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Effectiveness of a behavior change program on cardiometabolic risk factors in adult women

Efetividade de um programa de mudança de comportamento nos fatores de risco cardiometabólicos em mulheres adultas

Eficacia de un programa de cambio de conducta sobre factores de riesgo cardiometabólicos en mujeres adultas

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Abstract

This study aimed to evaluate the effectiveness of a behavior change program, called Vida Ativa Melhorando a Saúde (Active Life Improving Health - VAMOS), on cardiometabolic risk factors in adult women. Study participants (> 18 years) were divided into two groups: intervention group (IG) and control group (CG). The GI participated in VAMOS, in 2016 and 2018, for three months, with 12 face-to-face meetings, once a week, for approximately 2 hours. The GC received general guidance on the importance of maintaining an active and healthy lifestyle before data collection. Both groups were evaluated at baseline and three months after the intervention. The evaluation consisted of a sociodemographic questionnaire, anthropometric measurements and blood collection to determine the biochemical profile. There was a reduction in uric acid (AU) (p <0.001) and waist circumference (WC) (p = 0.001) in the GI from pre- to post-intervention. For the other variables evaluated, no statistically significant difference was observed within and between the groups. It is concluded that the VAMOS program was effective in reducing UA and WC, important indicators of cardiovascular diseases, in adult women.
Keywords: Women; Uric acid; Waist circumference; Cardiovascular diseases.

Resumo

Este estudo teve como objetivo avaliar a efetividade de um programa de mudança de comportamento, denominado Vida Ativa Melhorando a Saúde (VAMOS), sobre os fatores de risco cardiometabólicos em mulheres adultas. As participantes do estudo (> 18 anos) foram divididas em dois grupos: grupo intervenção (GI) e grupo controle (GC). O GI participou do VAMOS, nos anos de 2016 e 2018, durante três meses, com 12 encontros presenciais, uma vez por semana, por aproximadamente 2 horas. O GC recebeu orientações gerais sobre a importância de manter um estilo de vida ativo e saudável antes da coleta de dados. Ambos os grupos foram avaliados no início e após três meses da intervenção. A avaliação constou de questionário sociodemográfico, medidas antropométricas e coleta de sangue para determinar o perfil bioquímico. Houve redução do ácido úrico (AU) (p <0,001) e da circunferência da cintura (CC) (p

= 0,001) no GI do pré para o pós-intervenção. Para as demais variáveis avaliadas, não foi observada diferença estatística significante dentro e entre os grupos. Conclui-se que o programa VAMOS foi efetivo na redução do AU e da CC, importantes indicadores de doenças cardiovasculares, em mulheres adultas.
Palavras-chave: Mulheres; Ácido úrico; Circunferência da cintura; Doenças cardiovasculares.

Resumen
Este estudio tuvo como objetivo evaluar la efectividad de un programa de cambio de comportamiento, llamado Vida Ativa Melhorando a Saúde (Vida Activa Mejorando la Salud - VAMOS), sobre los factores de riesgo cardiometabólico en mujeres adultas. Los participantes del estudio (> 18 años) se dividieron en dos grupos: grupo de intervención (GI) y grupo de control (GC). El GI participó en VAMOS, en 2016 y 2018, durante tres meses, con 12 encuentros presenciales, una vez por semana, de aproximadamente 2 horas. El GC recibió orientación general sobre la importancia de mantener un estilo de vida activo y saludable antes de la recolección de datos. Ambos grupos fueron evaluados al inicio y tres meses después de la intervención. La evaluación consistió en un cuestionario sociodemográfico, medidas antropométricas y extracción de sangre para determinar el perfil bioquímico. Hubo una reducción en el ácido úrico (AU) (p <0,001) y la circunferencia de la cintura (CC) (p = 0,001) en el GI desde antes hasta después de la intervención. Para las demás variables evaluadas, no se observó diferencia estadísticamente significativa dentro y entre los grupos. Se concluye que el programa VAMOS fue efectivo en la reducción de la AU y la CC, importantes indicadores de enfermedades cardiovasculares, en mujeres adultas.
Palabras clave: Mujeres; Ácido úrico; Circunferencia de la cintura; Enfermedades cardiovasculares.

1. Introduction

In 2015, the main cause of deaths from non-communicable diseases (NCD) in Brazil was cardiovascular diseases (CVD) (Malta et al., 2017). Its burden is enormous since the cost of hospital admissions for CVD is considered the highest in the country, which leads to high costs in the inpatient component of health care (Oliveira et al., 2020).

According to the Global Health Data Exchange, in 2019, 12,746,931 individuals had CVD in Brazil, and 6,917,779 were women. CVDs remained the leading cause of death in women and accounted for 190.104 female deaths (30.41% of total deaths) in that year in Brazil (IHME, 2019).

In recent decades, CVD mortality has declined in Brazil for both men and women, but in a heterogeneous way across states and for different specific causes (Guimarães et al., 2015; Lotufo, 2019). However, the total number of CVD deaths has increased, probably due to population growth and aging (Rodgers et al., 2019). In addition, the population aging and the increase in the prevalence of cardiovascular risk factors, such as hypertension and diabetes, have increased the impact of CVDs in Brazil (Brant et al., 2017). Notably, the most prevalent CVDs, such as ischemic cardiomyopathy and cerebrovascular diseases, have common risk factors - hypertension, obesity, sedentary lifestyle, poor eating habits, smoking, alcohol consumption, dyslipidemia, and insulin resistance- which are potentially modifiable through healthy life habits (Garcia et al., 2016).

Despite this decline, the reduction in mortality due to CVDs has reached a plateau in the last years, suggesting a need to renew the strategies to tackle these diseases (Brant et al., 2017). Therefore, efforts to establish public health policies have been held to stimulate the control of risk factors and promote healthy behaviors, aiming to reduce the global burden of NCDs – with emphasis on CVDs – in the upcoming decades (Brasil, 2021). In this context, one of the strategies implemented by the Ministry of Health in Brazil to tackle CVDs was the development of the National Policy of Health Promotion, which has prioritized actions in nutritional education, physical activity, and the prevention of tobacco use and alcohol consumption (Brasil, 2014).

In this sense, a health promotion strategy focused on behavior change was developed and called "*Vida Ativa Melhorando a Saúde*" program (VAMOS), which aims to motivate adults and elderly people to adopt an active and healthy lifestyle through the practice of physical activity and nutrition behavior (Benedetti et al., 2017; Tomicki et al., 2021a). The VAMOS Program has already proven effective in improving these two behaviors that act as protective factors mainly against CVD (Gerage et al., 2017; Meurer et al., 2019; Quadros et al., 2020; Souza et al., 2020; Tomicki et al., 2021b). The program`s potential to improve anthropometric parameters has also been shown (Tomicki et al., 2021b), which should be confirmed by other studies. However, there is still no evidence regarding the impact of this program on cardiometabolic risk factors, which still needs to be investigated. Therefore, this study aims to evaluate the effectiveness of the o Vida Ativa Melhorando a Saúde (Active Living Improving Health) program on the lipid and anthropometric profile of women.

2. Methodology

The study was carried out in 2016 and 2018 in Florianópolis, state of Santa Catarina, Brazil. It was characterized as a community-based clinical trial, parallel-controlled, non-randomized, and non-blinded study (Hulley et al., 2015).

2.1 Participants

Residents in Florianópolis, women, aged 18 years or over, interested in adopting an active and healthy lifestyle were considered potentially eligible for the study.

Then, it was made a verbal invitation to Basic Health Units (BHU) users, and to participants of a university extension project from the Federal University of Santa Catarina. The program was applied to participants in an extension project (n=34) and another portion (n=95) in BHU.

Participants were divided into two groups: intervention group and control group:

Intervention group (IG): Individuals submitted to this group participated in the VAMOS program for three months. The program included 12 face-to-face meetings per week lasting 90-120 minutes each. Health professionals, previously certified in online training (José et al., 2019), were responsible for conducting the meetings, which were held in the form of "chat". Each session was based on a printed VAMOS booklet, distributed free of charge, with content, purpose, and specific activities to help participants understand the need for behavioral change regarding adopting an active and healthy lifestyle and how to maintain them. Participants must be present at all sessions. When there was a lack of a meeting, the content was presented at another time. Other details about the program were previously published (Benedetti et al., 2017; Tomicki et al., 2021a).

Control Group (CG): A CG was created after creating the IG using the same inclusion criteria. Participants in this group received information face-to-face about the importance of physical activity and healthy eating in a single moment (before the baseline collection).

2.2 Data collect

Participants from both groups were equally evaluated. Data collection was performed two times: baseline and post-intervention (after three months of intervention). Data collection was carried out by previously trained researchers, as described below:

2.2.1 Sociodemographic Data

The individual characteristics of the participants have been assessed in a face-to-face interview. The interview was to identify age, body mass, marital status, education level, occupation, and nutritional status.

2.2.3 Biochemical profile

Fasting venous blood samples (5 mL) were removed from the antecubital vein in a vacuum tube, centrifuged at 3.000 rpm for 10 minutes, and transferred the obtained serum to Eppendorf tubes. The levels of glucose, total cholesterol (TC), high-density lipoprotein cholesterol (HDL), triglycerides (TG), creatinine (CR), and uric acid (UA) were analyzed by the corresponding biochemical kits (Labtest Diagnóstica SA, Lagoa Santa, Brazil) in an automated BS-120-Mindray (Shenzhen Mindray Bio-Medical Electronics Co, Shenzhen, China). In addition, low-density lipoprotein cholesterol (LDL) was measured indirectly using the Friedewald equation as follows: LDL = TC - HDL - (TG/5) (Friedewald; Levy; Fredrickson, 1972). All results were expressed in mg/dL.

2.2.4 Anthropometric profile

The body mass (BM) was evaluated using a digital scale with a precision of 0.1 kg. Height assessment was performed using a portable stadiometer with 0.1 cm accuracy. Waist circumference (WC) was measured using a non-elastic anthropometric tape with a precision of 0.1 cm located between the iliac crest and the last rib not to compress the skin. Finally, the body mass index (BMI) was calculated by dividing the BM in kilograms by squared height in meters. International Society for the Advancement of Kinanthropometry (ISAK) (Stewart et al., 2011) procedures were used.

2.3 Ethical aspects

The project was approved by The Research Ethics Committee from the Federal University of Santa Catarina (nº 1.394.492 and nº 1.518.283). All research objectives were informed to the participants. Those who agreed signed the consent form.

2.4 Data analysis

The assumptions of normality and homogeneity of variance of the statistical models were checked using the Shapiro-Wilk test and Levene's test, respectively. Descriptive statistics were performed in the sample characterization analysis by the mean and standard deviation for continuous variables and absolute and relative frequency for categorical variables. The chi-square test and Student's t-test for independent samples were used to compare groups at baseline. For the intra- and inter-group comparison of biochemical profile and anthropometric variables (two groups and two times – baseline and post-intervention), the Two-way Analysis of Covariance (ANCOVA) for repeated measures was applied using education as covariate, followed by the LSD post hoc test to identify the differences. Analyzes were performed by intention-to-treat, including all participants assessed at baseline. If the values from the last analysis were missing, data imputation was performed, replacing the missing value with the last observed value (Almeida et al., 2015). However, it is important to note that only 3.87% (n=5) of the data were imputed. All analyzes were performed using the Statistical Package for Social Sciences (SPSS) version 25®. In all tests, the 5% significance level was used.

3. Results

The sample characterization is shown in Table 1. There was a statistically significant difference between groups only for the education level, with a higher percentage of incomplete primary for CG ($p < 0.05$).

Table 1. Sociodemographic variables of study participants (n=129), Florianópolis 2016 e 2018.

Variables	IG (n=53)	CG (n=76)	p value
Age[#]	61.58±10.69	59.63±11.90	0.341
Body mass[#]	76.88±14.09	72.17±14.40	0.068
Marital status (% Married)*	45.3	50.0	0.498
Education level (% Incomplete primary)*	18.9	36.8	0.010[a]
Occupation (% Without Occupation)*	73.6	67.1	0.430
Nutritional status (% Overweight/obesity)*	90.6	78.9	0.079

[#] t test for independent samples. *Chi square test. [a]p<0.05. Benchmark for Overweight/Obesity: Body Mass Index ≥ 25 kg/m².
Source: Authors.

Table 2 shows lipid variables for both groups at pre- and post-intervention. There was a statistically significant difference between groups at baseline (p=0.022) for UA, but the interaction group by time found for this variable showed a significant decrease only for IG from pre- to post-intervention (p<0.001).

Table 2. Biochemical profile of both groups at pre- and post-intervention (n=129), Florianópolis 2016 e 2018.

				Effects	
VARIABLES	**IG (n=53)**	**CG (n=76)**	**Group**	**Time**	**Interaction**
Glucose (mg/dL)			0.108	0.562	0.493
Baseline	107.70±41.31	101.28±34.23			
Post-intervention	108.62±36.13	99.42±43.67			
Total Cholesterol (mg/dL)			0.020	0.259	0.222
Baseline	212.15±52.08	188.14±36.14			
Post-intervention	205.79±50.16	185.74±43.97			
HDL (mg/dL)			0.510	0.711	0.038
Baseline	49.70±14.43	48.39±14.29			
Post-intervention	48.08±12.76	50.32±14.36			
LDL (mg/dL)			0.099	0.523	0.693
Baseline	132.43±53.28	115.61±34.26			
Post-intervention	129.38±48.66	112.34±40.60			
Triglycerides (mg/dL)			0.008	0.021	0.059
Baseline	148.96±66.41	123.38±59.32			
Post-intervention	132.06±55.71	117.39±61.99			
Creatinine (mg/dL)			0.045	0.005	0.089
Baseline	0.90±0.31	0.83±0.17			
Post-intervention	0.80±0.18	0.78±0.19			
Uric Acid (mg/dL)			0.142	0.003	0.035
Baseline	4.89±1.11#	4.34±1.30			
Post-intervention	4.21±1.35*	4.24±1.44			

*p<0.05 for intragroup comparisons with baseline and #p<0.05 for intergroup comparisons at baseline. Source: Authors.

Table 3 shows the anthropometric data of both groups at pre- and post-intervention. There was a statistically significant difference between groups at baseline for WC (p=0.037). A statistically significant reduction in WC was observed only for IG (p=0.001) from pre- to post-intervention. For HDL, there was interaction, but it was not possible to identify the difference when the post hoc was applied. For the other variables, there was no statistical difference within and between groups (p > 0.05).

Table 3. Anthropometric indicators of both groups at pre- and post-intervention (n=129), Florianópolis 2016 e 2018.

			Effects		
VARIABLES	**IG (n=53)**	**CG (n=76)**	**Group**	**Time**	**Interaction**
BM			0.015	0.146	0.742
Baseline	76.88±14.09	72.17±14.40			
Post-intervention	76.10±13.71	72.18±14.24			
BMI			0.131	0.171	0.704
Baseline	30.67±5.08	30.09±6.05			
Post-intervention	30.35±4.93	30.12±6.12			
WC			0.049	0.033	0.013
Baseline	97.40±11.01#	94.32±13.25			
Post-intervention	95.38±10.09*	94.51±13.65			

*p<0.05 for intragroup comparisons with baseline. and #p<0.05 for intergroup comparisons at baseline. BM=body mass. BMI=body mass index. WC=waist circumference. Source: the authors.

4. Discussion

This research aimed to evaluate the effectiveness of the VAMOS program in women's biochemical and anthropometric profile and presented as main results the reduction of UA and WC in the IG. The VAMOS program aims to promote a healthy lifestyle, mainly by promoting physical activity and adequate and healthy nutrition behavior, to reduce chronic diseases in adults and the elderly and to promote a better quality of life for them (Benedetti et al., 2012, 2017). Thus, the decreases in UA and WC in the IG demonstrated the program's effectiveness since elevated WC is a risk factor for CVD (Dobbelsteyn et al., 2001), as well as increases in UA (Lee et al., 2019).

The literature has shown that high values of UA also have a positive correlation with components of metabolic syndrome (MS), such as BMI, waist-hip ratio, WC, glucose, and TG, and that an increase in UA increases the chance of developing MS (Klongthalay and Suriyaprom, 2020). Besides, many epidemiological studies have shown that hyperuricemia is associated with the development of CVD, chronic kidney disease, diabetes, and MS, which are well known to be related to atherosclerosis (Si et al., 2021; Kimura, Tsukui, Kono, 2021). However, as far as we know, there are no data in the literature regarding the effectiveness of behavior change programs on UA levels, which compromises the comparison of this finding with the literature.

On the other hand, it is notorious that physical activity plays an essential role in controlling UA levels. More significant involvement with physical activity decreases hyperuricemia levels, while longer sedentary behavior increases it (Dong et al., 2021; Park et al., 2019). Moreover, it has been shown that the protective effect of physical activity on the UA was reduced by the increase in sedentary behavior (Dong et al., 2021). Previous studies with the VAMOS program showed that the CG increased the time in sedentary behavior (Gerage et al., 2017) and that people submitted to this program increased moderate and vigorous physical activity (Meurer et al., 2019; Tomicki et al., 2021b). Therefore, we believe that the positive changes in UA levels observed in the present study were related to these behavior changes. In addition to physical activity, encouraging changes in eating habits is essential for a healthy lifestyle. Individuals with UA stones's formation have a higher dietary intake of proteins than non-formers (Trinchieri et al., 2020). In addition, the high consumption of animal-derived food, seafood, and legumes is associated with greater risks of hyperuricemia (Aihemaitijiang et al., 2020). Furthermore, it was observed that in men and women, the high consumption of ultra-processed foods increased the risk of developing hyperuricemia (Zhang et al., 2021). Given that other studies (Gerage et al., 2017, Meurer et al., 2019) showed that participants in the VAMOS program presented a reduction in the consumption of ultra-processed foods, we also consider this aspect positively influenced our findings for UA levels.

Concerning WC, studies that applied for this behavior change program (VAMOS) and that showed statistically significant results in WC are still embryonic. So far, only the research by Tomicki et al. (2021b) has observed changes in this variable after an intervention with this program. However, this result seems to align with the general literature since a recent systematic review with meta-analysis (Barrett et al., 2021) showed that behavior change programs could reduce WC similarly to that observed in the present study (~2 cm). This review also highlights that three studies with behavior change interventions showed statistically significant changes in WC. Moreover, these differences were evident when the follow-up assessment was carried out six months or less after the intervention, which is consistent with what was done in the present study. In addition, it has been shown that the prevalence of high WC is higher among married women, with advanced age, who live in urban areas and have a high level of education (Cisse et al., 2021), data similar to the sample in the present study.

Thus, in summary, it can be inferred that physical activity, sedentary behavior, and diet influence both WC and UA since previous studies related to VAMOS have shown positive results associated with physical activity and the eating habits of its participants. Therefore, it is believed that the changes in behavior observed through these two outcomes also impact the reduction of WC and UA, demonstrated in the present study.

Among the limitations of this study, the absence of physical activity, sedentary behavior, and healthy eating habits data should be considered, which would allow the analysis of the associations between changes in behavior components and changes in cardiometabolic risk factors variables. Moreover, the lack of a rigorous randomization process cannot be neglected in interpreting the present results.

On the other hand, we must consider as a strong point the fact that this is the first study that evaluated the effectiveness of the VAMOS on cardiometabolic risk factors. Furthermore, studies with other behavior change programs that evaluated UA and its relationship with physical activity, sedentary behavior, and healthy eating were not found in the literature, showing the originality of the present study.

5. Conclusion

The VAMOS program effectively reduced UA and WC, significant risk factors of CVD in adult women. It showed the potential of this kind of behavior change program in terms of prevention and treatment of CVDs.

In this sense, it is suggested that future studies analyze the mediation of behavioral changes in the changes in cardiometabolic risk factors resulting from behavior change programs.

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