

# The effects of health interventions on dietary habits and physical measurements

EFEITOS DE INTERVENÇÕES EM SAÚDE SOBRE OS HÁBITOS ALIMENTARES E MEDIDAS FÍSICAS

EFFECTOS DE INTERVENCIONES EN SALUD SOBRE HÁBITOS ALIMENTARIOS Y MEDIDAS FÍSICAS

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## ABSTRACT

The objective of this study was to determine the effects of health interventions on dietary habits and physical measurements. This quasi-experimental intervention study was performed with health service clients. The individuals' dietary habits, anthropometric measurements and blood pressure (BP) were obtained and measured, and a Food Frequency Questionnaire was administered upon their enrolment in the service. Interventions included physical activity, nutritional education groups, and individual nutritional counseling. Effects were measured by repeating physical measurements and using the *What's your diet like?* test. A total of 167 participants (mean age=52.5 years, SD12.6 years; 92.8% women) were included in the study. Following the interventions, there was a reduction in systolic BP ( $P=0.02$ ) and use of *animal fats* ( $P<0.01$ ), as well as an increase in the percentages of individuals having a normal waist circumference and daily consumption of greens/vegetables and milk/dairy products ( $P<0.01$ ). Participation in the interventions was effective in improving the clients' nutrition and health, demonstrating the importance of interventions that combine dietary practices and physical activity in the promotion of health.

## DESCRIPTORS

Health education  
Food habits  
Obesity  
Intervention studies

## RESUMO

O estudo teve como objetivo determinar efeitos de intervenções em saúde sobre hábitos alimentares e medidas físicas. Trata-se de estudo de intervenção quase experimental com usuários de Serviço de Saúde. Avaliaram-se, portanto, hábitos alimentares, antropometria e pressão arterial (PA) e aplicou-se Questionário de Frequência Alimentar no ingresso dos indivíduos no serviço. Intervenções: grupos de atividade física e educação nutricional, e acompanhamento nutricional individual. Mensuraram-se os efeitos pela repetição das medidas físicas e pelo teste *Como está sua alimentação*. Foram avaliados 167 indivíduos (idade média=52,5±12,6; 92,8% mulheres). Após a intervenção, houve redução da PA sistólica ( $p=0,02$ ) e do uso de *banha animal* ( $p<0,01$ ); aumento do percentual de indivíduos com classificação normal para circunferência da cintura, do consumo diário de verduras/legumes e leite/derivados ( $p<0,01$ ). Participar das intervenções foi efetivo para melhorar a alimentação e saúde dos usuários, denotando a importância de intervenções que associem práticas alimentares e atividade física para a promoção da saúde.

## DESCRIPTORIOS

Educação em saúde  
Hábitos alimentares  
Obesidade  
Estudos de intervenção

## RESUMEN

Se objetivó determinar efectos de intervenciones de salud sobre hábitos alimentarios y medidas físicas. Estudio de intervención cuasi-experimental con pacientes de Servicio de Salud. Se evaluaron hábitos alimentarios, antropometría y presión arterial (PA), y se aplicó Cuestionario de Frecuencia Alimentaria al ingreso del individuo al servicio. Intervenciones: grupos de actividad física y educación nutricional, y seguimiento nutricional individual. Se midieron los efectos por repetición de medidas físicas y por test *Cómo está su alimentación*. Fueron evaluados 167 individuos (edad promedio=52,5±12,6; 92,8% mujeres). Luego de la intervención, hubo reducción de PA sistólica ( $p<0,01$ ) y del uso de *grasa animal* ( $p<0,01$ ); aumento del porcentaje de individuos clasificados normales para circunferencia de cintura, del consumo diario de verduras/legumbres y leche/derivados ( $p<0,01$ ). Participar en las intervenciones fue efectivo para mejorar la alimentación y salud de los pacientes, expresando la importancia de intervenciones que asocien prácticas alimentarias y actividad física para la promoción de salud.

## DESCRIPTORIOS

Educación en salud  
Hábitos alimenticios  
Obesidad  
Estudios de intervención

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## INTRODUCTION

Dietary pattern associated with physical inactivity constitutes an important determinant of increased obesity and other non-transmittable diseases and conditions in recent decades<sup>(1)</sup>.

According to the Family Budget Survey (2002/2003)<sup>(2)</sup>, 29.5% of the population were overweight and 11.1% were obese. The Second Telephone Survey of Risk Factors for and Protection against Chronic Diseases (VIGITEL), conducted in Brazilian state capitals and the federal district in 2008<sup>(3)</sup>, revealed that 30.3% of those interviewed were overweight and 13.0% were obese.

This increase in obesity has been mainly associated with inadequate dietary habits and insufficient physical activity. In Brazil, between the periods 1974-1975 and 2002-2003, the consumption of soft drinks and biscuits increased by 400%, while the consumption of processed meats grew by around 300%. In contrast, the consumption of fruits, greens and vegetables was considerably below the recommended minimum of 400 grams/day, thus accounting for only around 3% of the total calorie content of the diet<sup>(2,4)</sup>.

According to the VIGITEL<sup>(3)</sup>, in 2008, only 31.5% of the population was consuming fruits and vegetables five or more times a week. Regarding physical activity practices, 26.3% of the population was physically inactive and only 16.4% practiced sufficient physical activity during leisure time<sup>(3)</sup>.

The high prevalence of obesity, as well as inadequacies in dietary habits and insufficient physical activity, appoints an urgent need for action to encourage and recover healthy dietary practices and to promote health. These actions can be based on health education and more specifically on healthy eating by means of food and nutrition education<sup>(5-6)</sup>.

Several studies have been conducted to evaluate the effectiveness of food and nutrition education for health promotion. A study<sup>(7)</sup> with adult women found that nutritional intervention (12 months), associated with regular physical exercise, increased consumption of fruits and vegetables, and reduced waist circumference ( $p = 0.015$ ).

Likewise, in another study, the intervention<sup>(8)</sup> showed that, after 12 weeks of participation in a nutrition intervention lasting three months, adult women reduced their waist circumference and increased consumption of vegetables and pulses, as well as the consumption of sweets. Similar results were found in a study<sup>(5)</sup> that combined nutritional intervention and physical exercise, conducted over a period of 10 months, in which there was a reduction in weight and waist circumference.

It is therefore believed that health promotion actions aimed at healthy eating and physical exercise should be carried out under the Brazilian Unified Health System (SUS), so as to contribute to reduce overweight and improve individuals' health. It is important to note, however, that these actions should be evaluated in order to determine their effectiveness. This study seeks, therefore, to evaluate the effect of nutritional interventions related to regular physical exercise and dietary habits, on physical measures of users of a health promotion service, the City Gym Belo Horizonte – Minas Gerais, Brazil.

## METHOD

The present study was part of the *A Healthier Belo Horizonte (BH+Saudável)* – Project for Promoting Healthy Ways of Life in the City of Belo Horizonte – Minas Gerais, Brazil. This consists of an intersectoral initiative by the Municipal Health Department of Belo Horizonte (SMSA-BH), Minas Gerais, to improve the quality of life of populations with high social vulnerability levels<sup>(9)</sup>.

In this project, the so-called City Gyms play a prominent role: these are health promotion services that provide nutritional guidance and regular physical exercise.

### *Study design: a sample*

This was a quasi-experimental before-and-after intervention study with a dynamic population, conducted among City Gym users aged 20 years and over, in the Eastern region of Belo Horizonte. The City Gym under study has a capacity of 400 users. The participants in the study were individuals who were registered at the City Gym between December 2006 and February 2008, with a reassessment carried out between November 2007 and May 2008.

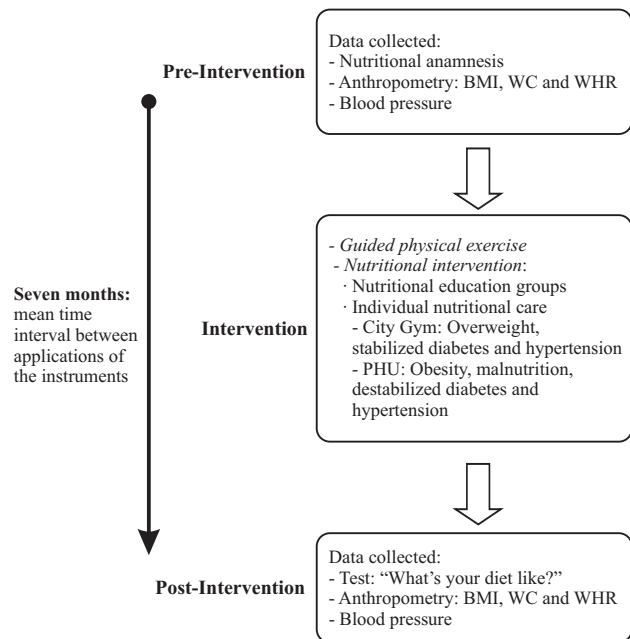
The sample consisted of 195 individuals who voluntarily agreed to participate in the study and who performed regular physical exercise at the study site during the period the intervention was assessed. We excluded 28 individuals who did not have nutritional assessment data and/or physical measurements at the time they joined the City Gym.

The study was divided into three phases: pre-intervention, intervention and post-intervention. During the pre-intervention phase, at the moment they started to use the service, the individuals were evaluated by means of nutritional anamnesis and physical measurements, such as weight, height, waist circumference, hip circumference and blood pressure.

The intervention (second phase) consisted of guided physical exercise practice and collective and/or individual nutritional monitoring. The third phase occurred after the

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intervention, on average seven months after the individual had started activities at the City Gym. On this occasion, physical measurements were repeated and the *What's your diet like?* test was applied<sup>(10)</sup> to evaluate interventions (Figure 1).



Note: BMI: body mass index; WC: waist circumference; WHR: waist-hip ratio; PHU: primary healthcare unit.

Figure 1 – Study design – Belo Horizonte, 2008

It should be appointed that, for pre- and post- interventions, we used two distinct types of evaluation, as the public health service in which the study was developed had only been in operation for one year, and was still developing strategies to evaluate the effectiveness of their actions for users' health. Thus, in the first phase, we used a tool approved by the service to evaluate its actions, which emphasized low cost, speed of application, objectivity and ease of use. This excessively compromised the number of questions: while the tool was useful to diagnose the users' nutritional status, it was inadequate to evaluate the effect of the service's actions on the users' eating habits. Thus, an additional method had to be used. Therefore, in the third phase, we opted to use a tool proposed by the Ministry of Health<sup>(10)</sup>, as it had characteristics similar to those used in the service to evaluate the nutritional status of those entering the service, and mainly because the service lacked an adequate tool to evaluate the users' nutritional development.

### Description of the interventions

The City Gym users practiced regular physical exercise and participated in nutritional education activities; however, certain specific cases received individual nutritional care.

The guided physical exercises included aerobic and anaerobic exercises, with a mean frequency of three times a week and 60 minutes per session. The exercises were set up to meet the students' physical requirements that had been identified during the assessment. The users were also advised to perform physical activities within their daily routines, using public spaces like squares and avenues<sup>(9)</sup>.

The nutritional interventions were focused on gradual changes in the subjects' ways of life, with the aim of increasing their experience of nutritionally adequate practices, enabling them to make concrete changes and autonomous dietary choices<sup>(6)</sup>.

Nutritional education groups were used for nutritional intervention. The groups encouraged the participants to construct concepts that were applicable to real situations, thereby providing the conditions for healthy food choices<sup>(6)</sup>. Through prior enrollment and spontaneous demand, the groups met monthly on different days in order to ensure that users had access. The workshops lasted 60 minutes and could attend to a maximum of 20 users. The topics were selected according to the users' profiles, previous knowledge and questions about diets.

Individual attention at the City Gym (the health promotion service) was provided only to users who did not adhere to the group strategy, and the following were inclusion criteria: overweight and stabilized diseases. For nutritional care, anamnesis and a nutritional diagnosis on which to base the guidance were used. These were furnished verbally or in writing, emphasizing healthy ways of life. Dietary plans were only prescribed in specific cases. It must be emphasized that the activities carried out consisted of nutritional education and dietary reeducation, highlighting the importance of healthy diets and weight for health.

Cases of greater disease severity were referred to the referral primary healthcare center for nutritional follow-up. The referral criteria, defined by the Intersectoral Group for Health Promotion of the municipal authorities of Belo Horizonte, were adult obesity (BMI > 30.0 kg/m<sup>2</sup>), overweight among elderly people (BMI > 27.0 kg/m<sup>2</sup>) and/or destabilized diseases. These individuals received individual nutritional care in conjunction with the Family Health Team. For this purpose, the same theoretical basis was used, but with more frequent follow-up because of greater severity. It is noteworthy that the referred users continued to practice exercises at the City Gym and join food and nutrition education groups, if they wished.

Individual nutritional care, both at the City Gym and at the primary healthcare center, was provided by trained nutrition students from *Universidade Federal de Minas Gerais*. After the first consultation, return visits were arranged at monthly intervals on average, depending on the user's development.

All activities, both in groups and individually, were based on material published by the Ministry of Health,

such as the Dietary Guide for the Brazilian Population<sup>(11)</sup>, among others. Furthermore, the activities were illustrated with educative and game materials, such as responses, photos and food labels.

### Collection and categorization of data

The nutritional anamnesis involved obtaining demographic data, information on dietary habits and applying a food frequency questionnaire (FFQ). The latter permitted identifying individuals' habitual diets by taking into consideration daily and seasonal variations. The FFQ referred to the last six months and consisted of 16 previously selected foods that were representative of the diet of the local population, according to the 24 hour Recall<sup>(12)</sup>.

The FFQ used contains different categories of food consumption frequency, which are daily, weekly, monthly, rarely and never. For the purpose of analysis, food consumption was classified as daily or periodic, here taken to mean weekly or monthly, while the classification of *rarely* was considered as *never*. All tests were based on the guidelines of the Dietary Guide for the Brazilian Population<sup>(11)</sup>.

The anthropometric data used consisted of weight, height, waist circumference and hip circumference, which were all measured in accordance with WHO recommendations<sup>(13-14)</sup>. The body mass index (BMI) was calculated using the weight and height measurements.

To measure the waist circumference, a measuring tape was positioned at the midpoint between the iliac crest and the last rib, without compressing any tissues. For hip circumference, the measuring tape was placed at the most protuberant gluteal point. Based on the waist and hip circumference measurements, the waist/hip ratio (WHR) was obtained.

Adult obesity was classified in accordance with WHO<sup>(13)</sup> recommendations (1995), using BMI values, as follows: low weight (BMI < 18.5 kg/m<sup>2</sup>), eutrophic (BMI ≥ 18.5 and ≤ 24.9 kg/m<sup>2</sup>), overweight (BMI ≥ 25.0 and ≤ 29.9 kg/m<sup>2</sup>) and obese (BMI ≥ 30.0 kg/m<sup>2</sup>). Among elderly people, overweight was classified in accordance with the Nutrition Screening Initiative<sup>(15)</sup> (1994); low weight (BMI < 22.0 kg/m<sup>2</sup>), eutrophic (BMI ≥ 22.0 and ≤ 27.0 kg/m<sup>2</sup>) and overweight (BMI > 27.0 kg/m<sup>2</sup>). For waist circumference (WC) and WHR, the cutoff point proposed by WHO<sup>(14)</sup> was employed, using the following indices to classify individuals at risk of developing complications associated with obesity [men: normal (WC < 94.0 cm), large (WC ≥ 94.0 cm and ≤ 101.9 cm) and very large (WC ≥ 102.0 cm); women (WC < 80.0 cm), large (WC ≥ 80.0 cm and ≤ 87.9 cm) and very large (WC ≥ 88.0 cm) and risk of developing diseases associated with obesity (men WHR > 0.95 and women WHR > 0.80). Blood pressure measurements were also evaluated<sup>(16)</sup>.

After the intervention, the *What's your diet like?* test proposed by the Ministry of Health<sup>(10)</sup> was used, consisting

of 18 questions on dietary habits. At this stage, physical measures (weight, height, waist circumference, hip circumference, and blood pressure) were obtained and the BMI and WHR were calculated.

Before applying the test, users were asked about their participation in nutritional education activities, whether individually or in groups, at the City Gym, the primary healthcare unit or other locations.

Properly trained nutrition students and nutritionists from *Universidade Federal de Minas Gerais* collected the data on individual nutritional care.

### Data analysis

The data were tabulated and analyzed using Epi-Info software, version 3.4.3, and the Statistical Package for the Social Sciences, version 17.0. Descriptive analysis, Pearson's chi-square test and Student's paired t-test were performed, with a significance level of 5.0%.

### Ethical issues

The project was approved by the Research Ethics Committees of the Federal University of Minas Gerais (103/07) and the municipal authorities of Belo Horizonte (087/2007).

## RESULTS

The sample consisted of 167 individuals with characteristics ( $p > 0.05$ ) similar to the total population at the City Gym ( $n = 269$ ). Demographic variables of the study participants are described in Table 1.

**Table 1** - Comparison between the sample and the current population at the Health Promotion Service - Belo Horizonte, MG, 2007-2008

Variables	Sample studied (n = 167)		Population (n = 269)		P value*
	n	Values	n	Values	
Age	167	52.5 SD:12.6	269	52.3 SD:13.6	0.19**
Adults	116	69.5%	180	66.9%	0.57
Elderly people (≥ 60 years)	51	30.5%	89	33.1%	0.88
<b>Gender</b>					
Male	12	7.2%	19	7.1%	-
Female	155	92.8%	250	92.9%	0.96

\*Paired Pearson's chi-square test. \*\*Student's t test

The users were followed for 7.0 SD: 3.0 months, and 80.3% had participated at least once in a nutritional intervention.

Dietary habits were inadequate for both adults and elderly in the pre-intervention, and there were significant changes ( $p < 0.05$ ) after the intervention, with distinctions between the groups as seen in Table 2.



**Table 2** – Comparison of dietary characteristics between adults and elderly people before and after nutritional intervention – Belo Horizonte, MG, 2007–2008

Variables	Adults					Elderly people				
	Before Intervention (n = 116)		After intervention (n = 116)		P value*	Before intervention (n = 51)		After intervention (n = 51)		P value*
	n	%	n	%		n	%	n	%	
<b>Number of meals</b>										
< 3 meals	7	6.0	3	2.6	-	4	7.8	0	0	-
3 to 4 meals	70	60.3	46	39.7	0.03	34	66.7	20	39.2	0.05
5 to 6 meals	39	33.6	67	87.8	0.01	13	25.5	31	60.8	0.02
<b>Daily consumption</b>										
Fruits	63	54.3	70	60.3	0.24	37	72.5	32	62.7	0.25
Greens and vegetables	49	42.2	101	87.1	<0.01	17	33.3	39	76.5	0.01
Milk and derivatives	71	61.2	95	81.9	<0.01	34	66.7	49	96.1	0.01
Processed meats and fried foods	4	7.8	2	4.7	0.05	16	13.8	7	6.6	0.66
<b>Periodic consumption</b>										
Animal lard	31	26.7	5	4.3	<0.01	10	19.6	2	3.9	0.01

\*Paired Pearson's chi-square test.

The prevalence of nutritional deficiencies and blood pressure measurement, as well as their changes after the nutritional intervention, are described in Table 3. It is noteworthy that there was an increase in the percentage of individuals without the risk of developing complica-

tions associated with obesity, according to waist circumference, and reduced average systolic blood pressure ( $p < 0.05$ ). However, sample losses were observed (54.5%) for physical measurements and there were no significant differences in relation to gender or age group (Table 3).

**Table 3** - Comparison of the individuals' physical measurements before and after the intervention. Belo Horizonte, MG, 2007-2008

Variables	Before intervention (n = 167)		After intervention (n = 91)		P value*
	n	Values	n	Values	
<b>Weight (kg)</b>	167	71.5 SD:15.6	91	71.5 SD:15.1	0.15
<b>Nutritional Status of adults (kg/m<sup>2</sup>)</b>	116	29.5 SD:5.7	64	29.5 SD:5.5	0.16
Low weight	4	3.4%	1	1.6%	-
Eutrophic	37	31.9%	22	34.4%	0.75**
Overweight	29	25.0%	17	26.6%	0.96**
Obese	46	39.7%	24	37.5%	0.89**
<b>Nutritional Status of elderly people (kg/m<sup>2</sup>)</b>	51	28.4 SD:5.3	27	29.1 SD: 4.6	0.37
Low weight	3	5.8%	2	7.4%	-
Eutrophic	18	35.4%	7	25.9%	0.80**
Overweight	30	58.8%	18	66.7%	0.64**
<b>Waist circumference (cm)</b>	167	87.8 SD:11.9	91	89.1 SD:11.8	0.72
Normal	55	32.9%	67	73.6%	0.01**
Large	40	24.0%	24	26.4%	1.00**
Very large	72	43.1%	-	-	-
<b>Waist-hip ratio</b>	166	0.84 SD:0.08	91	0.84 SD:0.07	0.15
Risk of development diseases	65	39.2%	32	35.2%	0.69**
<b>Blood pressure (mmHg)</b>	-	-	-	-	-
Systolic	164	128.2 SD:21.9	88	123.0 SD:21.2	0.02
Diastolic	164	80.9 SD:10.3	88	78.5 SD:11.7	0.12

\* Student's t test. \*\* Paired Pearson's chi-square test.

## DISCUSSION

This study demonstrated that interventions that include physical exercise and collective and individual nutritional activities could be effective in promoting the adoption of healthy dietary habits and reducing waist circumference and systolic blood pressure.

Nutritional education programs may have a positive influence on diets, and it has been verified that collective and individual nutritional interventions are equally

effective<sup>(17)</sup>. However, although participants in such interventions said that they preferred individual treatment, those that participated in group interventions presented better results<sup>(18)</sup>.

In the present study, the dietary changes obtained, such as increased consumption of greens, vegetables, milk and milk derivatives; and reduced consumption of fried food, sausages and *animal fat*, would seem to suggest that the nutritional education activities were applicable to the users' daily practices.

The interventions helped to increase the number of meals per day and the consumption of greens, vegetables, milk and milk derivatives, as well as reduce the consumption of foods that are sources of saturated fats. The intervention study<sup>(7)</sup>, which included the practice of physical activities and nutritional counseling for women with a predominant age of 35 years, also found increased consumption of fruits and vegetables ( $p < 0.01$ ).

A study<sup>(5)</sup> on nutritional interventions and physical exercise among obese women, obtained results similar to this study, including reductions in the excessive consumption of high caloric density foods, and increases in the consumption of foods that are sources of vitamins, minerals and fibers.

However, with regards to the present study, the reduction in the consumption of saturated fats needs to be explored in greater depth, since it was observed that only 25.4% of the individuals chose low-fat milk, while a study of nutritional interventions and physical exercise among obese women found that there was an increase of around 30% in the preference for skimmed milk among subjects<sup>(5)</sup>.

In the present study, there was no significant increase in the consumption of fruits, despite the stimulation. This may be due to social factors, such as education levels, income levels and social isolation. According to the Belo Horizonte social census, 62.7% of the total population in the coverage area of the City Gym had only elementary education, and only 24.4% said they were formally employed, while around 16.0% were unemployed<sup>(19)</sup>.

In a study<sup>(20)</sup> from the results of the Family Budget Survey 1998/99 in São Paulo, the consumption of fruits, greens and vegetables rises directly with increasing family income, so that a 1.0% augmentation in income would increase access to fruits, greens and vegetables by 0.04% among all foods acquired.

Furthermore, consumption of fruit and vegetables may be associated with nutritional status. In a survey conducted among women aged 20 to 60 years, it was demonstrated that low fruit consumption was positively associated with high BMI (PR = 2.18; 95% CI: 1.35-3.53;  $p = 0.0010$ )<sup>(21)</sup>. This is an important fact, considering the high prevalence of nutritional problems encountered in this study.

Regarding weight and BMI, there was no significant change, a finding similar to a study<sup>(5)</sup> that did not observe weight reduction after 10 months of intervention, and another<sup>(7)</sup> that observed no change in mean body mass index after 12 months of intervention ( $p = 0.987$ ). However, the prevalence of excess weight was similar to the values found by VIGITEL<sup>(3)</sup>, in which 43.3% of the Brazilian population aged 18 years or over presented overweight.

Nonetheless, the reduction in abdominal obesity, as measured by waist circumference, and increases in the percentage of individuals with adequate waist circumference values have to be considered. This was probably due to the adoption of healthy dietary habits and regular physical exercise, thus demonstrating that the interventions were effective. A

study of a nutritional intervention<sup>(8)</sup> (groups and individual) among women observed a reduction in waist circumference after three months of dietary intervention ( $p = 0.0001$ ) with continuous reduction after 6 months ( $p = 0.04$ ).

Bringing waist circumference measurements down to normal values is even more important than reducing total weight, because diminished abdominal fat implies greater reduction in metabolic risks, such as glucose-insulin homeostatic disorders, systemic arterial hypertension and dyslipidemia, among others<sup>(22)</sup>. Corroborating this finding, systolic blood pressure measurements were also significantly reduced.

Systolic/diastolic blood pressures may be lowered by 6.9/4.9 mmHg through regular practice of physical exercise among individuals who were previously sedentary, independent of age. Greater reductions in systolic blood pressure occur particularly among hypertensive individuals, thereby reducing the risk of cardiovascular diseases. In addition, a diet with fruits, greens and vegetables, and low in fat may reduce blood pressure<sup>(17)</sup>.

Despite the findings, limitations should be considered. The intervention period of around seven months may have been insufficient for the subjects to adopt healthy ways of life, which might have been reflected in significant reductions in other physical measurements, particularly among the elderly subjects. Nevertheless, the low education levels and socioeconomic conditions prevailing in the region where the City Gym is located may also have impaired such changes. On the other hand, the reductions in abdominal adiposity and systolic blood pressure showed that these interventions at the health services were effective.

The fact that different instruments were used to assess food consumption before and after the intervention might have caused difficulty to evaluate the subjects' dietary habits. However, the instruments used shared the same objectives and questions, thereby allowing data comparison.

Sample losses were observed (54.5%) for physical measurements, which may have influenced the favorable outcome. However, the study was conducted at a health service that had recently experienced some difficulties, such as an insufficient number of professionals to meet the high demand for physical assessments and reassessments. It is noteworthy that, nonetheless, significant reductions in waist circumference and systolic blood pressure were achieved. Furthermore, one should consider the importance of carrying out intervention studies in routine health services in order to contribute to improve the quality and effectiveness of actions taken.

In the absence of a control group, it cannot be demonstrated that the present study outcomes resulted from the intervention. Yet, there are ethical issues that do not permit withholding treatment from a particular group of individuals, like at health services for example. Moreover, many of the intervention studies do not include control groups for similar reasons<sup>(7)</sup>.

## CONCLUSION

Participation in the interventions effectively improved dietary habits, with subsequent reductions in abdominal adiposity and systolic blood pressure. Therefore, these re-

sults emphasize the importance of associating healthy dietary practices and physical exercises to promote healthy ways of life among public health service users, resulting in an improved quality of life.

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