RESEARCH PAPER

Global Knowledge And Awareness Of Metabolic Syndrome: A Systematic Review And Meta-Analysis

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Abstract
Background: Metabolic syndrome (ms) is a growing global concern that is linked with the increasing mortality and morbidity rate. Thus, this study aims to develop general knowledge and awareness regarding this among all types of people.
Material and Methods: This study has followed picos framework for search strategy and used pubmed, scopus and google scholar and search engine. Prisma framework has been included for meta-analysis to show the inclusion and exclusion criteria. Out of 1167 search results, four articles have been selected for the systematic review that developed a thorough analysis of metabolic syndrome starting from susceptible age groups to their regulation.
Result: The systematic review of those four articles showed that men are more susceptible for the syndrome than women. On the other hand, older adults have a high tendency of developing ms. But the prevalence in children and adolescents can be controlled by calculating their mds at the right time. A balanced diet at the right age can lower the risk of developing obesity and ms. This study has also highlighted that breast cancer (bc) survivors have higher mortality and morbidity rate due to ms. Additionally, this study has also shown the exercises that are useful for controlling ms and interlinked cardiovascular diseases.
Discussion: The systematic review and meta-analysis have shown that ms is dependent on age, gender, geographical background, educational knowledge, medical history, smoking habit, alcohol addiction and daily lifestyle. Maintenance of a proper lifestyle and treatment at the right time can lower the risk of ms and mortality rate.
Conclusion: This study has developed a clear idea on general knowledge and awareness for increasing global concern known as metabolic syndrome. This paper has suggested that early precautions and healthy lifestyle can lower the risk of ms. However, inclusion of only four articles is considered as the limitation of this research.
Keywords: Metabolic Syndrome, Breast Cancer, Cardiovascular Disease, Risk Factors, Aerobic Exercise, Resistance Exercise, Combined Exercise, Mediterranean Diet Score, Body Mass Index, Network Meta-Analysis, Intervention, Mortality, Morbidity.
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1. Introduction

Metabolic syndrome (MS) is a public health concern as the number of young and older adults having metabolic syndrome is increasing day by day. In recent studies, it has been identified that cardiovascular disease is the main reason behind increasing the rate of mortality and morbidity. In this context this study will focus on metabolic syndrome and its causes and health impacts on human beings. Metabolic syndrome increases the risk of cardiovascular disease in 1 out of 3 adults. Thus, this study will produce a systematic review on the general knowledge and awareness of metabolic syndrome to develop a clear idea on the severity of the syndrome. This research will follow relevant articles for meta-analysis of the collected data through specific search strategy. Developing a general knowledge and awareness on metabolic syndrome may help in reassessment of the cardiovascular prevention strategies in future.

2. Background

There is a wide variation of concept on metabolic syndrome as it has an impact on various diseases and there are no specific criteria to assess metabolic syndrome. According to researchers, it is identified as the cluster of interconnected metabolic risk factors which directly enhances the development of atherosclerotic coronary disease and type II diabetes. The metabolic syndrome (Insulin Resistance Syndrome) is also responsible for chronic diseases, high blood pressure, hypertriglyceridemia (de Siqueira Valadares *et al,* 2022). Women with MS have been identified to have increasing risk of breast cancer (BC) due to hormonal imbalance. The motivation behind developing this general knowledge and awareness is the increasing number of patients with cardiovascular diseases, type II diabetes, breast cancer (Chlebowski *et al,* 2024). Previous research has also shown that it is not only prevalent among young and older adults, children are also affected by MS. More than 29% children with obesity have developed a high risk of MS aged between 7-9 years old. The metabolic screening of BC survivors' states that they have major changes in body after developing BC that creates higher risk for MS (Miranda-Tueros *et al,* 2024). Though the current

healthcare system has attempted multiple cases of MS, there is still an adequate gap that needs to be checked.

3. Aim of the Study

The aim of this study is to create a general knowledge and awareness on metabolic syndrome in the context of risk factors, prevalence, interventions, and awareness. It will also focus on effective strategies for management and prevention of MS to reduce global burden through systematic review and meta-analysis.

4. Materials and Methods

4.1 Data Sources and Search Strategy

This study has selected specific data from the authentic sources and selection of data was very specific. For this systematic review, systematic searches are done from sources like PubMed, Scopus and google scholar database. The search engine of these databases was used by using specific keywords. The keywords are "metabolic syndrome", "general knowledge", "awareness", "type II diabetes", "cardiovascular disease", "chronic diseases", "breast cancer", "adult", "children", "risk factor", "intervention". The PICOS framework has been used in this project for the search strategy. The details of the PICOS framework are mentioned below.

Table 1: PICOS framework

P= Population
I= Intervention
C= Comparison
O= Outcomes
S= Study design

(Source: Self-created)

4.2 Selection Criteria and data Extraction

According to the PICOS framework, this study has made few inclusion and exclusion criteria to extract data that have been collected through search strategy.

Inclusion Criteria: The inclusion criteria for the data extraction are as follows,

- Prevalence of Metabolic syndrome and related issues
- Quantitative approaches were included that highlighted interventions.
- All ranges of people starting from child (7 onwards) to younger adults have been chosen as samples.
- No geographic barrier is considered for the selection of samples as it is a global concern.
- Articles with systematic reviews, meta-analysis with interventions, prevalence and risk factors were selected.
- Articles published 2020 onwards have been included for data extraction. English language has been preferred.
- Only full text articles have been included.

Exclusion Criteria: The exclusion criteria for the data extraction are as follows,

- Articles with incomplete data or errors have been excluded.
- Articles with ethical issues have been excluded.
- Articles with only abstract and title are excluded.

As per the selection criteria, a total of four articles have been chosen that followed systematic reviews and meta-analysis. No disagreements were found and extracted data were categorised as per the necessary criteria. Out of the four chosen articles, Rus *et al,* 2023 stated the prevalence and risk factors MS through systematic review and meta-analysis. Larruy-García *et al,* 2024 mentioned that MS is not restricted to young and older adults, it is also prevalent in children. According to Harborg *et al,* 2025, women who have survived breast cancer are at high risk or suffering with MS. Lastly, Liang *et al,* 2021 highlighted the impact of combined exercises on patients with MS specially who are at high risk of cardiovascular diseases.

4.3 Study Population: PRISMA Flow Diagram

The study population will be highlighted through a PRISMA flow diagram that will mention the process to select the specific four articles for the study (Islam *et al,* 2024). The following PRISMA diagram shows the process of selecting the study population. First the relevant articles have been identified through the search engines named PubMed, Scopus and Google Scholar. A total of 1,167 articles were found which were filtered by searching specific titles as per this study. 950 relevant articles were found and the rest were excluded. After that, Full-text articles were selected by excluding 718 articles with only abstracts. The next filter was applied according to the inclusion criteria that showed 88 articles and the rest 144 articles were excluded. Finally, as per the exclusion criteria, 84 articles have been excluded and 4 articles have been chosen for systematic review and meta-analysis that ensured global coverage of evidence.

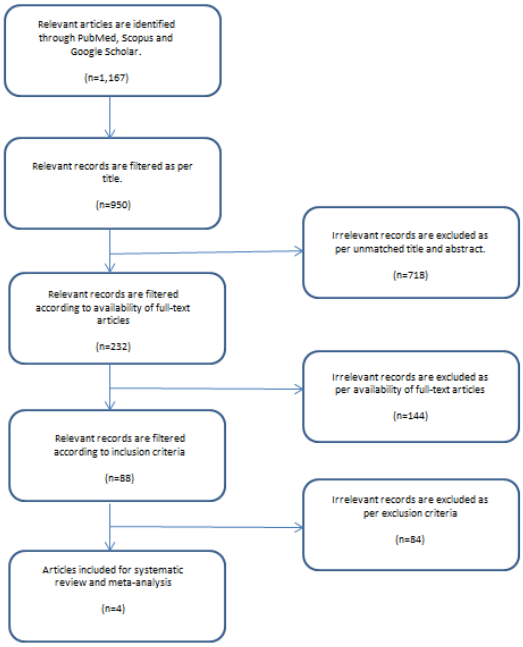

Figure 1: PRISMA Flow Diagram
(Source: Self-created)

4.4 Quality Assessment

Quality assessment of the relevant literature has been done through standardised tools. Rus *et al,* 2023 included 64 female patients and 53 male patients for the assessment of prevalence of MS while addressing their characteristics. The statistical analysis showed that the prevalence of MS is higher in men than females. Larruy-García *et al,* 2024 stated that quality assessment was done by the authors using cross-sectional studies. The Mediterranean dietary pattern has been chosen for the assessment of quality scores (Larruy-García *et al,* 2024). Harborg *et al,* 2025 included disease-free survival (DFS) data for the quality control of the report along with sensitivity analysis. Liang *et al,* 2021 used Jadad scale and the Cochrane Risk of Bias Tools for the quality assessment of the extracted data (Liang *et al,* 2021).

5. Result

5.1 Systematic Review

Title	Year of Publication	Aim of the study	Study design	Findings	Author
Prevalence and Risk Factors of Metabolic Syndrome: A Prospective Study on Cardiovascular Health	September, 2023	The aim of the study is to establish a correlation between several environmental factors, daily lifestyle and the level of risk of developing MS.	This prospective study included 117 patients of age group between 30-79 years. Out of them 53 were men and 64 were women and it was conducted from January 2022-February 2022.	Regular physical activity is preferred to deal with metabolic syndrome as it is developed due to obesity. A healthy lifestyle is important that includes a balanced diet, fresh vegetables and fruits. Excluding smoking and alcohol addiction is important to avoid cardiovascular complications.	Rus *et al,* 2023
Diet Quality Scores, Obesity and Metabolic Syndrome in Children and Adolescents: A Systematic Review and Meta-	September, 2024	It aimed to find a link between dietary plan, diet quality score and metabolic syndrome in children and adoles	Mediterranean dietary pattern It was followed to assess the children aged 12 years old. Diet-quality score	This study proves that there is a link between Mediterranean diet (MD), body mass index (BMI), waist circumference (WC). MD has a significa	Larruy-García *et al,* 2024

Analysis		cents.	(DQS), age of participants and obesity measurement is done.	nt impact on different DQS and obesity outcomes in children and adolescents.	
Metabolic syndrome is associated with breast cancer mortality: A systematic review and meta-analysis	2025	It focused on the assessment of risk level among women who have survived breast cancer.	Random-effects models are used to analyse the study data. Data collection was done from randomised-controlled data and observational studies (Harborg *et al,* 2025).	The research stated the importance of MS screening of BC patients and survivors to reduce the mortality rate. Other than that, reversing diabetes and lipid control can reduce the risk of MS in BC patients and survivors.	Harborg *et al,* 2025
Effects of aerobic, resistance, and combined exercise on metabolic syndrome parameters and cardiovascular risk factors: a systematic review and network meta-analysis	December, 2021	This study focuses on the evaluation of aerobic, resistance and combined exercise on the risk factors of metabolic syndrome.	STATA 15.0 software was included in the study for network meta-analysis (NMA). Bayesian random effects model Is included to compare the results from NMA.	Oxidative stress, endothelial dysfunction and inflammatory processes are considered as the pathophysiological components. The prevention of cardiovascular diseases (CVD) is based on these components that are linked with effective exercises. Resistance exercise is effective for inflammatory processes and endothelial activity. Anti-inflammatory and anti-oxidant activity are improved by aerobic exercises. Combined exercise is effective for both.	Liang *et al,* 2021

5.2 Meta-Analysis

5.2.1 Geographical barrier: As per the analysis of Rus *et al,* 2023, it can be said that rural background is a predisposing factor for the development of metabolic syndrome. People who are coming from rural environments are more susceptible to MS. As people from rural areas have low educational knowledge regarding the severity of MS, they sometimes neglect necessary precautions and treatment at the right time. However, other studies suggest that urbanisation is the reason behind the increasing rate of metabolic syndrome (Gonzalo-Encabo *et al,* 2023).

5.2.2 Smoking habit and addiction to alcohol: Studies have shown that people with smoking and alcohol addiction are more inclined towards the development of metabolic syndrome. According to Rus *et al,* 2023, out of all participants, 66.10% were alcohol consumers and 69.2% were non-alcoholic. The relationship between smoking habit, alcohol consumption and metabolic syndrome has been analysed which showed that people with these habits are more likely to develop metabolic syndrome (Sandsdal *et al,* 2023).

5.2.3 Age and Gender: The severity of this syndrome is based on gender and age. Almost every age group has been included in this study starting from 10 years to 60 years. As per reports men are more susceptible to MS than females (Rosenthal *et al,* 2022). On the other hand, people aged above 70 years have higher tendencies to develop this syndrome which increases the risk of cardiovascular disease.

5.2.4 Mediterranean Diet: Larruy-García *et al,* 2024 included Mediterranean Diet Score (MDS) in the meta-analysis. A comparative study was conducted between the people having low adherence to MD and high adherence to MD. Heterogeneity was tested using I2 statistics and sources were identified by comparing subgroups boys and girls. This study clearly proves that there is a link between MD and lifestyle of people, specifically during childhood (Dayi and Ozgoren, 2022).

5.2.5 Combined exercise: STATA 15.0 software was included in this study by Liang *et al,* 2021. Reports have suggested that aerobic exercise is best suitable to control metabolic syndrome and it also controls BMI. This study has proved that any kind of body exercise which lowers fat is the best exercise for metabolic syndrome.

6. Discussion

This systematic review and meta-analysis is focused on the growing concern regarding metabolic syndrome. According to the systematic review that has been done above, metabolic syndrome is directly linked with cardiovascular diseases. According to Rus *et al,* 2023, people from different age groups have different tendencies for developing this syndrome that increases the risk of cardiovascular disease. Furthermore, men also have higher tendencies than females for MS (Nabipoorashrafi *et al,* 2022). The author has also mentioned that geographical background, educational knowledge, smoking and alcohol addiction are also deciding factors of severity of the syndrome.

As per Harborg *et al,* 2025, female patients who have survived breast cancer are more susceptible for metabolic syndrome. This study has suggested that lipid control, maintaining a healthy lifestyle, reversing diabetes can reduce the risk of MS which in turn will reduce the mortality rate. In case of children and adolescents, the severity of the disease is measured by MDS which highlights the tendency of developing obesity according to BMI and WC (Noubiap *et al,* 2022). This study by Larruy-García *et al,* 2024 is clear indication that children and adolescents with high MDS are more prone to obesity and metabolic syndrome. Thus in the case of children and adolescents, their eating habits and maintenance of a balanced diet can lower the risk of MS. The study by Liang *et al,* 2021 mentioned the impact of combined exercises in controlling metabolic syndrome. Aerobic exercise and resistance exercise are considered to improve anti-oxidant process and endothelial function respectively. The combined exercise has an impact on both and it is safe for the prevention of cardiovascular diseases.

7. Conclusion

Metabolic syndrome is a growing global concern that is directly and indirectly increasing the morbidity and mortality rate. As per this systematic review, it has been understood that the prevalence of MS is dependent on the lifestyle of people of all age groups starting from children, young adults, older adults. The medical background is also a deciding factor for the severity of MS as the females with history of BC have higher tendencies of developing MS. A total of four articles have been chosen in this research for the systematic review and meta-analysis of a thorough understanding of metabolic syndrome. It has covered the prevalence of MS among all age groups and provided recommendations for improving the severity of MS by combined exercises. However, selection of only four articles is considered as a research gap that needs to be improved in future.

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