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ARQUIVOS DO MUDI

ARTIGO DE REVISÃO

Physical exercise in adults with metabolic syndrome: a integrative review

Exercício físico em adultos com síndrome metabólica: uma revisão integrativa

Ejercicio físico en adultos con síndrome metabólico: una revisión integrativa

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ABSTRACT. Introduction: metabolic Syndrome is a condition marked by risk factors that raise the chances of cardiovascular disease and type 2 diabetes. **Objective:** this integrative review aimed to analyze the effects of physical exercise on adults with Metabolic Syndrome. **Method:** aliterature search was conducted in Google Scholar, LILACS, MEDLINE, SciELO, and PubMed, applying specific inclusion criteria: randomized studies, adults aged 18–60, diagnosed with Metabolic Syndrome, published between 2009 and 2019, and from Latin American countries. **Results:** of the 1,161 studies initially found, seven met the criteria. The results show that physical exercise plays a key role in reducing risk factors, with benefits including weight loss, lower blood pressure, increased HDL, reduced abdominal circumference, improved endothelial function, and reduced insulin resistance. **Conclusion:** aerobic exercise, even in the short term, stands out as a crucial non-pharmacological intervention that enhances physical fitness and health outcomes in individuals with Metabolic Syndrome.
Descriptors: Metabolic syndrome; Exercise; Health.

RESUMO. Introdução: a síndrome metabólica é uma condição marcada por fatores de risco que aumentam as chances de doenças cardiovasculares e diabetes tipo 2. **Objetivo:** Esta revisão integrativa teve como objetivo analisar os efeitos do exercício físico em adultos com síndrome metabólica. **Método:** foi realizada uma busca na literatura nas bases Google Scholar, LILACS, MEDLINE, SciELO e PubMed, com critérios específicos de inclusão: estudos randomizados, adultos entre 18 e 60 anos, diagnóstico de síndrome metabólica, publicados entre 2009 e 2019, e originários de países da América Latina. Dos 1.161 estudos inicialmente encontrados, sete atenderam aos critérios. **Resultados:** os resultados demonstram que o exercício físico exerce papel fundamental na redução de fatores de risco, com benefícios como perda de peso, redução da pressão arterial, aumento do HDL, diminuição da circunferência abdominal, melhora da função endotelial e da resistência à insulina. **Conclusão:** o exercício aeróbico, mesmo em curto prazo, destaca-se como intervenção não farmacológica essencial na melhora da aptidão física e da saúde em indivíduos com síndrome metabólica.
Descritores: Síndrome metabólica; Exercício físico; Saúde.

RESUMEN. Introducción: el síndrome metabólico es una condición caracterizada por factores de riesgo que aumentan las probabilidades de enfermedades cardiovasculares y diabetes tipo 2. **Objetivo**: esta revisión integrativa tuvo como objetivo analizar los efectos del ejercicio físico en adultos con síndrome metabólico. **Método:** se realizó una búsqueda bibliográfica en Google Scholar, LILACS, MEDLINE, SciELO y PubMed, aplicando criterios de inclusión específicos: estudios aleatorizados, adultos entre 18 y 60 años, diagnóstico de síndrome metabólico, publicados entre 2009 y 2019, y procedentes de países de América Latina. **Resultados**: de los 1.161 estudios inicialmente encontrados, siete cumplieron con los criterios. Los resultados muestran que el ejercicio físico desempeña un papel clave en la reducción de los factores de riesgo, con beneficios como pérdida de peso, disminución de la presión arterial, aumento del HDL, reducción del perímetro abdominal, mejora de la función endotelial y de la resistencia a la insulina. **Conclusión**: el ejercicio aeróbico, incluso a corto plazo, se destaca como una intervención no farmacológica fundamental para mejorar la condición física y la salud en personas con síndrome metabólico.
Descriptores: Síndrome metabólico; Ejercicio; Salud.

INTRODUCTION

The global population has been undergoing significant changes in its morbidity and mortality profile, primarily marked by the increasing number of individuals who are overweight or obese. Various social, economic, cultural, nutritional, and epidemiological transitions are characterized by multiple factors, including the relative increase in deaths resulting from non-communicable chronic diseases (NCDs), such as diabetes mellitus, hypertension, and obesity[1].

Schmidt et al.[2] found that major NCDs, including cardiovascular diseases, diabetes, cancers, chronic respiratory diseases, and neuropsychiatric disorders, account for a significant portion of deaths before the age of 70. The decline in quality of life has led to disability and a high degree of limitation for sick individuals in their work and leisure activities, as well as placing substantial pressure on healthcare systems.

Factors such as the increased risk of developing cardiovascular disease and type 2 diabetes make Metabolic Syndrome (MS) a global public health problem, highlighting the importance of its investigation[3,4]. Eckel et al.[5] describe MS as a disorder characterized by several cardiovascular risk factors, including increased abdominal circumference, dyslipidemia with hypertriglyceridemia and reduced HDL-C levels, glucose metabolism alterations, and hypertension. Additionally, Reaven[6] notes that individuals may present other clinical aspects such as alterations in uric acid metabolism, increased sympathetic nervous system activity, elevated pro-coagulant factors (PAI-1 and fibrinogen), and endothelial dysfunction.

According to Pitsavos et al.[7], lifestyle changes aimed at preventing and/or treating both the psychological symptoms and the physical factors associated with MS are identified as the primary non-pharmacological treatment strategy. This lifestyle change includes adopting regular physical exercise, altering dietary patterns, as well as reducing stress and voiding excessive alcohol and tobacco consumption.

However, national data indicate that, in recent years, the prevalence of MS has doubled, particularly among individuals aged 35 to 64 years. Furthermore, it is important to consider that 12% of individuals exhibited all the components of MS, while only 8.3% did not present any components. These results differ from those observed in another national study, where 5.2% of individuals aged 18 and older presented all components, and 13.6% had none[8].

There are numerous interventions implemented in the treatment of the components of MS, including dietary habit changes, pharmacological agents, and physical exercise. Engaging in physical exercise is recommended as a prophylactic and therapeutic measure for all risk factors associated with coronary artery disease, including[9,10]. In this context, the practice of physical exercise is a fundamental factor for controlling the risk factors associated with the development of MS. Therefore,

the objective of this study was to seek scientific evidence regarding the types of physical exercises suitable for adults with MS.

METHODS

The integrative review was conducted in the second semester of 2019. The research question formulated for the study aimed to determine the impact of physical exercise on adults with MS in Latin America. Individuals are classified as having MS when they meet three or more of the following criteria: altered blood glucose levels (≥ 100 mg/dL or the use of hypoglycemic medications), altered HDL cholesterol levels (< 40 mg/dL for men and < 50 mg/dL for women or the use of lipid-lowering medications), triglyceride levels (≥ 150 mg/dL); increased abdominal circumference (≥ 102 cm for men and ≥ 88 cm for women)[11], and high systolic blood pressure (≥ 130/85 mm Hg or the use of antihypertensive medication)[12].

Search strategies

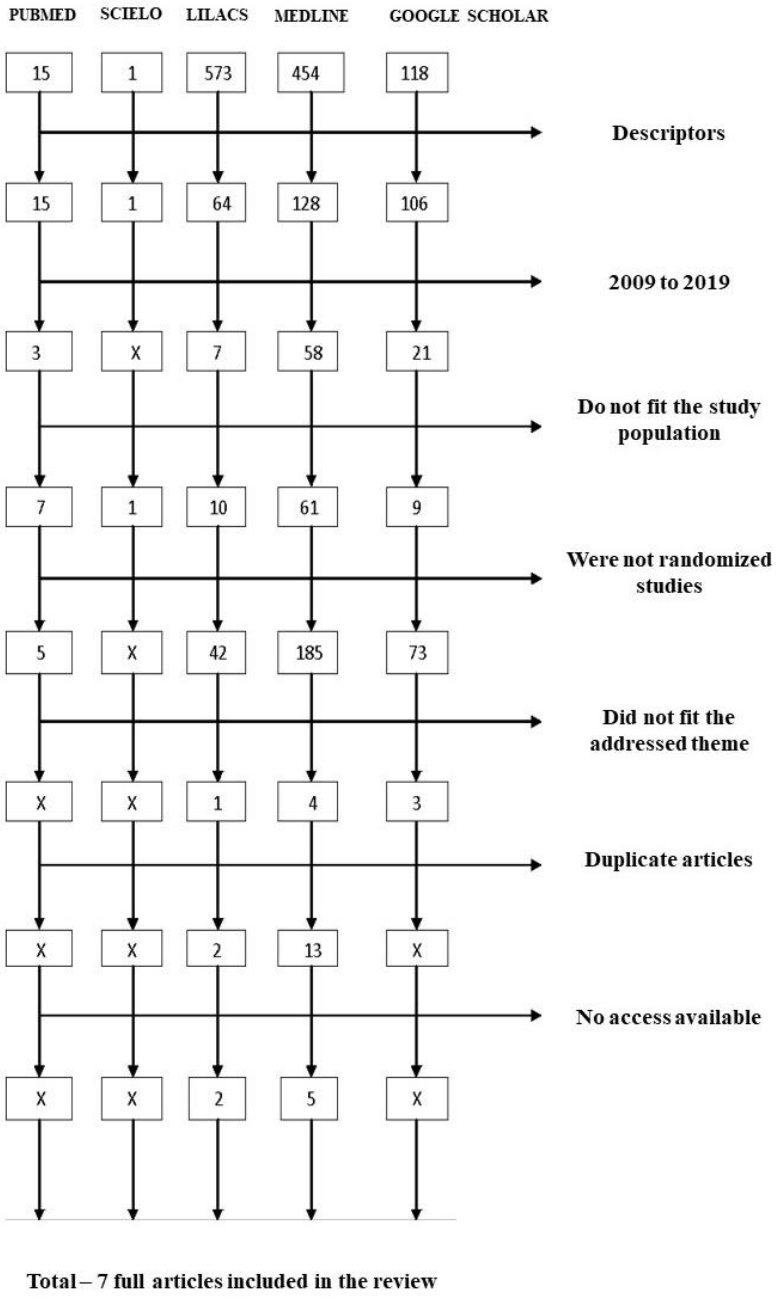
The integrative review was conducted in the second semester of 2019, using 1.161 articles available from the following data sources: Scientific Electronic Library Online (SCIELO), Latin American and Caribbean Health Sciences Literature (LILACS), US National Library of Medicine (PUBMED), Medical Literature Analysis and Retrieval System Online (MEDLINE), and Google Scholar. These databases were selected because they are the most indexed sources in the health field.

In the first phase of the article selection process, searches were conducted using descriptors in Portuguese. After this step, the selection was refined by reading the titles, followed by abstracts. The selection of descriptors used in the review process was carried out through consultation with DECs (Health Sciences Subject Descriptors from BIREME). Logical operators "AND" ("E"), "OF" ("DE"), and "WITH" ("COM") were used to combine descriptors and terms to track relevant publications.

This review aimed to include recent research evidence on MS in adults. Therefore, the selected time frame was from 2009 to 2019. Articles were searched using the descriptors "metabolic syndrome," "adults," and "physical exercise," covering studies published in the last ten years. Additionally, a language filter was applied, considering articles written in English, Spanish, and Portuguese.

The inclusion criteria were: a) Randomized studies; b) Adults with an established diagnosis of MS; c) Publications between 2009 and 2019; d) Studies conducted in Latin American countries. Articles involving subjects under 18 years old, over 60 years old, or those without access to full text were excluded. Below is the flowchart of the articles found:

Flowchart 1 - Articles Found.



Fonte:

RESULTS

Through the inclusion and exclusion criteria defined in this research, a total of 1.161 articles were found across all the data sources searched. When filtering for the last 10 years (2009-2019), the number of articles was reduced to 512. Subsequently, after reviewing the titles and abstracts, 89 articles did not match the target population, 88 were not randomized studies, 305 were unrelated to

the research topic, 8 were duplicates, and access was not possible for 15 articles. This process resulted in the final inclusion of 7 articles.

The first database searched was PubMed, where 15 articles were initially identified using the selected descriptors. After applying the exclusion criteria, no articles met the focus of this study: 7 were not randomized, 5 were unrelated to the research topic, and 3 did not match the required population.

The second database analyzed was SciELO, which yielded only one article using the research keywords. However, after reviewing the title and abstract, it was excluded because it was not a randomized study.

For the third database, LILACS, the initial search identified 573 articles. After applying the research criteria, 64 articles remained. A further screening based on title and abstract revealed that 7 did not match the target population, 10 were not randomized studies, 1 was a duplicate, 42 were unrelated to the research topic, and 2 were inaccessible. This process led to the inclusion of 2 articles that met the inclusion criteria.

In Google Scholar, 118 articles were initially found, and after filtering for the 2009-2019 period, 106 articles remained. A further analysis of titles and abstracts showed that 21 were excluded for not matching the target population, 9 were not randomized studies, 3 were duplicates, and 73 did not align with the research topic, ultimately leading to zero included articles.

The Medline database yielded 454 articles. Since this platform did not offer the option to filter by publication year (2009-2019), an additional exclusion step was performed through title and abstract screening. This process excluded 58 articles for not matching the study population, 61 for not being randomized, 4 for being duplicates, 185 for being unrelated to the research topic, and 13 due to inaccessible content. 5 articles were selected for inclusion. The remaining 128 articles were from years prior to 2009, and thus, they did not meet the study's time frame criteria.

After a peer-reviewed selection process, a total of 7 articles met all inclusion criteria, with 5 from the MEDLINE database and 2 from LILACS.

DISCUSSION

The studies included in this are discussed according to the variables investigated. According to Szwarcwald et al.[13], Latin American countries, in general, are undergoing an epidemiological transition, with significant changes in health and disease patterns influenced by demographic, economic, social, cultural, and environmental factors.

A wide range of socioeconomic characteristics is observed across Latin American countries, reflecting differences in cardiovascular mortality and morbidity. According to Zhang et al.[14], lifestyle

changes in the region, particularly the transition from traditional dietary habits to Western nutrition models, occurred years before the rise in cardiovascular diseases, possibly facilitating the genetic expression of these conditions. The morbidity pattern is further complicated by the progressive migration of rural populations to urban areas, leading to urban peripheries composed of individuals with limited resources and a higher prevalence of emerging risk factors such as acculturation, violence, stress, and malnutrition[15].

Kawamoto et al.[16], in a cross-sectional study examining the relationship between MS factors and C-reactive protein (CRP), indicated that inflammation is linked to insulin resistance, total cholesterol levels, BMI, glucose, uric acid, and triacylglycerol, while inversely related to HDL cholesterol levels.

Among the articles included in this research, three primarily focused on aerobic exercise, with interventions using treadmills, stationary cycling, and HIIT training. The intensity levels varied from 65% to 90% of maximum heart rate (HRmax), classifying these as moderate to high-intensity exercises. These interventions yielded better responses regarding multiple factors influencing individuals with MS.

According to Chen J. et al.[17], MS shares several similarities with chronic kidney disease, with risk factors including obesity, dyslipidemia, hypertension, glucose intolerance, and insulin resistance. Additionally, MS presents a significant risk for chronic kidney diseases and albuminuria (albumin in urine).

Unlike the results obtained from aerobic exercise interventions, one study investigated resistance training in a gym setting, which led to improvements in some aspects, although not as pronounced. The study by Soares et al.[18] highlighted the importance of lifestyle changes in the prevention and treatment of cardiovascular diseases, demonstrating that 25.7% of individuals had a high risk of developing coronary heart disease within ten years. After the intervention, this risk decreased by 11.4% through the adoption of healthier habits.

Using the Framingham study[19], which adjusts an individual's age to their atherosclerotic burden, it was noted that the average vascular age was higher than the chronological age across all groups. Since abdominal circumference (AC) is a relevant factor in identifying MS, the present study observed a significant reduction in AC among women, with the most significant decrease occurring in the INES3 group (nutritional intervention, physical exercise, and omega-3 fatty acid supplementation).

Reductions in systolic blood pressure and blood glucose also showed beneficial effects due to the applied interventions. Regarding total cholesterol and HDL-c, there was an increase in the INES3 group post-intervention, as physical exercise helps raise HDL-c levels. Lastly, nutritional intervention

proved to be a fundamental tool in treating individuals with SM. The study concluded that all groups showed similar improvements, reducing the risk of cardiovascular diseases, reinforcing that lifestyle changes are crucial in managing MS[19].

Additionally, it was observed that combined exercise methods provide benefits not only in cardiovascular aspects but also in muscle strengthening. Of the three studies using this method, two interventions encouraged individuals to adopt a new lifestyle by incorporating physical exercise. One study utilized rumba dance as aerobic exercise, while the other involved mountain cycling[20].

From the interventions analyzed in the study by Stensvold et al.[22], high-intensity interval aerobic training (HIIT) was found to have a significant effect on inflammatory status in individuals with MS, making it a potentially effective and low-cost method for these individuals. The study reported that HIIT significantly reduced interleukin-18 (IL-18), whereas strength training did not produce the same effect. The proposed high-intensity exercise during the 12-week intervention was likely too short to impact the measured inflammatory markers.

Regarding strength training and serum tumor necrosis factor-alpha (TNF-α), there was an increase, which may have occurred due to delayed onset muscle soreness (DOMS), which typically peaks 24 to 72 hours after exercise, while blood samples were collected 48 hours post-training. In the Stensvold et al.[22] study, there were no dietary changes among participants, but fat mass loss was observed in both the high-intensity interval training and strength training groups, with the former resulting in a more favorable inflammatory state. The study concluded that high-intensity interval aerobic exercise may be effective in reducing low-grade inflammation in individuals with MS.

In the study by Layne et al.[23], an eight-week supervised resistance training program showed improvements in several physical factors in previously sedentary healthy individuals and those with MS. In the sedentary control group, there was improved insulin response, with decreased fasting serum insulin concentrations. However, in individuals with MS, despite increases in strength and endurance due to resistance training, insulin resistance remained unchanged after the eight-week intervention. This may have been influenced by factors such as age, body fat, and baseline strength, which also contributed to significant differences between the two study groups.

Intrinsic differences in muscle composition also influenced the results, as individuals with MS demonstrated better adaptations in their training due to the presence of type 2B muscle fibers in the vastus femoris, whereas the sedentary group did not develop as much peak strength due to a predominance of type 1 fibers. It is important to consider that training intensity was applied equally to both groups. The lack of improvement in insulin response was associated with low physical fitness levels and a highly sedentary lifestyle among individuals with MS.

The study by Dieli-Conwright et al.[21] aimed to help breast cancer survivors with MS achieve a better quality of life through social, physical, and mental aspects and to understand the metabolic effects of exercise interventions. The results emphasized the importance of following a long-term, low-cost exercise program incorporating both aerobic and resistance training. A unique aspect of this study was the inclusion of a 12-week follow-up period after the intervention to assess the participants' adherence to physical exercise in the long term, revealing that over 80% remained physically active.

Ortega et al.[22] conducted a 24-week non-pharmacological study with 36 volunteers with MS to analyze the cardiometabolic benefits of HIIT training combined with supplementation of oleate (X-31OLE) and polyunsaturated omega-3 fatty acids (X-3PUFA). The intervention demonstrated that HIIT training combined with supplementation improved insulin sensitivity, HDL cholesterol, and stress reduction (hsCRP) compared to the HIIT and placebo groups. However, the HIIT-only group did not show improvements in VO2max, blood pressure, or body fat. The study concluded that X-31OLE supplementation enhanced the benefits associated with 24 weeks of physical training in MS patients and highlighted that combining HIIT with X-3PUFA and oleate supplementation may have a greater impact on some MS factors than exercise alone.

The study by Layne et al.[23] indicated that physical training improved cardiovascular rehabilitation by reducing systemic oxidative stress markers in women with MS. Short-term aerobic and resistance training positively affected blood pressure and arterial stiffness but did not significantly impact heart rate. Additionally, Layne et al.[23] suggested that strength training could be an essential tool for better vascular adaptation, allowing more efficient blood flow and better physiological responses. Short-term, non-pharmacological physical training programs may be useful in reducing MS risk factors. The study also showed that the six-minute walk test, a cost-effective tool for assessing functional exercise capacity, could help improve cardiovascular parameters in patients with MS.

This research significantly contributes to the field of Physical Education, as professionals in this area are considered health specialists and must be prepared to design appropriate training programs for individuals with MS. Since MS is linked to NCDs, specific training approaches are necessary.

The study by Pérez-Idárraga et al.[20] found that a 12-week intervention combining dance-based aerobic exercise (rumba) and resistance training, along with nutritional education, had significant effects on several cardiovascular risk factors in individuals with MS, emphasizing weight loss, reduced abdominal circumference, and a lower ten-year cardiovascular risk.

CONCLUSION

The fast-paced nature of daily life directly influences people's lifestyles, leading to unhealthy habits such as high-fat diets, physical inactivity, stress, and other negative health factors, contributing to the increasing number of individuals with MS. To improve the quality of life for these individuals, it is essential to raise awareness about adopting a healthy lifestyle throughout life.

The present study confirmed the importance of physical exercise in preventing and treating risk factors associated with MS. It demonstrated positive effects on body weight loss, blood pressure regulation, increased HDL cholesterol levels, reduced abdominal circumference, improved endothelial stiffness, and enhanced insulin resistance. Therefore, it is concluded that engaging in physical exercise is crucial for improving the quality of life in individuals with MS.

It is important to highlight the role of aerobic exercise in any training program, as it enhances improvements in various components of physical fitness. All studies, regardless of type and intensity, indicate that short-term physical exercise training represents a significant non-pharmacological approach for individuals with MS.

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