CLINICAL NUTRITION
DOI: 10.12957/demetra.2026.93164

DEMETRA
Alimentação, Nutrição & Saúde

e-ISSN:2238-913X

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This manuscript stems from the Master's Degree thesis "Effect of nutritional guidance based on the Brazilian cardioprotective diet booklet on anthropometric, lipid parameters and atherogenic indices of an acute myocardial infarction survivor" by Amanda Célia Martins Pastl, which was supervised by Sandra Mary Lima Vasconcelos. It was presented at the Postgraduate Program in Nutrition of Federal University of Alagoas, 2025.

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Editora
Renata Brum Martucci

Evolution of anthropometric and atherogenic cardiovascular risk indicators and indices of acute myocardial infarction survivors exposed to cardioprotective dietary guidance: randomized clinical trial

Evolução de indicadores e índices de risco cardiovascular antropométricos e aterogênicos em sobreviventes de infarto agudo do miocárdio expostos à orientação alimentar cardioprotetora: um ensaio clínico randomizado

Abstract

Introduction: Cardiovascular episodes such as Acute Myocardial Infarction (MI) are the leading cause of death worldwide. A healthy diet is crucial to manage these episodes. *Objective*: Assessing the progression of anthropometric and atherogenic cardiovascular risk indicators and indices in MI survivors exposed to cardioprotective dietary guidance. *Methods*: Study based on aclinical trial conducted with aconvenience sample comprisingpatients suffering from recent myocardial infarction who were treated through qualitative nutritional guidance based on the Brazilian Cardioprotective Diet booklet (Brazil, 2012) at hospital discharge. Post-MI patients with abdominal obesity determined through abdominal circumference were included in the study and randomized into an intervention group (IG -following the cardioprotective diet) and a control group (CG -followingthe standard nutritional guidance by the hospital's dietitian). Anthropometric assessments (BMI for adults vs. elderly, abdominal and neck circumferences, waist:height ratio), lipid profile and plasma atherogenic indices – PAIs (Castelli indices: CI-I and CI-II; atherogenic indices: AI-I and AI-II) were assessed at discharge and after 6-month follow-up. Chi-squared testsand linearmixed models were applied at5% significance level. *Results*: The total of 106 volunteers participated in the study. They were mostly women (67%), over 59 years old (55.7%) - 77.4% were hypertensive, 47.2% diabetic and 43.4% dyslipidemic. There were no differences in anthropometric parameters between the intervention (IG) and control (CG) groups (p>0.05). Both groups showed similar LDL reduction (IG-15.32%,CG-13.7%;p=0.862) and non-HDL cholesterol (IG- 24%, CG- 27.4%; p= 0.515), as well as HDL increase (IG +16.4%, CG +21.6%; p= 0.562) with significant improvements, over time (LDL p= 0.031; non-HDL p < 0.001; HDL p < 0.001). PAIs decreased similarly between groups (p>0.05) and significant reductions were recorded for AI-I and CI-I (p<0.05), over time. *Conclusion*: Nutritional guidance based onthe playful strategy in the cardioprotective booklet did not show additional beneficial effects. Improvements in the assessment parameters were observed in both groups.

Keywords: Acute Myocardial Infarction. Cardiovascular Risk. Healthy Eating.

Resumo

Introdução: Eventos cardiovasculares, como o infarto agudo do miocárdio (IAM), são a principal causa de morte mundial. A alimentação saudável é crucial no tratamento desses eventos. ***Objetivo***: Avaliar a evolução de indicadores e índices de risco cardiovascular antropométricos e aterogênicos em sobreviventes de IAM expostos à orientação alimentar cardioprotetora. ***Métodos***: Estudo baseado em ensaio clínico com amostra de conveniência de recém-infartados, com orientação nutricional qualitativa usando a cartilha *Alimentação Cardioprotetora Brasileira* na alta hospitalar. Foram incluídos pacientes com obesidade abdominal (segundo circunferência abdominal) pós-IAM, randomizados em grupo intervenção-GI (dieta cardioprotetora) e controle-GC (orientação padrão, do nutricionista do hospital) para avaliação antropométrica (IMC adultos vs idosos, circunferências abdominal e do pescoço, cintura/estatura), perfil lipídico e índices aterogênicos plasmáticos-IAPs (Castelli: IC-I e IC-II, aterogênicos: IA-I e IA-II) na alta e após seis meses de seguimento. Foram usados testes Qui-quadrado e modelos lineares mistos com significância de 5%. ***Resultados***: Participaram 106 voluntários, majoritariamente mulheres (67%), >59 anos (55,7%), 77,4% hipertensos, 47,2% diabéticos e 43,4% dislipidêmicos. Não houve diferença nos parâmetros antropométricos GI vs GC (p>0,05). Ambos os grupos mostraram semelhante redução no LDL (GI-15,32%, GC-13,7%; p=0,862) e não-HDL (GI-24%, GC-27,4%; p=0,515) e no aumento do HDL (GI +16,4%, GC+21,6%; p=0,562), com melhora significativa ao longo do tempo (LDL-p=0,031; Não-HDL-p<0,001; HDL-p<0,001). Houve redução semelhante de IAPs entre grupos (p>0,05), sendo significativamente ao longo do tempo o IA-I e IAI-I (p<0,05). ***Conclusão***: A orientação nutricional com a estratégia lúdica da cartilha cardioprotetora não apresentou efeitos benéficos adicionais. Melhoras nos parâmetros ocorreram em ambos os grupos.

Palavras-chave: Infarto Agudo do Miocárdio. Risco Cardiovascular. Alimentação Saudável.

INTRODUCTION

Acute myocardial infarction (MI) is one of the leading causes of death worldwide. It is a medical emergency associated with high morbidity and mortality risks. Brazil witnesses from 300.000 to 400.000 MI cases on a yearly basis and estimated mortality rate of one death for every five to seven hospitalizations. In total, 737.213 hospitalizations were recorded from 2019 to 2023 due to MI and it resulted in 67.716 deaths; the peak of these cases was observed in 2023. The South eastern region accounts for the highest incidence of cases and mortality rates due to this condition, whereas the Northern region recorded the lowest rates of this. Men in the age group 70-79 years with previous history of heart failure stood out as the most affected epidemiological profile. These data emphasize the pressing need for implementing preventive strategies and specialized care aimed at promoting cardiovascular health in the country.[1,2]

The prevention of coronary artery disease (CAD), which is a myocardial infarction (MI) precursor, is based on the adoption of a healthy diet as one of the main pillars of lifestyle habits. Accordingly, the Heart Hospital/Syrian Beneficent Association (HCor-SP) developed the "Brazilian Cardioprotective Diet" (Dica-BR) booklet in partnership with the Ministry of Health (MS) in 2012. It is a playful-nature educational tool based on qualitative guidelines aimed at patients. Its main goal is to help triggering behavioral changes to improve cardiovascular health.[3-5]

Dica-BR booklet classified different food types based on cardiovascular diseases (CVDs) prevention and management guidelines, as well as on the Dietary Guidelines for the Brazilian Population.[3] It uses the Brazilian flag colors as mnemonic device to categorize food types into three different groups depending on their energy density, saturated fat content, cholesterol and sodium. These categories were distributed based on portions inspired by the Brazilian national flag: green, yellow and blue. The green group included unprocessed or minimally processed food, such as fruits, vegetables and skim milk, which should be consumed at larger portions. The yellow group comprised food presenting intermediate energy density like cereals and vegetable oils, which are recommended to be consumed at moderate scale. Finally, the blue group encompassed food rich in cholesterol, sodium and saturated fat, such as cheese and meat, whose consumption should be limited.[4] In addition, a red group- a color that is not found in the Brazilian flag -was created in separate and included in the study. This group encompassed ultra-processed food types whose consumption is discouraged in cardioprotective diets.[3]

The cardioprotective diet is an evidence-based therapeutic strategy belonging to a set of interventions aimed at changing cardiovascular risk factors (CVR) associated with diet, such as systemic arterial hypertension (SAH), dyslipidemia, type 2 diabetes mellitus (DM), overweight and obesity. This strategy complies with principles set for therapeutic adherence and its dietary guidance has become an effective tool to achieve sustainable health and to integrate interdisciplinary approaches aimed at optimizing chronic diseases management through lifestyle changing. The cardioprotective diet is a core cardiovascular risk control element supported by a low-tech intervention (represented by the booklet) that makes patient adherence and self-care easier, including anthropometric and lipid markers monitoring, among other CVR determinants.[3,5]

In addition to traditional lipid fractions, such as total cholesterol (TC), low-density lipoprotein (LDL), high-density lipoprotein (HDL) and triglycerides (TGL), scientific attention has headed towards composite lipid indices like Castelli I index (CI-I), Castelli II index (CII-I), plasma atherogenic index (PAI) and atherogenic index (AI).[6] These indices gather multiple lipid variables into a single composite parameter. They have emerged as more effective cardiovascular risk predictors, mainly for coronary artery disease, and exceeded the accuracy of traditional lipid indicators.[7-9] These indices provide a more understandable lipid profile assessment and allow a more accurate cardiovascular risk stratification.[6-9] The current article adopts the name 'plasma atherogenic indices' (PAI) for the atherogenic indices AI (AI-I) and II (AI-II) and for PAI, as well. Thus, PAIs correspond to CI-I, CII-I, AI-I and AI-II.

Cardiovascular risk (CVR) anthropometric markers like waist-to-height ratio (WHR), waist circumference (WC), neck circumference (NCC) and conicity index (CI) are widely used for CVR assessment. Increased WHR has been closely associated with chronic non-communicable diseases (NCDs).[10] Waist circumference (WC) is an anthropometric marker highlighting visceral abdominal fat; it is acknowledged as significant myocardial infarction (MI) risk predictor.[11] NCCs have been associated with higher cardiovascular risk, mainly in individuals with metabolic disorders like insulin resistance, hypertension, dyslipidemia and higher likelihood of multiple concomitant metabolic disorders.[12] Waist circumference (WC) is an effective predictor of visceral fat, which is associated with higher risk of affecting the metabolic and cardiovascular health.[13] These anthropometric markers play key role in preventing cardiometabolic diseases, despite some limitations for their clinical application.[14]

Cardiovascular health[1,3,4] studies are essential for healthcare professionals, the government and for society as a whole because they help better understanding the cardiovascular diseases, their causes, prevention and treatment. They promote society's awareness of risk factors and encourage the adoption of healthy habits to help reducing these diseases' social and economic impacts. They update healthcare professionals' knowledge on effective interventions that improve the quality of the provided care. This research is essential for governments to formulate public policies aimed at preventing and controlling cardiovascular diseases, as well as at guiding the allocation of resources for awareness campaigns and at improving the services provided by the Unified Health System (SUS). These studies are essential to help achieving population health, to optimize clinical practice and to support governmental decisions aimed at benefiting the community.

Although Dica-BR is well-established as health education tool, studies assessing its effectiveness in post-MI patients, mainly in those assisted by the Brazilian Unified Health System (SUS), are scarce. Therefore, in order to fill this gap, the aims of the present study are to assess the evolution of anthropometric and atherogenic cardiovascular risk indicators and indices in MI survivors exposed to cardioprotective dietary guidance. According to the study hypothesis, the exposure to dietary guidance based on the Dica-BR booklet would lead to significant improvement in the assessed cardiovascular risk markers after 6-month follow-up.

METHODS

Study type and site

The current study stems from the research project "Cardioprotective dietary guidance contribution to inflammatory and oxidative stress markers in obese adults and elderly surviving stroke and acute myocardial infarction assisted by the Unified Health System (SUS) referral services in Alagoas State".

The current study was carried out in compliance with CONSORT (Consolidated Standards of Reporting Trials) guidelines to ensure results presentation transparency and quality (Figure 1), and to meet 89% of items in the CONSORT checklist.[15]

The study was conducted in two public hospitals in Alagoas State. These hospitals are referral centers of the Brazilian Unified Health System (SUS) to provide care for patients suffering from myocardial infarction (MI) and stroke. Alagoas State is located in Northeastern Brazil and had estimated population of 3.220.848 inhabitants in 2025, according to data provided by the Brazilian Institute of Geography and Statistics (IBGE).[16] The latest United Nations Development Program (UNDP) report has shown Human Development Index (HDI) of 0.684 in this region, and this number can be classified as a medium result.[17] Alagoas State recorded 11.289 deaths due to acute myocardial infarction (MI) from 2018 to 2024.[18]

Sample and Eligibility Criteria

This sub-study stemmed from a Master's Degree thesis that had adopted a convenience sample comprising volunteers of both sexes. Participants were in the age group over 20 years and were hospitalized due to myocardial infarction and stroke confirmed by official diagnostic tests. Individuals with abdominal obesity confirmed through WC[19] and clinically stable, with no recommendation for surgery or other invasive procedure were included in the study. Those who did not meet these criteria were excluded from it.

MI diagnosis, specific to this sub-study participants, was confirmed through electrocardiogram, positive troponin I level or coronary angiography. All hospitalized individuals presenting MI who met the eligibility criteria were invited to participate in the study. Subsequently, they subsequently signed the informed consent. Randomization was performed in Microsoft Excel spreadsheet based on participants' allocation into two different groups: control and intervention.

The control group (CG) was prescribed with standard nutritional guidance, which consisted of a list of food types to be avoided and a list of food to be more often consumed - the lists were provided at hospital discharge. In addition to routine nutritional guidance (Dica-BR booklet), the intervention group (IG) got an educational guide aimed at promoting healthy eating habits for cardiovascular health protection.[3]

All individuals in the present study who had MI diagnosis and complete biochemical data on lipid profile (TC, HDL-C, LDL-C, non-HDL cholesterol and triglycerides) were assessed at baseline (pre-intervention) and post-intervention anthropometric measurements (weight, height, WC and NCCs). Economic, demographic and lifestyle information based on variables predefined for the analysis were selected from the main research database. Only 106 participants of the 177 available in the database had MI and met the inclusion criteria; they were considered eligible for the analyses.

Variables

Dependent variables

1. Lipid indicators: Total cholesterol (high if >190 mg/dL); HDL-cholesterol (low if <40 mg/dL); LDL-cholesterol (high if >130 mg/dL); Non-HDL-C (very high risk if <80 mg/dL and high if <100 mg/dL).[20]
2. Plasma atherogenic indices (PAIs): Castelli I index (CI-I=CT/HDL-C) at cutoff values <5 for men and <4.5 for women; Castelli II index (CII-I=LDL-C/HDL-C) at cutoff point <3.5 for men and >3 for women, according to Gaggine (2022); atherogenic I index (AI-I=log10(TG/HDL-C)) at risk ratio ≤0.11 and atherogenic II index (AI-II=Non-HDL-C/HDL-C) at risk ratio <30.[21] Risk classification for these indices was categorized (yes; no).[17] PAIs were organized as described above.
3. Anthropometric indicators and indices: Overweight (body mass index - BMI), adult (≥25 kg/m²) and elderly (>28 kg/m²);[22] higher WC (>80 cm in women and >94 cm in men); High NCCs (>37 cm in men and >32 cm in women); WHR (adequate or inadequate) at cutoff point >0.52 for men and >0.53 for women weretaken into consideration.[23]

Independent variables

Dietary guidance based on the Dica-BR booklet was the exposure variable in the current qualitative study. This booklet categorizes different food types into groups identified by colors in the national Brazilian flag (green, yellow and blue) based on energy density (ED, kcal/g), saturated fat (SF, mg/g), cholesterol (Col, mg/g) and sodium (Na, mg/g). Green corresponded to unprocessed or minimally processed food (ED ≤1.11 kcal/g, SF ≤0.01 mg/g, Col ≤0.04 mg/gand Na ≤2.01 mg/g). Yellow represented food accounting for density 1 to 2 times higher than that of the green group. Blue represented the group of food with density 3 to 4 times higher than that of the green group. A red group comprising ultra-processed food types whose consumption is discouraged was created in separatee.[3]

Randomized control was applied to allocate participants in the IG, which received the Dica-BR guidelines from researchers in a full-color printed booklet. A digital copy of it was sent out through WhatsApp, in addition to routine hospital guidelines. The control group (CG) did not receive the Dica-BR guidelines, only guidelines adopted by dietitians as hospital routine, the so-called "standard". The hospital guidelines were based on Dietary Guidelines for the Brazilian Population (Brazil, 2014).[24] The instructions were verbally provided and they included a list of nutritional recommendations and food types to be often consumed: fruits, vegetables, skim milk, among others, and to be avoided (ultra-processed food and salt, for example). The instructions were given to each patient and to their caregivers (all had some schooling level) in order to reinforce their understanding about this matter, since they are based on a shared scope of nutritional guidelines. The Dica-BR playful strategy was a differentiating factor in the intervention group.

Covariables (Data collected through interviews and/or consultations in medical records; Dica-BR playful strategy in the intervention group):

1. Economic: monthly family income (> 1 minimum wage and ≤ 1 minimum wage).
2. Demographics: age (20-59 years and over 59 years) and sex (female and male).
3. Clinical data: dyslipidemia (yes, no), hypertension (yes, no) and diabetes mellitus (yes, no).
4. Life style: Smoking (yes, no), excessive alcohol consumption (yes, no) and exercising (type, weekly frequency and duration - sedentary < 150 min/week and active ≤ 150 min/week, according to the World Health Organization-WHO, to the American College of Sports Medicine-ACSM and to the Brazilian Ministry of Health).

Data collection

Data collection was carried out in the hospital's wards by previously trained researchers from December 2021 to June 2024. Information was gathered through structured interviews and recorded on a specific form. Demographic, socioeconomic, lifestyle, clinical and dietary data were collected. Subsequently, blood samples were collected for biochemical analyses and anthropometric measurements were taken. The data collection process took place at two different stages: (1) initial interview during hospitalization and (2) 6-month follow-up after hospital discharge.

Sociodemographic and clinical data, including medical hypertension, diabetes mellitus and dyslipidemia diagnoses, and other associated comorbidities, as well as medical history and information on prescribed medication at hospital discharge, were collected from patient records. Life-style information, such as alcohol consumption, smoking and exercising, and the regular use of home medications, was gathered through structured interview.

Waist circumference (WC) anthropometric measurements, chest circumference (CC), body weight and height were assessed. Weight was measured with portable digital scale (Líder®LS-300) and height was measured with portable stadiometer (WCS®). Alternative methods, including the Chumlea equation (1985) to correct water weight in patients with edema, and techniques based on knee height, half wingspan and supine height were used to estimate weight and height whenever direct measurements were not feasible.

Anthropometric measurements were taken with the aid of inelastic measuring tape (Sanny® brand, 0.1 cm accuracy). Each measurement was taken in duplicate to ensure data reliability. Waist circumference (WC) was measured based on the protocol set by the Ministry of Health, whereas the NCC was measured right above the cricoid cartilage.

The assessed biochemical parameters included total cholesterol (TC), LDL-c, HDL-c, triglycerides (TG) and non-HDL cholesterol.Blood samples were collected in the hospital at baseline and in a partner laboratory after the intervention (post-intervention). Biochemical analyses were performed through the enzymatic method for lipid quantification purposes, whereas LDL-c was estimated through the Martin equation and non-HDL cholesterol was calculated by subtracting TC from HDL-c.

The research protocol and complete methodological procedure details have been published.[25]

Data analysis

Categorical variables were described in absolute and relative frequencies and continuous variables were presented in means and standard deviation. The association of socioeconomic variables, lifestyle and health conditions at admission between the intervention and control groups was assessed through Pearson's chi-square test. Linear mixed models were used to compare means set between the intervention and control groups at baseline and at post-intervention time points. Effect sizes were estimated through partial eta-square (ηp^2) test. All tests were carried out at 0.05% significance level.

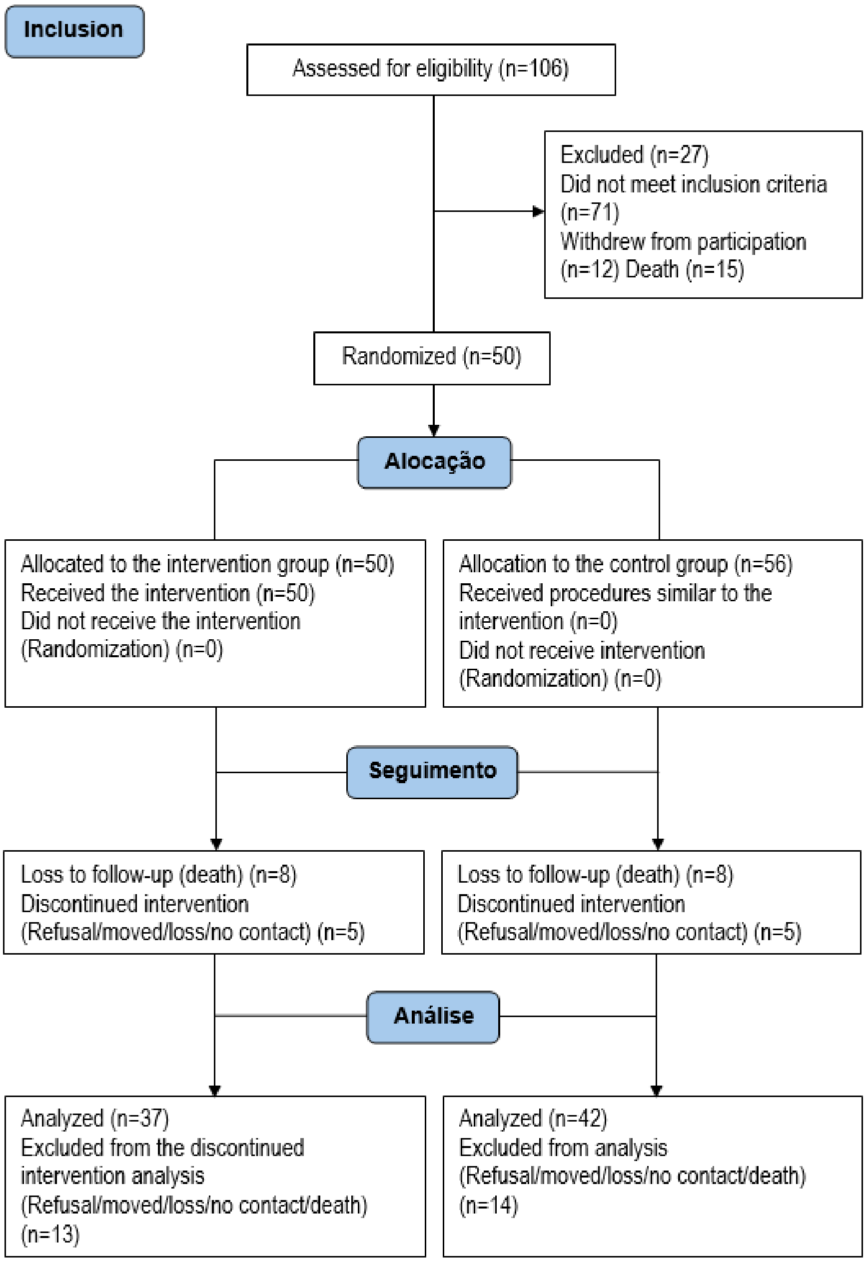
Ethical aspects

The present study was submitted to and approved by the Research Ethics Committee of Federal University of Alagoas (CEP-UFAL) under registration number CAAE 39996120.0.0000.5013 and opinion number 6.073.534.The research was carried out in compliance with bioethical precepts provided for on CNS Resolution n. 466, from December 12, 2012, issued by the National Health Council. Furthermore, the study was registered with the Brazilian Network of Clinical Trials, also known as REBEC, under number RBR-4ttgs2j. All volunteer participants were made aware of and signed the Informed Consent Form (ICF) before data collection.

RESULTS

The initial study sample comprised 106 participants; 50 of them (47.2%) were allocated to the intervention group (IG) and 56 (52.8%) to the control group (CG).There were 27 losses during follow-up time - 13 participants (26.0%) in IG (8 deaths and 5 refusals/changes/loss of contact) and 14 participants (25.0%) in CG (7 deaths and 7 refusals/changes/loss of contact).Thus, the final sample encompassed 79 individuals distributed as follows: 37 (46.8%) in IG and 42 (53.2%) in CG (Figure 1); 67.0% (n=71) of this total belonged to the female sex and 55.7% (n=59) were in the age group over 59 years.

Figure 1. CONSORT 2010 – Checklist of information to be include in randomized trial reports.



In total, 76.4% (n=81) of participants reported to engage in ≥150 minutes exercising per week, whereas 26.4% (n=28) reported excessive alcohol consumption. The aliquot of 77.4% (n=82) participants had history of hypertension, 47.2% (n=50) had diabetes mellitus and 43.4% (n=46) had dyslipidemia (Table 1). No statistically significant differences were observed between the intervention and control groups at baseline ($p > 0.05$). The delivered medication included antiplatelet agents like acetylsalicylic acid (ASA) and clopidogel (ticagrelor or prasugrel), beta-blockers (carvedilol, bisoprolol or metoprolol succinate), angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) - captopril, enalapril or losartan - and statins (atorvastatin or rosuvastatin). Biguanides (metformin) and sulfonylureas (gibenclamide and gliclazide) were the most often prescribed medication for diabetics.

Table 1. Socioeconomic, lifestyle and health condition features at MI survivors' admission to RCT. Alagoas State, 2025.

Variables	Total (n=106)	Control (n=56)	Intervention (n=50)	
	n(%)	n(%)	n(%)	p*
Sex				
Female	71 (67.0)	39 (69.6)	32 (64.0)	0.537
Male	35 (33.0)	17 (30.4)	18 (36.0)	
Age group				
under 59 years	47 (44.3)	21 (37.5)	26 (52.0)	0.134
over 59 years	59 (55.7)	35 (62.5)	24 (48.0)	
Income				
Higher than 1 MW	52 (49.1)	29 (51.8)	23 (46.0)	0,552
Up to 1 MW	54 (50.9)	27 (48.2)	27 (54.0)	
Smoking				
No	85 (81.0)	46 (83.6)	39 (78.0)	0.463
Yes	20 (19.0)	9(16.4)	11 (22.0)	
Alcohol consumption				
No	78 (73.6)	41 (73.2)	37 (74.0)	0.927
Yes	28 (26.4)	15 (26.8)	13 (26.0)	
Exercising				
Up to 150 min/week	25 (23.6)	10 (17.9)	15 (30.0)	0.142
>15 min/week	81 (76.4)	46 (82.1)	35 (70.0)	
HAS[a]				
No	24 (22.6)	9(16.1)	15 (30.0)	0.087
Yes	82 (77.4)	47 (83.9)	35 (70.0)	
DM[b]				
No	56 (52.8)	30 (53.6)	26 (52.0)	0.871
Yes	50 (47.2)	26 (46.4)	24 (48.0)	
Dyslipidemia[c]				
No	60 (56.6)	29 (51.8)	31 (62.0)	0.29
Yes	46 (43.4)	27 (48.2)	19 (38.0)	

MI: acute myocardial infarction; RCT: randomized clinical trial; MW: minimum wage; min: minutes;
[a]SAH: systemic arterial hypertension;
[b]DM: diabetes *mellitus*.
* Chi-square test - *significant p-value <0.05.

Table 2 presents anthropometric parameter comparisons between the assessed groups. The evolution of the Intervention group' BMI (adults and elderly) recorded initial mean value of 27.97 kg/m² (SD±4.40), and it increased to 28.37 kg/m² (SD±4.34) at the end of the intervention; this number corresponded to 1.43% increase.On the other hand, the control group (adults and elderly) showed mean BMI decrease from 26.62 kg/m² (SD±5.05) to 25.45 kg/m² (SD±4.45), which represented 4.39% decrease. There was significant time effect on BMI (p=0.015) and it highlighted significant changes throughout the follow-up time. Furthermore, the time/group interaction was also statistically significant (p=0.039). This finding suggests that the BMI variation differed between groups, over time.

However, results' refining to assess mean BMI based on age group showed that adults in the intervention group recorded 3.4% increase in this variable and those in the control group recorded 4.68% decrease in it. However, they remained in the overweight range. Elderly in the control group recorded 5.7% decrease (26.1±1.6 vs 24.6±0.5 Kg/m²) and remained in the eutrophic range. The intervention group presented 2.1% decrease (28.5±1.1 vs 27.9±0.8 Kg/m²) and moved from the overweight/obesity range to the eutrophic range, although without statistical significance (p>0.05).

Table 2. Comparison of MI survivors' anthropometric parameters between the control and intervention groups before and after the cardioprotective dietary intervention. Alagoas, 2025.

	Grupo Intervenção (n=37)		Grupo Controle (n=42)				
	Before x(dp)[a]	After x(dp)[a]	Before x(dp)[a]	After x(dp)[a]	p_t[b]	p_i[c]	n_p[2d]
BMI[e]	27.97 (4.40)	28.37 (4.34)	26.62 (5.05)	25.45 (4.45)	0.015*	0.039*	0.05
NCC[f]	37.95 (3.10)	38.61 (3.28)	36.17 (3.89)	35.47 (3.62)	0.116	0.168	0.02
WC[g]	100.46 (10.95)	95.78 (11.22)	96.58 (10.62)	95.78 (11.22)	0.359	0.143	0.03
WHR[h]	0.61 (0.07)	0.62 (0.07)	0.61 (0.07)	0.60 (0.08)	0.343	0.158	0.03

[a]x: mean, sd: standard deviation;
[b] pt: p-value corresponding to time effect;
[c] pi: p-value corresponding to time effect and group interaction;
[d] np²: partial square, P *significant P value in the linear mixed model;
[e]BMI: body mass index;
[f]NC: neck circumference;
[g]WC: waist circumference;
[h]WHR: Ratio between waist circumference and height.

Table 3 presents a comparison of lipid-profile biochemical parameters between IG and CG. No statistically significant cholesterol (TC) and triglyceride (TGL) level differences were observed between the groups, over time. Both groups showed mean LDL decrease. These mean decreased from 111.21 mg/dL (SD±48.66) to 94.86 mg/dL (SD±48.41) in IG, whereas these values decreased from 120.56 mg/dL (SD±39.77) to 104.21 mg/dL (SD±44.28) in CG. According to the analysis, there was significant time effect on LDL levels (p=0.031), although no significant difference was observed between the assessed groups (p=0.862).

The intervention group (IG) showed non-HDL cholesterol decrease from 142.08 mg/dL (SD±41.62) to 107.94 mg/dL (SD±58.91). These mean values decreased from 152.94 mg/dL (SD±45.24) to 111.00 mg/dL (SD±50.79) in CG. Similar to the other lipid parameters, there was statistically significant difference, over time (p<0.001), but no significant differences between the groups (p=0.515). The effect size was also small (np²=0.004).

Table 3. Comparison of MI survivors' laboratory parameters between the control and intervention groups before and after the intervention. Alagoas, 2025.

	Intervention Group (n=37)		Control Group (n=42)		p_t[b]	p_i[c]	$n_p{}^{2}$[d]
	Before x (dp)[a]	After x (dp)[a]	Before x (dp)[a]	After x (dp)[a]			
Total cholesterol (mg/dL)	175,68 (43,96)	169,00 (64,19)	190,23 (45,95)	178,62 (57,69)	0,127	0,635	0,002
Triglyceride (mg/dL)	175,68 (43,96)	169,00 (64,19)	190,23 (45,95)	178,62 (57,69)	0,846	0,190	0,020
LDL[e] (mg/dL)	111,21 (48,66)	94,86 (48,41)	120,56 (39,77)	104,21 (44,28)	0,031*	(48.66)	(48.41)
HDL[f] (mg/dL)	33,59 (11,56)	38,82 (12,66)	37,33 (13,84)	44,82 (14,47)	<0,001*	33.59 (11.56)	38.82 (12.66)
No-HDL (mg/dL)	142,08 (41,62)	107,94 (58,91)	152,94 (45,24)	111,00 (50,79)	<0,001*	142.08 (41.62)	107.94 (58.91)

[a] x: mean, sd: standard deviation;
[b] pt: p-value corresponding to time effect;
[c] pi: p-value corresponding to time effect and group interaction;
[d] np²: partial square, P;
[e]LDL: low-density lipoproteins;
[f]HDL high-density lipoproteins.
*significant P value in the linear mixed model.

The PAIs analysis between IG and CG groups is presented in Table 4, which showed some significant changes, over time. No statistically significant CI-I differences were observed between the groups or between the assessed time points. Similarly, CII-I also did not present significant variations. However, IA-I recorded significant decrease, over time (p=0.040), although no difference was observed between the assessed groups (p=0.220). Finally, IA-II also recorded significant decrease, over time (p=0.030), but there was no statistical difference between the analyzed groups (p=0.800).

Table 4. Comparison of plasma atherogenic indices recorded for the assessed MI survivors between the control and intervention groups before and after the intervention. Alagoas, 2025.

	Intervention group (n=37)		Control group (n=42)				
	Before x (dp)[a]	After x (dp)[a]	Before x (dp)[a]	After x(dp)[a]	p_t [b]	p_i [c]	np^2 [d]
Castelli Index I	5.74 (2.67)	5.32 (5.83)	5.63 (2.25)	4.86 (5.26)	0.356	0.774	0.0008

Table 4. Comparison of plasma atherogenic indices recorded for the assessed MI survivors between the control and intervention groups before and after the intervention. Alagoas, 2025. (continues)

	Intervention group (n=37)		Control group (n=42)				
	Before x (dp)[a]	After x (dp)[a]	Before x (dp)[a]	After x(dp)[a]	p_t [b]	p_i [c]	np^2 [d]
Castelli Index II	3.54 (1.79)	2.93 (3.43)	3.62 (1.81)	2.79 (2.81)	0.096*	0.754	0.001
Atherogenic Index I	0.67 (0.32)	0.66 (0.37)	0.65 (0.27)	0.55 (0.33)	**0.046***	0.226	0.02
Atherogenic Index II	4.74 (2.67)	3.26 (3.43)	4.63 (2.26)	2.94 (2.79)	**0.003***	0.801	0.0006

[a]x: mean, sd: standard deviation;
[b] pt: p-value corresponding to time effect;
[c] pi: p-value corresponding to time effect and group interaction;
[d] np²: partial square, P.
*significant P value in the linear mixed model.

DISCUSSION

The current study assessed the impacts of a dietary intervention based on exposure to nutritional guidance substantiated by the Dica-BR booklet (verbally explained and handed out in printed and digital format) on MI survivors' anthropometric and biochemical parameters. BMI increase was observed in the intervention group (IG) and its decrease was recorded in the control group (CG), besides the significant effect of time and the time/group interaction.

Adherence to the guidelines was not monitored and it may have influenced the study results. Monitoring adherence to dietary interventions is recommended for the proper interpretation of the observed effects.[26-28] Furthermore, some anthropometric measurements were estimated through the knee height and half-wingspan equations when taking direct measurement was not possible. It could underestimate height and/or overestimate weight and, consequently, affect BMI.[29] However, the procedure was standardized across groups to minimize differential bias.

BMI stratification by age group (exploratory analysis) showed that adults in the intervention group (IG) recorded 3.4% for this variable, whereas the control group recorded 4.68% decrease in it. Both groups remained overweight. The elderly in the control group recorded 5.7% BMI reduction and maintained eutrophy. The intervention group recorded 2.1% decrease in this variable. It migrated from overweight/obesity to eutrophy, although these numbers did not feature statistical significance (p>0.05).

Although adherence was not measured, this pattern suggested higher engagement by older adults (in both groups) or higher responsiveness to recommendations and routine care; adults in IG, in their turn, gained weight. This finding should be interpreted with caution, given that only exploratory analysis was performed. The study was not designed to test the age/group interaction, and there was no adherence monitoring. Nevertheless, according to the results, the need for age-specific strategies (e.g., gradual goals, reinforcement and understandable checks for adults) and for formal adherence measurements in future studies remain.

There were changes in lipid profile (LDL-C, HDL-C, and non-HDL cholesterol) over time, but no differences between groups. This pattern complied with usual post-event care (clinical follow-up based on therapeutic optimization and likely standard nutritional guidance in both groups).[30]

AI-I and IA-II showed variations in the atherogenic indices, over time, small effect sizes and no time/group interaction. In addition to residual inflammatory processes during the post-MI period, which may modulate some metabolic responses, lack of differences between groups, despite changes in lipid fractions, can be related to unmeasured (heterogeneous) adherence and to the usual care provided in post-event follow-up.[30]

In summary, Dica-BR book let additional effects were heterogeneous under the assessed conditions (one-off guidance, without reinforcement, without adherence monitoring/assessing, just as in the control group). Lack of adherence assessment and using estimated BMI measurements from part of the sample should be taken into consideration. Time effect was observed in both groups' LDL-C, HDL-C and non-HDL, but there was no difference between them. This outcome was consistent with the usual care provided for the control group and with likely insufficient exposure/adherence to the booklet when it comes to the proposed intervention. These elements reinforced the need for more intensive educational strategies and structured adherence support, such as summarized materials, comprehension checks, and goals and periodic reinforcement, in order to broaden the clinical impact.[30,31]

A pragmatic RCT conducted in a Swedish location with a different population in primary care was adopted to test written dietary advice based on standardized follow-up visits (3 weeks and 6 months). It showed no overall LDL-C improvement against the control. This finding suggested that printed material/brief contacts tend to have small effects on lack of intensive support and formal adherence strategies.[32,33] However, unlike what was observed in the present study, the Brazilian Cardioprotective Nutritional Program (BALANCE)[32] assessed cardioprotective diet effects in individuals with pre-existing CVDs, which highlighted significant BMI reduction in participants undergoing the here in addressed intervention. This intervention comprised three main components, namely: (a) dietary prescription based on specific nutritional recommendations for cardiovascular diseases,(b) use of nutritional education tools, with emphasis on accessible and easily implemented foods, and (c) intensive follow-up through individual consultations, group sessions and regular phone contact.

This multicomponent and intensive intervention (dietary prescription, educational tools and continuous follow-up) based on adherence monitoring proved effective in triggering changes in eating behaviors and in improving cardiovascular health indicators. This finding reinforced that frequency, continuity and active support tend to be key determinants for more significant clinical effects.[34-36]

Findings by Rique,[37] Smith[38] and Santos[39] emphasized that LDL-C reduction is gradual and depends on exposure duration and adherence consistency. As already mentioned, adherence was not herein measured and it limited the quantification of its role in the outcomes.

These studies have shown that the LDL reduction process is influenced by factors like intervention time, adherence quality/consistency and individual features, such as genetic predisposition and eating behavior. However, the study could not quantify the role of the Dica-BR guide in the outcomes. However, the current findings regarding the time effect were in compliance with the literature. Thus, nutritional interventions' effectiveness depends on the provided guidance, as well as on the continuous maintenance of these practices, over time.[37-39] Although the immediate effects may be small, the positive results observed over time highlight the effectiveness of sustained nutritional interventions in improving lipid markers and in reducing cardiovascular risk.

Results indicated the time effect on atherogenic indices (IA-I and IA-II), but no difference between the groups. They showed that the observed temporal improvement is consistent with routine care; however, it cannot be specifically attributed to the booklet, given the lack of adherence monitoring and the punctual nature of the taken action. Furthermore, effect sizes were small and reinforced the need for interpreting these changes as moderate.

Rather than concluding that "the intervention promoted improvement", the present findings allowed suggesting that more intensive strategies based on adherence monitoring are likely necessary to produce differentiable effects between groups and clinically relevant effects, over time.[40,41]

Therefore, the present findings pointed out that the isolated exposure to the Dica-BR booklet, without monitoring and other educational activities, may have limited effectiveness. Assumingly, patients have received nutritional guidance in some previous situations or have been exposed to information about food through social media or media outlets, such as television and radio. This process may generate some degree of health literacy and encourage improved self-care.[42-44]

The interpretation of its effects should be cautious, mainly in absence of continuous support and adherence monitoring, if one takes into account the standard nutritional guidance provided in the service and the Dica-BR booklet delivery (followed by explanations to the intervention group). It is worth recommending individual nutritional follow-up based on targets and feedback in order to maximize these effects, including the mitigation of the observed increased BMI. It must be combined with complementary strategies (online monitoring, home visits and regular educational sessions) to broaden the exposure to the booklet's content, to increase adherence to the intervention and achieve more robust clinical impacts.[26]

Thus, it is important highlighting that the present study has some limitations that should be taken into consideration, namely: one-off intervention without both reinforcement and adherence measurement/monitoring, which limit causal featuring; co-interventions in usual care and lack of data about medication maintenance/adjustments that may have diluted differences between groups; part of the anthropometry estimated through knee height and half-wingspan equations may have introduced BMIerrors.[45] Exercising and food intake were not longitudinally monitored. Furthermore, losses during follow-up and final sample size may have reduced the possibility of detecting differences between groups.

Results in the current study can help other researchers in planning future studies on dietary guidance based on the Dica-BR booklet and on adherence to treatment by patients with MI or other CVDs. Future research could be conducted by applying this dietary guidance method and addressing the limitations of the present. It is also necessary trying to minimize the discussed limitations.

It is noteworthy that results in this research can help managers, healthcare professionals and researchers in deciding to add health literacy strategies related to healthy eating, mainly in discussions related to health promotion and recovery. These results can help different healthcare professionals at the time to choose more effective educational methods for patients with acute myocardial infarction (MI), improve their quality of life and increase adherence to the treatment regimen, mainly to the dietary component.

CONCLUSION

The additional guidance provided in the Dica-BR booklet (with explanations) did not lead to anthropometric, lipid and atherogenic outcome differences between the MI survivors' groups in comparison to the service's standard nutritional guidance. Time effect was observed, but with slight improvements (e.g., LDL-C, AI-I and AI-II) in both group.

Therefore, nutritional guidance strategies based on adherence support and monitoring, and on longitudinal follow-up should be taken into consideration in clinical trials substantiated by nutritional intervention. It is so, because there are a number of determining factors in the complex universe of eating behavior.

ACKNOWLEDGEMENTS

The current study was supported by the shared management of Research Program for SUS (PPSUS) through the Foundation for Research Support of Alagoas State (FAPEAL), the Ministry of Health - Department of Science and Technology (MS-Decit), the National Council for Scientific and Technological Development (CNPq) and the State Secretariat of Health of Alagoas (SESAU-AL).

REFERENCE

1. Neto MF de P, Lira PP, Corrêa D do RG, Souza TC, Silva MAG de B, Souza US de, et al. Perfil epidemiológico das internações por Infarto Agudo do Miocárdio entre 2019 e 2023. Brazilian Journal of Implantology and Health Sciences. https://doi.org/10.36557/2674-8169.2024v6n4p2287-2296.

2. Oliveira GMM de, Brant LCC, Polanczyk CA, Malta DC, Biolo A, Nascimento BR, et al. Estatística Cardiovascular – Brasil 2023. Arq Bras Cardiol. https://doi.org/10.36660/abc.20240079.

3. Brasil. Ministério da Saúde. Manual de alimentação cardioprotetora [Internet]. Brasília: Ministério da Saúde; [Acesso 2 maio 2025]. Disponível em: https://www.gov.br/saude/pt-br/composicao/saps/ecv/publicacoes/manual-de-alimentacao-cardioprotetora/view.

4. Brasil. Ministério da Saúde. Cartilha de alimentação cardioprotetora brasileira [Internet]. Brasília: Ministério da Saúde; 2020 [acesso 1 maio 2025]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/alimentacao_cardioprotetora.pdf.

5. Souza JT, Cardoso LM, Oliveira GMM, Cunha DB, Moreira ASB, Bressan J, et al. Effects of a Brazilian cardioprotective diet and nuts on cardiometabolic parameters after myocardial infarction: study protocol for a randomized controlled clinical trial. https://doi.org/:10.1186/s13063-021-05494-0.

6. Gaggini M, Gorini F, Vassalle C. Lipids in Atherosclerosis: Pathophysiology and the Role of Calculated Lipid Indices in Assessing Cardiovascular Risk in Patients with Hyperlipidemia. Int J Mol Sci. https://doi.org/10.3390/ijms24010075.

7. Dong J, Yang C, Zhuang Q, Sun J, Wei P, Zhao X, et al. The Associations of Lipid Profiles With Cardiovascular Diseases and Deathina10-Year Prospective Cohort Study. Front Cardiovasc Med. https://doi.org/10.3389/fcvm.2021.745539.

8. Marcadenti A, Machado RHV, Santos RHN, Kasai CC dos S, Kovacs C, Bello A, et al. Adequação do Consumo de Ácidos Graxos entre Pacientes em Prevenção Cardiovascular Secundária. Arq Bras Cardiol. https://doi.org/10.36660/abc.20230487.

9. Santos ASEA de C, Rodrigues APDS, Rosa LP de S, Noll M, SilveiraEA.Traditional Brazilian Dietand Olive Oil Reduce Cardiometabolic Risk Factors in Severely Obese Individuals: A Randomized Trial. Nutrients. https://doi.org/10.3390/nu12051413.

10. Corrêa MM, FacchiniLA,Thumé E, Oliveira ERA de, Tomasi E. The ability of waist-to-height ratio to identify health risk. Rev Saúde Pública. https://doi.org/10.11606/s1518-8787.2019053000895.

11. Dutra SGV. Waist circumference: a parameter of vascular health. Arq Bras Cardiol. https://doi.org/10.36660/abc.20220508

12. Zaciragic A, Elezovic M, Babic N, Avdagic N, Dervisevic A, Huskic J. Neck Circumference as an Indicator of Central Obesityin Healthy Young Bosnian Adults: Cross-sectional Study. IntJPrev Med. https://doi.org/10.4103/ijpvm.IJPVM_484_17.

13. Silva AAGO, Araujo LF, Diniz MFHS, Lotufo PA, Bensenor IM, Barreto SM, et al. Circunferência do pescoço e risco cardiovascular em 10 anos na linha de base do ELSA-Brasil: diferenciais por sexo. Arq Bras Cardiol. https://doi.org/10.36660/abc.20220508.

14. Navarro LNP, Vasconcelos SML, Silveira JAC da, Cardoso IB, Ferreira RC. Indicadores antropométricos de um novo evento cardiovascular não fatal: uma revisão sistemática. RevEletr Acervo Saúde. https://doi.org/10.25248/reas.e10441.2022.

15. Cuschieri S. The CONSORT statement. Saudi J Anaesth. https://doi.org/10.4103/sja.SJA_559_18.

16. Instituto Brasileiro de Geografia e Estatística. Cidades e Estados: Alagoas. [Acesso em 17 nov 2025]. Disponível em: https://www.ibge.gov.br/cidades-e-estados/al.html.

17. Programa das Nações Unidas para o Desenvolvimento (PNUD). Relatório especial 2023-25 anos: desenvolvimento humano no Brasil: Construir caminhos, pactuando novos horizontes. Brasília, DF: Programa das Nações Unidas para o Desenvolvimento – PNUD, 2024.

18. Brasil. Ministério da Saúde. Sistema de Informações sobre Mortalidade (SIM). Óbitos por Infarto Agudo do Miocárdio (I21), Alagoas, 2018–2024 [Internet]. DATASUS/TABNET; 2025 [acesso 19 nov 2025]. Disponível em: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/obt10al.def.

19. International Diabetes Federation. The IDF consensus worldwide definition of the metabolic syndrome. Brussels: International Diabetes Federation, 2006.

20. Faludi AA, Izar MCO, Saraiva JFK, Chacra APM, Bianco HT, Afiune Neto A, et al. Atualização da Diretriz Brasileira de Dislipidemias e Prevenção da Aterosclerose – 2017.Arq Bras Cardiol. https://doi.org/10.5935/abc.20170121.

21. Martins JP, Silva AR. Índices lipídicos como marcadores de risco cardiovascular. Ver Bras Cardiologia. https://doi.org/10.1234/rbc.v35i2.5678.

22. Organização Pan-Americana de Saúde. XXXVI Reunión del Comité Asesorde Investigaciones en Salud – Encuesta Multicêntrica – Salud Bienestar y Envejecimiento (SABE) en América Latina y el Caribe. Informe preliminar, 2002.

23. Pitanga FJG, LessaI. Razão cintura-estatura como discriminador do risco coronariano de adultos. Rev Assoc Med Bras. https://doi.org/10.1590/S0104-42302006000300016.

24. Brasil. Ministério da Saúde. Guia alimentar para a população brasileira [Internet]. 2nded. Brasília: Ministério da Saúde; 2014 [acesso 15 maio 2025]. 156p. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/guia_alimentar_populacao_brasileira_2e d.pdf.

25. Vasconcelos SML, Barros-Neto JA, Araújo WO, Vasconcelos DDS, Araújo JDS, Santos JG, et al. Elaboração de manual para execução de protocolo de ensaio clínico com indivíduos pós AVC e IAM apoiado nos princípios das boas práticas clínicas: relato de experiência. Brazilian Journal of Development. https://doi.org/10.34117/bjdv8n9-17.

26. Staudacher HM, Yao CK, Chey WD, Whelan K. Optimal design of clinical trials of dietary interventions in disorders of gut–brain interaction. Am J Gastroenterol. https://doi.org/10.14309/ajg.0000000000001732.

27. Worthington A, Coffey T, Gillies K, Roy R, Braakhuis A. Exploring how researchers consider nutrition trial design and participant adherence: atheory - based analysis. Front Nutr. https://doi.org/10.3389/fnut.2024.1457708.

28. Leidy HJ, Gooding R, Hicks-Roof K. Perspective: Key considerations when develop in gand publishing dietary interventions for human clinical trials. J Nutr. https://doi.org/10.1016/j.tjnut.2024.08.024.

29. Fogal AS, Franceschini SCC, Priore SE, Cotta RMMC, Ribeiro AQ. Stature estimation using the knee height measurement amongst Brazilian elderly. Nutr Hosp. 2015;31(2):829–834.

30. Wu G, Chang P, Xie H, et al. The effect of cardiac rehabilitation on lipid levels in patients with coronary heart disease: a systematic review and meta-analysis. Ann Palliat Med. 2022;11(12):3712–3726.

31. US Preventive Services Task Force, Krist AH, Davidson KW, et al. Behavioral Counseling Interventions to Promote a Healthy Diet and Physical Activity for Cardiovascular Disease Prevention in Adults With Cardiovascular Risk Factors: US Preventive Services Task Force Recommendation Statement. JAMA. https://doi.org/10.1001/jama.2020.21749.

32. Hoffmann TC, Glasziou P, BoutronI, Milne R, Perera R, Moher D,et al. Better reporting of interventions: TIDieR checklist and guide. BMJ. 2014;348:g1687. https://doi.org/10.1136/bmj.g1687.

33. Rydell A, Hellsten M, Lindow M, Iggman D. Effectiveness of written dietary advice for improving blood lipids in primary care adults — Apragmatic randomized controlled trial (MYDICLIN). Nutrients. https://doi.org/10.3390/nu14051022.

34. Weber B, Bersch-Ferreira ÂC, Torreglosa CR, Marcadenti A, Lara ES, da Silva JT, et al. Implementation of a Brazilian Cardioprotective Nutritional (BALANCE) Program for improvement on quality of diet and secondary prevention of cardiovascular events: a randomized, multicenter trial. Am Heart J. https://doi.org/10.1016/j.ahj.2019.06.010.

35. Weber B, Galante AP, Bersch-Ferreira AC, Torreglosa CR, Carvalho VO, Victor E da S, et al. Effects of Brazilian Cardioprotective Diet Program on risk factors in patients with coronary heart disease: a Brazilian Cardioprotective Diet randomized pilot trial. Clinics. https://doi.org/10.6061/clinics/2012(12)10.

36. Bersch-Ferreira AC, Hall WL, Santos RHN, Torreglosa CR, Sampaio G, da Silva JT, et al. The effect of a regional cardioprotective nutritional program on inflammatory biomarkers and metabolic risk factors in secondary prevention for cardiovascular disease: a randomized trial. ClinNutr. https://doi.org/10.1016/j.clnu.2021.04.035.

37. Rique ABR, Soares EA, Meirelles CM. Nutrição e exercício na prevenção e controle das doenças cardiovasculares. Ver Bras Med Esporte. https://doi.org/10.1590/S1517-86922002000600006

38. Smith J, Brown E, Jones M. Efeitos da dieta cardioprotetora no colesterol LDL: um estudo longitudinal. J Clin Nutr. https://doi.org/10.5935/abc.20170121.

39. Santos ASEA de C, Rodrigues APDS, Rosa LP de S, Noll M, Silveira EA. Traditional Brazilian Diet and Olive Oil Reduce Cardiometabolic Risk Factors in Severely Obese Individuals: A Randomized Trial. Nutrients. https://doi.org/10.3390/nu12051413.

40. US Preventive Services Task Force, Krist AH, Davidson KW, Mangione CM, Barry MJ, Cabana M, et al. Intervenções de aconselhamento comportamental para promover uma dieta saudável e atividade física para prevenção de doenças cardiovasculares em adultos com fatores de risco cardiovascular: Declaração de recomendação da Força-Tarefa de Serviços Preventivos dos EUA. JAMA. https://doi.org/10.1001/jama.2020.21749.

41. Hoffmann TC, Glasziou P, Boutron I, Milne R, PereraR,Moher D, et al. Melhor relato de intervenções: modelo para lista de verificação e guia de descrição e replicação de intervenções (TIDieR). https://doi.org/10.1136/bmj.g1687.

42. World Health Organization, Regional Office for Europe. Health literacy: the solid facts. Copenhagen: WHO;2013.

43. Magnani JW, Mujahid MS, Aronow HD, Cené CW, Dickson VV, Havranek E et al. Health Literacy and Cardiovascular Disease: A Scientific Statement From the American Heart Association. Circulation. 2018;138 (2):e48–e74. https://doi.org/10.1161/CIR.0000000000000579.

44. Levin-Zamir D, BertschiI. Media Health Literacy, e Health Literacy and the Role of the Social Environment. Int J Environ Res Public Health. 2018;15(8):1643. https://doi.org/10.3390/ijerph15081643.

45. Fogal AS, Franceschini SCC, Priore SE, Cotta RMM, Ribeiro AQ. Stature estimation using knee height measurement among Brazilian elderly. Nutr Hosp. 2015;31(2):829- 834. https://doi.org/10.3305/nh.2015.31.2.7618.

Contributors

Pastl ACM and Vasconcelos SML contributed to the conception, idea, and design of the study; Pastl ACM, Barbosa LB, Badué GS, and Vasconcelos SML contributed to the analysis and interpretation of the data, participated in the manuscript writing, and provided critical revisions; Barbosa LB and Vasconcelos SML also contributed to the final revision for manuscript submission; Araújo JS and Santos MVR contributed to the interpretation of the data and the writing and revision of the manuscript. All authors approved the final version of the article.

Conflict of interest: The authors declare no conflict of interest.

Received: July 27, 2025
Accepted: December 2, 2025