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The impact of a nutritional intervention on the nutritional status and anthropometric profile of participants in the Health Gym Programme in Brazil

Raquel Mendonça de Deus [1]
Sueli Aparecida Mingoti [2]
Patrícia Constante Jaime [3]
Aline Cristine Souza Lopes [1]

Abstract *The objective of this study was to assess the impact of an intervention implemented under the Programa Academia da Saúde (Health Gym Programme) of Belo Horizonte, MG on the nutritional status and anthropometric profile of participants. Intervention study involving participants in the Health Gym Programme which encompasses group food and nutrition education activities over a period of 11 months combined with regular physical activity. Impact was assessed by comparing nutritional and anthropometric indicators in women participants who were divided into two groups according to their participation rate in the intervention. A total of 124 women were evaluated, results showed an increase in the number of daily meals ($p<0.001$) among all participants. Participants whose participation rate was less than 50% ($n = 61$) reduced their daily consumption of sugary soft drinks ($p = 0.03$), while those whose participation rate was 50% and over ($n = 63$) reduced daily per capita intake of oil ($p = 0.01$) and sugar ($p = 0.002$), increased their consumption of fruit ($p = 0.004$), and milk and dairy products ($p = 0.02$), and also experienced weight loss (-1.3 ± 3.9kg; $p = 0.02$). The findings show the importance of combining nutritional interventions with physical activity to ensure positive impacts on the nutritional status and anthropometric profile of participants in the Health Gym Programme.*

Key words *Health services, Primary Health Care, Intervention studies, Food and nutritional education*

[1] Departamento de Enfermagem Materno-Infantil e Saúde Pública, Escola de Enfermagem, Universidade Federal de Minas Gerais (UFMG). Av. Prof. Alfredo Balena 190/420, Santa Efigênia. 30130-100 Belo Horizonte MG Brasil. raqueldmendonca@gmail.com
[2] Departamento de Estatística, Instituto de Ciências Exatas, UFMG.
[3] Faculdade de Saúde Pública, Universidade de São Paulo.

Introduction

The high prevalence of obesity and other non-communicable diseases (NCDs) constitutes a major public health challenge because these diseases demand comprehensive and continuous care together with the promotion of physical activity and healthy eating, and prevention of weight gain[1].

Interventions against obesity and other NCDs include policies, regulations, and intersectoral and care-based actions. Primary Health Care (PHC) services are well placed to develop health promotion actions targeting specific population groups, individuals and families[2,3].

The *Programa Academia da Saúde* (PAS), or Health Gym Programme, is an important primary health care initiative in Brazil which is implemented through health care centers equipped with exercise and fitness equipment by qualified professionals who give guidance on body practices, physical activity, leisure and healthy living[4]. The initiative began in 2002 under the name *Academia da Cidade*, or City Gym, and aimed to offer facilities to enable citizens to practice regular physical activity[5].

Various studies have shown the importance of this initiative. A study in Curitiba, the capital city of the State of Paraná, showed that there was an association between participation in the programme and the practice of leisure-time physical activity and walking[6], while another study in Recife, the capital city of the State of Pernambuco, showed that participants in the City Gym programme practiced more leisure-time physical activity than those who did not have any knowledge of the programme[7]. Furthermore, physical activity combined with the promotion of healthy eating by the City Gym Programme was shown to be effective in improving the health profile of participants[8].

Given the recent implementation of this initiative and limited number of intervention studies addressing health services, particularly primary health care, few results are available concerning the services offered by this programme, particularly those related to food and nutrition[9]. However, studies addressing the promotion of healthy eating, particularly when combined with the practice of physical activity, show satisfactory results when it comes to the control of obesity[10-12], but reveal the need to explore the impact of such initiatives in the context of health services in order to broaden understanding of viable and feasible strategies for this setting.

In light of the above, this study aimed to assess the impact of nutritional interventions combined with physical activity on the nutritional status and anthropometric profile of women participants in the Health Gym Programme in the municipality of Belo Horizonte in the State of Minas Gerais, Brazil.

Methods

This investigation comprises a non-randomised intervention study involving women aged 20 years and over practising physical activity under the *Programa Academia da Saúde* (PAS), or Health Gym Programme. The programme is implemented in PHC centres called *polos*, which provide facilities and opportunities to practice regular physical activity, together with health promotion services, including activities related to diet, citizenship and leisure. These *polos* are furnished with exercise and fitness equipment and have qualified professionals and aim to provide care and health promotion services and encourage healthy life styles among the programme's target audience[5].

The *polo* investigated by this study is located in a region of high social vulnerability (SVI = 0.77) in Belo Horizonte, in the State of Minas Gerais. The Social Vulnerability Index (IVS) is a composite indicator which combines different socioeconomic and environmental variables to analyse the characteristics of population groups in given geographical areas. The index ranges from zero to one; the closer the value is to one, the greater the social vulnerability of the population, and therefore the inequality[13].

At the beginning of the study, all participants in the programme were invited to participate in the nutritional interventions implemented at the *polo* and grouped *a posteriori* according to their degree of exposure to the intervention, based on their participation rate in the nutritional activities carried out during the period:

$$\text{Participation rate} = \frac{\text{number of times that the individual participated}}{\text{total number of actions provided}} \times 100$$

The participants were then divided into two groups according to their participation rate and based on the recommendations of a World Health Organisation publication[14] addressing adherence

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to health interventions: Group UP (unsatisfactory participation), comprising participants whose level of physical activity and participation rate in nutritional interventions was unsatisfactory (participation rate under 49.9%); and Group SP (satisfactory participation) comprising participants whose level of physical activity and participation rate in nutritional interventions was satisfactory (participation rate of 50.0% or over).

The practice of physical activity in the *polo* was guided by a physical education teacher and included light aerobic and anaerobic exercises practiced for an average of 60 minutes three times a week. It should be noted that practice of physical activity was similar in both groups[15].

The nutritional interventions assessed by this study were carried out over a period of 11 months and consisted of open group food and nutrition education activities offered on a monthly basis to the service users, combined with physical activity. Each group activity lasted 60 minutes and included a maximum of 20 service users and were replicated to include all women participating in the programme. This group size was chosen to guarantee the effective participation and communication of all service users[3,16]. The intensity of nutritional interventions was based on formal guidelines on the intensity of interventions for the control of obesity[17].

These collective actions are designed to promote healthy food choices through the development of concepts which are applicable to the participants' reality[3]. The topics were selected based on an initial assessment of the participants' profile to ascertain their knowledge and doubts about food and nutrition, and included the following: principles of healthy eating; portion size; purchase; food hygiene, storage and flavour; food and anxiety; and the wider concept of health.

The activities used effective teaching resources, such as replicas, photographs of food, household measures, and educational games and drama activities to promote understanding. The nutritional interventions were carried out by undergraduate and postgraduate nutrition and dietetics students who were trained and supervised by the researchers who conducted this study.

The impact of the nutritional interventions was tested by comparing the evolution of the nutritional and anthropometric indicators of the two groups. The following nutritional indicators were analysed: number of meals; per capita daily salt, oil and sugar intake; and frequency of consumption of given food stuffs (fruit, vegetables, milk and dairy products, sweets, sugary soft drinks, fried food, processed meat products and lard). The anthropometric indicators were weight, body mass index (BMI), and waist circumference and waist/hip ratio. The data was collected before the intervention and 11 months after by trained interviewers using a questionnaire and by taking anthropometric measurements.

A semi-structured and pretested questionnaire[18] was used which encompassed the following information: 1) sociodemographic and economic data (age, schooling, and per capita income); 2) self-reported morbidities; 3) Nutritional profile (number of daily meals; daily per capita salt, oil and sugar intake based on the monthly amount of these products used by the household divided by the number of people who partake in meals; and frequency of consumption of given food stuffs).

The anthropometric measurements which were taken were weight, using a digital scale, and height, waist circumference (WC), and hip circumference (HC), using an inelastic measuring tape, in accordance with Ministry of Health recommendations[19]. This data was then used to calculate Body Mass Index (BMI = weight/height^2) and waist-to-hip ratio (WHR= WC / HC)[20].

A description of the data and evaluation of normality of distribution of quantitative variables was performed using the Kolmogorov–Smirnov test. An intergroup comparison was also conducted using the following tests: Student t-test for the means of normally distributed variables; the Mann-Whitney test for the analysis of variables which were not normally distributed; the chi-squared test; and Fisher's exact test for proportions.

Intergroup comparisons were made to assess indicators of the impact of the intervention using the following statistical tests: McNemar's test for dichotomous categorical variables; the paired student t-test for normal continuous variables; and Wilcoxon signed-rank test for non-normal continuous variables. The significance level was set at 5% ($p<0.05$) for all tests.

The mean and standard deviation of normally distributed variables and median and interquartile range of asymmetrically distributed variables were calculated using the Statistical Package for the Social Sciences (SPSS) version 17.0.

The study was approved by the Research Ethics Committees of the Federal University of Minas Gerais and Belo Horizonte City Council.

Results

A total of 124 women participated in the study, of which 61 were classified into Group UP and 63 into Group SP. The sociodemographic and health characteristics and nutritional profile of the women before the intervention were similar in both groups. Weight (p = 0.04), body mass index (p = 0.02) and proportion of overweight (p = 0,02) was greater among members of Group SP (Table1), while the daily consumption of vegetables (p = 0.02) and sugary soft drinks (p = 0.03) was lower (Table 2).

The average number of daily meals increased in both groups after the intervention (Group UP: p = 0.005; Group SP: p < 0.001). The women in Group UP mentioned a significant reduction in the daily consumption of sugary soft drinks (11.5% to 1.6%; p = 0.03), while those in Group SP mentioned an increase in the daily consumption of fruit (58.1% to 79.0%; p = 0.004) and milk and dairy products (60.3% to 74.6%; p = 0.02) (Table 3), as well as a reduction in the per capita daily intake of oil [-6.0ml (AI: 14.5); p = 0.01] and sugar [-19.5g (AI: 42.5); p = 0.002] (Table 4).

Average weight loss in the Group SP was 1.3 kg (p = 0.02) (Table 5), with values close to the significance level for BMI.

Discussion

The nutritional interventions implemented by the Health Gym Programme, comprising group food and nutrition education activities combined with physical activity, were shown to have a positive impact on the nutritional status and anthropometric profile of the participants in the programme.

The results regarding nutritional status and anthropometric profile corroborate the findings of other intervention studies[8,10-12,21,22] and highlight an increase in the consumption of healthy foods, such as fruit, milk and dairy products, and a reduction in the use of ingredients such as sugar and oil, which when used in excess in cooking may compromise food quality[23,24]. Various studies point to the fact that a reduction in the excessive intake of high-calorie foods and an increase in the consumption of low-calorie foods, rich in micronutrients, fibres and water, together with lower intake of sugar and oil, helps weight loss and the prevention and control of NCDs[21-26]; which is essential given the health profile of the participants in this study.

Average weight loss in women who practiced physical activity and regularly participated in the food and nutrition education activities was 1.3 kg. It is important to emphasise that regu-

Table 1. Sociodemographic and health characteristics and nutritional profile of groups before the intervention. Belo Horizonte, 2011.

Variables	Group UP		Group SP		P value
	n	Values	n	Values	
Age (years)*	61	49,7 ± 13,6	63	51,3 ± 10,9	0,47[a]
Schooling (years)*	34	7,0 ± 3,5	32	7,5 ± 3,4	0,61[a]
Per capita income (R$)**	33	333,3 (IR: 420,0)	30	336,0 (IR: 301,5)	0,82[b]
Self-reported morbidities (%)***					
Systemic arterial hypertension	28	49,1	31	51,7	0,78[c]
Hypercholesterolemia	35	62,5	38	63,3	0,93[c]
Hypertriglyceridemia	10	18,2	9	14,8	0,62[c]
Diabetes Mellitus	7	12,5	7	11,3	0,84[c]
Anthropometric*					
Weight (Kg)	61	68,6 ± 11,5	63	73,7 ± 15,9	0,04[a]
BMI (Kg/m²)	61	27,8 ± 4,5	63	30,2 ± 6,2	0,02[a]
Waist circumference (cm)	61	85,2 ± 9,6	62	88,2 ± 11,6	0,12[a]
Waist/hip ratio	61	0,8 ± 0,1	62	0,8 ± 0,1	0,92[a]
Overweight - BMI>25,0 (%)	40	65,6	53	84,1	0,02[c]

* Mean. ** Median. *** Individuals reported they did not know.
[a] Student t-test. [b] Mann-Whitney test. [c] Chi-squared test.
Note: IQR – interquartile range – resulted the difference between the upper (P75) and lower (P25) quartiles. Group UP – unsatisfactory participation in physical activity and nutritional interventions. Group SP – satisfactory participation in physical activity and nutritional interventions. BMI - body mass index.

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Table 2. Nutritional indicators of groups before the intervention. Belo Horizonte, 2011.

Indicators	Group UP		Group SP		P value
	n	Values	n	Values	
Number of meals*	61	4,0 (IR:2,0)	63	4,0 (IR:2,0)	0,88[a]
Intake per capita*					
Salt (g)	31	5,5 (IR:4,1)	31	5,5 (IR:5,0)	0,91[a]
Óil (ml)	34	16,6 (IR:10,9)	31	15,0 (IR:18,7)	0,94[a]
Sugar (g)	34	41,7 (IR:33,3)	31	55,5 (IR:50,0)	0,13[a]
Frequency Consumption (%)					0,19[b]
Fruits			62		
Daily	59	69,5		58,1	
Others		30,5		41,9	
Vegetables			63		0,02[b]
Daily	51	52,5		31,7	
Others		47,5		68,3	
Milk and dairy products					0,18[b]
Daily	60	71,7	63	60,3	
Others		28,3		39,7	
Sweets			63		0,75[b]
Daily	61	18,0		15,9	
Others		82,0		84,1	
Soft drinks					0,03[b]
Daily	61	11,5	63	1,6	
Others		88,5		98,4	
Fried foods			63		0,16[b]
Daily	61	9,8		3,2	
Others		90,2		96,8	
Processed meats			63		0,62[b]
Daily	61	1,6		4,8	
Others		98,4		95,2	
Animal lard					0,55[b]
Daily	61	13,1	62	9,7	
Others		86,9		90,3	

*Mediana. [a] Mann-Whitney test. [b] Chi-squared test.
Note: IQR – interquartile range. Group UP – unsatisfactory participation in physical activity and nutritional interventions. Group SP – satisfactory participation in physical activity and nutritional interventions.

lar physical activity is associated with the mitigation of cardiovascular risk factors, regardless of weight changes, in part due to the improvement of cardiorespiratory fitness[27]. These results demonstrate the potential for health care and promotion in primary care settings when interventions are based on scientific evidence and tailored to the individual characteristics of people, their families and the community[2,3].

The weight loss observed in these women is even more significant in light of the fact that evidence points to a trend in weight gain in the absence of health promotion. Studies show that annual weight gain in adults varies between 0.5 and 2 kg[26,28]. In Brazil, data from the *Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Surveillance of Risk Factors for Chronic Diseases by Telephone Survey, VIGITEL, acronym in Portuguese) shows that the average annual increase in prevalence of overweight and obesity in adult women between 2006 and 2011 was 1.5 and 1%, respectively[29].

This study's findings demonstrate the importance of expanding intervention strategies that promote regular physical activity combined with nutritional care as part of an overall comprehensive obesity prevention and control strategy. In this sense, the expansion of public health programmes, such as the PAS[5], that encompass regular physical activity, body practices, healthy

Table 3. Variation frequency consumption, according study group. Belo Horizonte, 2011.

Frequency Consumption (%)	Group UP			p value	Group SP			p value
	Before Intervention		After intervention		Before Intervention		After intervention	
	n	%	%		n	%	%	
Fruits	59			1,00	62			0,004
Daily		69,5	67,8			58,1	79,0	
Others		30,5	32,2			41,9	21,0	
Vegetables	61			0,23	63			0,29
Daily		52,5	41,0			68,3	58,7	
Others		47,5	59,0			31,7	41,3	
Milk and dairy products	60			1,00	63			0,02
Daily		71,7	70,0			60,3	74,6	
Others		28,3	30,0			39,7	25,4	
Sweets	60			1,00	63			0,29
Daily		16,7	15,0			15,9	9,5	
Others		83,3	85,0			84,1	90,5	
Soft drinks	61			0,03	63			1,00
Daily		11,5	1,6			1,6	1,6	
Others		88,5	98,4			98,4	98,4	
Fried foods	60			1,00	63			1,00
Daily		10,0	11,7			3,2	3,2	
Others		90,0	88,3			96,8	96,8	
Animal lard	59			1,00	62			0,22
Daily		11,9	11,9			9,7	3,2	
Others		88,1	88,1			90,3	96,8	

McNemar test. Note: The other category refers to the weekly consumption, monthly, rarely and never. Group UP – unsatisfactory participation in physical activity and nutritional interventions. Group SP – satisfactory participation in physical activity and nutritional interventions.

Table 4. Variation of nutritional indicators, according study groups. Belo Horizonte, 2011.

Indicator	Group UP			
	Before Intervention	After Intervention	Difference	P value
Number of meals*	4,0 (IR:2,0)	5,0 (IR:1,0)	0,3 (IR:1,0)	0,005[a]
Intake per capita*				
Salt (g)	5,5 (IR:4,2)	5,5 (IR:4,5)	0,0 (IR:3,1)	0,82[a]
Óil (ml)	16,6 (IR:10,9)	15,6 (IR:11,9)	0,0 (IR:8,0)	0,11[a]
Sugar (g)	41,7 (IR:33,3)	40,3 (IR:29,8)	-1,7 (IR:19,7)	0,13[a]
Indicator	**Group SP**			
	Before Intervention	After Intervention	Difference	P value
Number of meals*	4,0 (IR:2,0)	5,0 (IR:2,0)	1,0 (IR:2,0)	< 0,001
Intake per capita*				
Salt (g)	5,5 (IR:5,0)	4,1 (IR:4,8)	-0,7 (IR:3,5)	0,09
Óil (ml)	15,0 (IR:18,7)	10,7 (IR:11,3)	-6,0 (IR:14,5)	0,01
Sugar (g)	55,5 (IR:50,0)	33,3 (IR:22,3)	-19,5 (IR:42,5)	0,002

* Mediana. [a] Wilcoxon signed-rank test.
Note: IQR - interquartile range. Group UP – unsatisfactory participation in physical activity and nutritional interventions. Group SP – satisfactory participation in physical activity and nutritional interventions.

Table 5. Variation of anthropometrics indicators, according study groups. Belo Horizonte, 2011.

Variables	Group UP			
	Before Intervention	After intervention	Difference	P value
Anthropometric measurements*				
Weight (Kg)	67,0 ± 10,8	67,0 ± 10,3	0,0 ± 3,9	0,96
BMI (Kg/m²)	27,5 ± 4,7	27,3 ± 4,2	-0,1 ± 1,9	0,61
Waist circumference (cm)	84,3 ± 10,0	83,6 ± 10,4	-0,7 ± 4,2	0,32
Waist/hip ratio	0,8 ± 0,1	0,8 ± 0,1	0,0 ± 0,5	0,59
Variables	**Group SP**			
	Before Intervention	After intervention	Difference	P value
Anthropometric measurements*				
Weight (Kg)	72,4 ± 15,4	71,2 ± 14,7	-1,3 ± 3,9	0,02
BMI (Kg/m²)	29,4 ± 5,8	28,9 ± 5,6	-0,5 ± 2,2	0,07
Waist circumference (cm)	87,0 ± 11,7	86,8 ± 12,2	-0,2 ± 6,0	0,81
Waist/hip ratio	0,8 ± 0,1	0,8 ± 0,1	0,0 ± 0,05	0,61

* Mean. Paired student t-test.
Note: BMI - body mass index. Group UP – unsatisfactory participation in physical activity and nutritional interventions. Group SP – satisfactory participation in physical activity and nutritional interventions.

eating and leisure[4,8], and therefore have potential to promote health, is recommended.

This study however observed a high turnaround among participants. This, together with a relatively high proportion of participants whose participation was unsatisfactory, limits the scope of the results. In order to meet the needs of the participants it is therefore necessary that the actions implemented in these *polos* consider local realities[3,5], particularly the socioeconomic status and level of schooling of the target audience[30]. In this respect, in the *polo* investigated by this study, the concepts of nutrition were illustrated using concrete, everyday examples, replicas and photographs of foods, and household measures.

The high prevalence of overweight and illnesses among participants point to the need for concomitant health promotion, prevention and recuperation actions under the PAS. Despite the complexity of the determinants and consequences of NCDs and the difficulties faced by health professionals in providing guidance on healthy life styles and health promotion[3,30], this study shows that the development of effective actions on a wide-scale is possible.

This study also revealed limitations which are inherent in the health service, such as logistical challenges and limited physical facilities. Overcoming these problems requires actions at the macro level including health policies directed at improving services and developing their full potential.

Another limitation was the fact that participants were not randomly allocated to groups. It was shown for example that overweight women, such as those in Group SP, may be more likely to participate in educational activities and modify their diet, and this could affect results. However, according to the protocol of the health service investigated by this study, nutritional guidance should be provided on a case-by-case basis according the complexities of each case, and this characteristic was respected by the study.

With respect to the food and nutrition education actions, to maintain data quality, the participation and knowledge acquired by both groups was equally monitored (data not shown), showing that intensity was lower in Group UP. It is also important to note that the main outcome - weight loss at the end of the 11 month intervention period - showed a power of 76.6% relative to the statistical test performed *a posteriori* considering the sample size and difference in weight before and after the intervention, corroborating the differences in the results found between the groups associated with the intervention.

Open group food and nutrition education activities promoted by the PAS were shown to be an effective and feasible way of providing nutritional counselling and health promotion. This find-

ing corroborates Ministry of Health guidance[31], which recommends this type of activity in the PHC because, apart from fostering an interdisciplinary approach, it promotes the active involvement of participants and allows them to express their own needs and those of the community.

The intensity and duration of the intervention, developed over a period of 11 months, may have influenced weight loss. For future studies, a minimum duration of 12 months is recommended, together with monthly or fortnightly meetings interspersed with brief contact through phone calls, for example, in order to intensify actions and increase their effectiveness, particularly with respect to weight loss.

This study's findings suggest that the nutritional interventions combined with regular physical activity proposed by the PAS have a positive impact on the nutritional status and anthropometric profile of participants in the programme, reinforcing the need for research to address the impacts of health services in order to improve the effectiveness of their actions. The actions developed in this *polo* of the Health Gym Programme have the potential to promote healthy lifestyles and are particularly relevant to Brazil's Unified Health System, especially considering the current expansion of Family Health Support Centres in the country[5,32].

Collaborators

RD Mendonça contributed to study conception and design, data collection, analysis and interpretation, and the drafting of this article. SA Mingoti contributed to data analysis and interpretation, and critically revised this article for important intellectual content and final approval of the version to be published. PC Jaime critically revised this article for important intellectual content, participated in drafting the manuscript and in the final approval of the version to be published. ACS Lopes contributed to study conception and design, data collection, analysis and interpretation, and critically revised this article for important intellectual content and final approval of the version to be published.

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References

1. Organização das Nações Unidas (ONU). *Political declaration of the High-Level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases*. Washington: ONU; 2011.
2. Mendes EV. *O cuidado das condições crônicas na Atenção Primária à Saúde: o imperativo da consolidação da Estratégia da Saúde da Família*. Brasília: Organização Pan-Americana da Saúde; 2012.
3. Carneiro ACLL, Souza V, Godinho LK, Faria ICM, Silva KL, Gazzinelli MF. Educação para a promoção da saúde no contexto da atenção primária. *Rev Panam Salud Publica* 2012; 31(2):115-120.
4. Brasil. Ministério da Saúde (MS). *Avaliação de Efetividade de Programas de Atividade Física no Brasil.* Brasília: MS; 2011.
5. Brasil. Ministério da Saúde (MS). Portaria nº 719, de 7 de abril de 2011. Institui o Programa Academia da Saúde no âmbito do Sistema Único de Saúde. *Diário Oficial da União* 2011; 7 abr.
6. Reis RS, Hallal PC, Parra DC, Ribeiro IC, Brownson RC, Pratt M, Hoehner CM, Ramos L. Promoting Physical Activity Through Community-Wide Policies and Planning: Findings From Curitiba, Brazil. *J Phys Act Health* 2010; 7(Supl. 2):S137-S45.
7. Simoes EJ, Hallal P, Pratt M, Ramos L, Munk M, Damascena W, Perez DP, Hoehner CM, Gilbertz D, Malta DC, Brownson RC. Effects of a community-based, professionally supervised intervention on physical activity levels among residents of Recife, Brazil. *Am J Public Health* 2009; 99(1):68-75.
8. Mendonça RD, Lopes ACS. The effects of health interventions on dietary habits and physical measurements. *Rev Esc Enferm USP* 2012; 46(3):573-579.
9. Canella DS, Silva ACF, Jaime PC. Produção científica sobre nutrição no âmbito da Atenção Primária à Saúde no Brasil: uma revisão de literatura. *Cien Saude Colet* 2013; 18(2):297-308.
10. Bogt NCW, Bemelmans WJE, Beltaman FW, Broer J, Smit AJ, Van der Meer K. Preventing weight gain by lifestyle intervention in a general practice setting: there-year results of a randomized controlled trial. *Arch Intern Med* 2011; 171(4):306-313.
11. Molenaar EA, Van Ameijden EJC, Vergouwe Y, Grobbee DE, Numas ME. Effect of nutritional counselling and nutritional plus exercise couselling in overweight adults: a randomized trial in multidisciplinary primary care practice. *Fam Pract* 2010; 27(2):143-150.
12. Goldberg Y, Boaz M, Matas Z, Goldberg I, Shargorodsky M. Weight loss induced by nutritional and exercise intervention decreases arterial stiffness in obese subjects. *Clin Nutr* 2009; 28(1):21-25.
13. Nahas MIP. Metodologia de construção de índices e indicadores sociais como instrumentos balizadores da gestão municipal da qualidade de vida urbana: uma síntese da experiência de Belo Horizonte. In: Daniel J, Hogan RB, Cunha JMP, Carmo RL. *Migração e Ambiente nas aglomerações urbanas*. Campinas: Unicamp; 2001. p. 30-45.
14. World Health Organization (WHO). *Adherence to long-term therapies: evidence for action*. Geneva: WHO; 2003.

15. Costa BVL, Mendonça RD, Santos LC, Peixoto SV, Alves M, Lopes ACS. Academia da Cidade: um serviço de promoção da saúde na rede assistencial do Sistema Único de Saúde. *Cien Saude Colet* 2013; 18(1):95-102.
16. Afonso L. *Oficinas em dinâmica de grupo: um método de intervenção psicossocial*. São Paulo: Casa do Psicólogo; 2006.
17. Preventive Services Task Force. Screening for obesity in adults: recomendations and rationale. *Ann Intern Med* 2003; 139(11):930-932.
18. Lopes ACS, Ferreira AD, Santos LC. Atendimento nutricional na Atenção Primária à Saúde: proposição de protocolos. *Nutrição em Pauta* 2010; 18(101):40-44.
19. Brasil. Ministério da Saúde (MS). *Sisvan: orientações básicas para a coleta, processamento, análise de dados e informação em serviços de saúde.* Brasília: MS; 2012.
20. World Health Organization (WHO). *Physical status: the use and interpretation of anthropometry*. Geneva: WHO; 1995.
21. Sartorelli DC, Franco LJ, Cardoso MA. High intake of fruits and vegetables predicts weight loss in Brazilian overweight adults. *Nutr Res* 2008; 28(4):233-238.
22. Assunção MCF, Gigante DP, Cardoso MA, Sartorelli DS, Santos IS. Randomized, controlled trial promotes physical activity and reduces consumption of sweets and sodium among overweight and obese adults. *Nutr Res* 2010; 30(8):541-549.
23. World Health Organization (WHO). Burden: mortality, morbidity and risk factors. In: *Global status report on noncommunicable diseases 2010*. Geneva: WHO; 2011.
24. Onakpova IJ, Perry R, Zhang J, Ernst E. Efficacy of calcium supplementation for management of overweight and obesity: systematic review of randomized clinical trials. *Nutr Rev* 2011; 69(6):335-343.
25. World Health Organization (WHO). *Obesity: preventing and managing the global epidemic*. Geneva: WHO; 2000.
26. Lewis CE, Jacobs DR, McCreath H, Kiefe CI, Schreiner PJ, Smith DE. Weight gain continues in the 1990s: 10-years trends in weight and overweight from the CARDIA study – Coronary Artery Risk Development in Young Adults. *Am J Epidemiol* 2000; 151(12):1172-1181.
27. Ross R, Janiszewski PM. Is weight loss the optimal target for obesity-related cardiovascular disease risk reduction? *Can J Cardiol* 2008; 24(Supl. D):25D-31D.
28. Visscher TL, Kromhout D, Seidell JC. Long-term and recent time trends in the prevalence of obesity among Dutch men and women. *Int J Obes Relat Metab Disord* 2002; 26(9):1218-1224.
29. Brasil. Ministério da Saúde (MS). *Vigitel Brasil 2011: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico*. Brasília: MS; 2012.
30. Sichieri RS, Souza RA. Estratégias para a prevenção da obesidade em crianças de adolescentes. *Cad Saude Publica* 2008; 24(Supl. 2):S209-S234.
31. Brasil. Ministério da Saúde (MS). *Curso de extensão em promoção de saúde para gestores do SUS com enfoque no Programa Academia da Saúde*. Brasília: MS; 2013.
32. Brasil. Ministério da Saúde (MS). *Diretrizes do NASF: Núcleo de Apoio a Saúde da Família*. Brasília: MS; 2009.

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