveness of physical activity in body mass loss is believed to be weak [41].

There is wide evidence that supports the association between body mass loss and reductions in BP in normotensive and hypertensive individuals [42] and also in non-obese and obese subjects [43]. However, in our intervention, this association was not observed. Interestingly, Winnicki et al. [42] described that the association between body mass reduction and consequent decline in BP was not linear, meaning that the dose–response association between these two variables was solely noticeable up to 13% of initial body mass loss. In the same way, important improvements in key risk factors associated with obesity including cardiovascular fitness and insulin sensitivity have also been observed with minor or no body mass loss [6, 9, 13]. Interestingly, some authors have suggested that fitness could counteract the negative effects of fatness [44] and that fitness is a more important factor than BMI when assessing mortality risk [45].

For this reason, it seems essential to tackle the development of chronic disorders and obesity through lifestyle interventions focused on increasing physical activity and improving diet rather than focusing on body mass loss alone [5, 46]. This seems to be an important public health message especially for individuals who are not capable of losing body mass or maintaining body mass loss, as they can still benefit from health improvements by performing regular physical activity [45].

A relationship between resting systolic and diastolic BP changes were also found among our participants. In agreement, similar results have been reported by others showing decreases in both systolic and diastolic BP after exercise [47]. A review by Cornelissen et al. [10] also showed reductions in both systolic and diastolic BP after endurance and resistance training but surprisingly combined training only showed to reduce diastolic BP.

Limitations

There are several limitations in this study that need to be considered. Our sample comprised overweight and obese individuals over 55 years of age; therefore, the extrapolation of the findings to a specific disorder group or other age group should be made with caution. In addition, the absence of a control group, the lack of randomization and the lack of medication and dietary monitoring hampered the possibility of controlling for possible bias and confounders. Nevertheless, it should be taken into account that in studies including individuals under free-living conditions, it might be unfeasible to isolate participants from a control group or to monitor subject's behavior out of the intervention [48]. It is also important to consider the pragmatic design of this community-based program, as it was intended to reach as many individuals as possible in a real-life setting and thus the ethical reservations of leaving subjects out of the intervention by requiring a control group. At the beginning of the program participants were advised not to change their medication and dietary habits. However, changes in the medication and energy intake of the subjects during the program were not monitored, and thus, it is difficult to determine whether these alterations occurred. Therefore, future research should account for dietary and medication modifications and also consider the inclusion of a control group to ascertain that physiological improvements are only attributable to physical activity.

Conclusion

It could be concluded that an exercise program based on moderate aerobic exercise, with sessions of 1 h performed three times a week over a 6-month period, has beneficial effects on cardiovascular risk factors such as systolic and diastolic resting BP and the 6MWT regardless of body mass loss in overweight and obese individuals. It is important to underline that these improvements were observed even after

only 3 months, underlining the short-term effectiveness of physical activity. Nevertheless, the greater changes observed in participants after 6 months confirm the dose–response association between physical activity and different health-related variables. These results emphasize the highly beneficial effects of physical activity regardless of body mass loss and the importance of tackling obesity through lifestyle interventions focused on increasing physical activity rather than focusing on body mass loss alone. In addition, this study offers insight into the development of physical activity interventions as it presents feasible and uncomplicated instruments to measure health-related cardiovascular factors to facilitate the prescription and individualization of exercise by physical activity professionals in public sport facilities.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This study complies with the ethical standards of the Ethics Committee of the University of the Basque Country on Research on Human subjects and performed according to the ethical standards of the 1964 Helsinki Declaration.

Informed consent Informed consent was obtained from all individual participants included in the study.

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