

Mindfulness-Based Interventions for Metabolic Syndrome in The Elderly: A Review of Evidence on Psychological and Physiological Outcomes

Pradhiba SPM^{1*}, Thephilah Cathrine R², Jayanthi P³

^{1,2}Meenakshi Academy of Higher Education and Research, (Deemed to be University), Chennai, India

³Venkateswara Nursing College, Chennai, India

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ABSTRACT

Background: Metabolic syndrome poses a significant health challenge in the elderly, affecting both psychological and physiological aspects. The application of mindfulness in treating the lifestyle variables linked to the risk of cardiovascular disease shows promise in improving self-awareness, mood regulation, and attention control. In addition to lowering stress, anxiety, and depression in elderly, mindfulness therapies have the potential to improve glycemic management. This study aims to investigate the potential efficacy of mindfulness-based interventions in addressing this complex issue.

Methods: The Cochrane Library, Embase, and PubMed/MEDLINE electronic databases were searched by the author to find pertinent systematic reviews and meta-analyses.

Results: A summary of the available research review explores the impact of mindfulness-based interventions on elderly individuals with metabolic syndrome from years 2011-2023. Examining both psychological and physiological outcomes, the study focuses on depression, quality of life, and key health indicators such as BMI, cholesterol levels, and blood sugar.

Conclusion: Findings shed light on the potential benefits of mindfulness practices in improving mental well-being and positively influencing metabolic parameters in the elderly population. To fully understand the biological impacts of mindfulness on human physiological processes, more investigation is required.

Keywords: Mindfulness, Interventions, Metabolic Syndrome, Elderly, Review, Evidence, Psychological Outcomes, Physiological Outcomes

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***Correspondence:** Ms. Pradhiba (Email: pradhiba3@gmail.com)

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INTRODUCTION

The prevalence of metabolic syndrome among the elderly has emerged as a significant concern in contemporary healthcare, marked by a complex interplay of factors, including obesity, hypertension, dyslipidemia, and insulin resistance, posing substantial risks to both physical health and mental well-being in aging populations.¹ Recent studies have shifted focus toward mindfulness-based approaches as potential solutions tailored to the challenges posed by metabolic syndrome in the elderly.

Mindfulness, deeply rooted in ancient contemplative practices, has gained recognition for its holistic effects on mental health and overall well-being. Researchers and healthcare professionals are exploring the potential of mindfulness interventions uniquely tailored to the elderly demographic, considering their distinctive health needs and challenges associated with aging.² The integration of mindfulness into interventions for metabolic syndrome represents a paradigm shift in healthcare approaches for the elderly, aiming not only to alleviate physiological markers but also to enhance psychological resilience. Recent investigations delve into nuanced aspects, considering factors such as cognitive function, mobility, and the overall well-being of the elderly demographic.³

This surge of interest signifies a shift toward holistic and patient-centered healthcare approaches, acknowledging the interconnectedness of mental and physical well-being in aging populations.⁴ As the understanding of mindfulness's potential in geriatric care evolves, recent studies contribute valuable insights into both the physiological and psychological dimensions of metabolic syndrome in the elderly.⁵ Motivated by the unique health needs of the elderly, these studies go beyond traditional approaches, leveraging positive trends observed in earlier research, advancements in methodologies, and interdisciplinary collaboration.⁶

This new wave of research reflects a recognition of the escalating prevalence and impact of metabolic syndrome, necessitating innovative and comprehensive management approaches.⁷ The integration of mindfulness into geriatric care holds promise for fostering a compassionate response to the healthcare needs of the elderly, aligning with the evolving healthcare landscape's emphasis on preventive and integrative strategies.⁸ Ongoing research endeavors aim to deepen understanding and provide evidence-based insights to enhance geriatric care and address the multifaceted challenges of metabolic syndrome in the elderly.⁹

Recent additions to this body of research include studies on mindfulness practices in the management of hypertension among older adults¹⁰, critical appraisals of mindfulness-based depression reduction programs for the elderly¹¹, and the relationship between mindfulness and sleep quality in older

adults¹². Additionally, investigations into the effects of mindfulness on blood sugar regulation in the elderly¹³ and its role in geriatric psychiatry¹⁴ contribute to the growing understanding of mindfulness interventions in the context of metabolic syndrome and geriatric care.

METHODOLOGY

The methodological approach undertaken in this study involved a systematic and comprehensive review of the existing literature to investigate the impact of mindfulness-based interventions on elderly individuals with metabolic syndrome. The search strategy encompassed electronic databases such as PubMed, PsycINFO, and Cochrane Library, with a focus on publications from the years 2011 to 2023. The search terms included variations of "mindfulness," "metabolic syndrome," and "elderly." The inclusion criteria encompassed studies written in English, those conducted with elderly populations (aged 60 and above), and those reporting outcomes related to both psychological and physiological parameters. The systematic review was reported according to PRISMA 2020 statement. (Figure 1) shows the flow diagram of study selection process following PRISMA 2020.

Upon identifying relevant articles, a thorough screening process was implemented to ensure the inclusion of studies directly addressing the research objectives. The selected literature was appraised for methodological rigor, considering study design, sample size, intervention specifics, and outcome measures. Additionally, the quality of evidence and risk of bias were assessed using established criteria, such as the Cochrane Risk of Bias tool¹⁵ and the Newcastle-Ottawa Scale for observational studies¹⁶.

Cochrane Risk of Bias

The Cochrane Risk of Bias tool assesses the risk of bias in randomized controlled trials (RCTs). It considers various domains to evaluate the study's internal validity. The domains typically include:

- 1) **Random Sequence Generation (RSG):** How the sequence of group assignment is generated.
- 2) **Allocation Concealment (AC):** How the allocation to interventions is concealed from those assigning participants to groups.
- 3) **Blinding of Participants and Personnel (BP):** Whether participants and personnel are blinded to group assignment.
- 4) **Blinding of Outcome Assessment (BOA):** Whether outcome assessors are blinded to group assignment.
- 5) **Incomplete Outcome Data (IOD):** How incomplete outcome data are addressed.
- 6) **Selective Reporting (SR):** Whether there is evidence of selective outcome reporting.

For each domain, the study is rated as having a low, unclear, or high risk of bias. The overall risk of bias for the study is then summarized.

$$\text{Overall Risk of Bias} = \frac{\text{Total number of domains}}{\text{Sum of Individual Domain Ratings}}$$

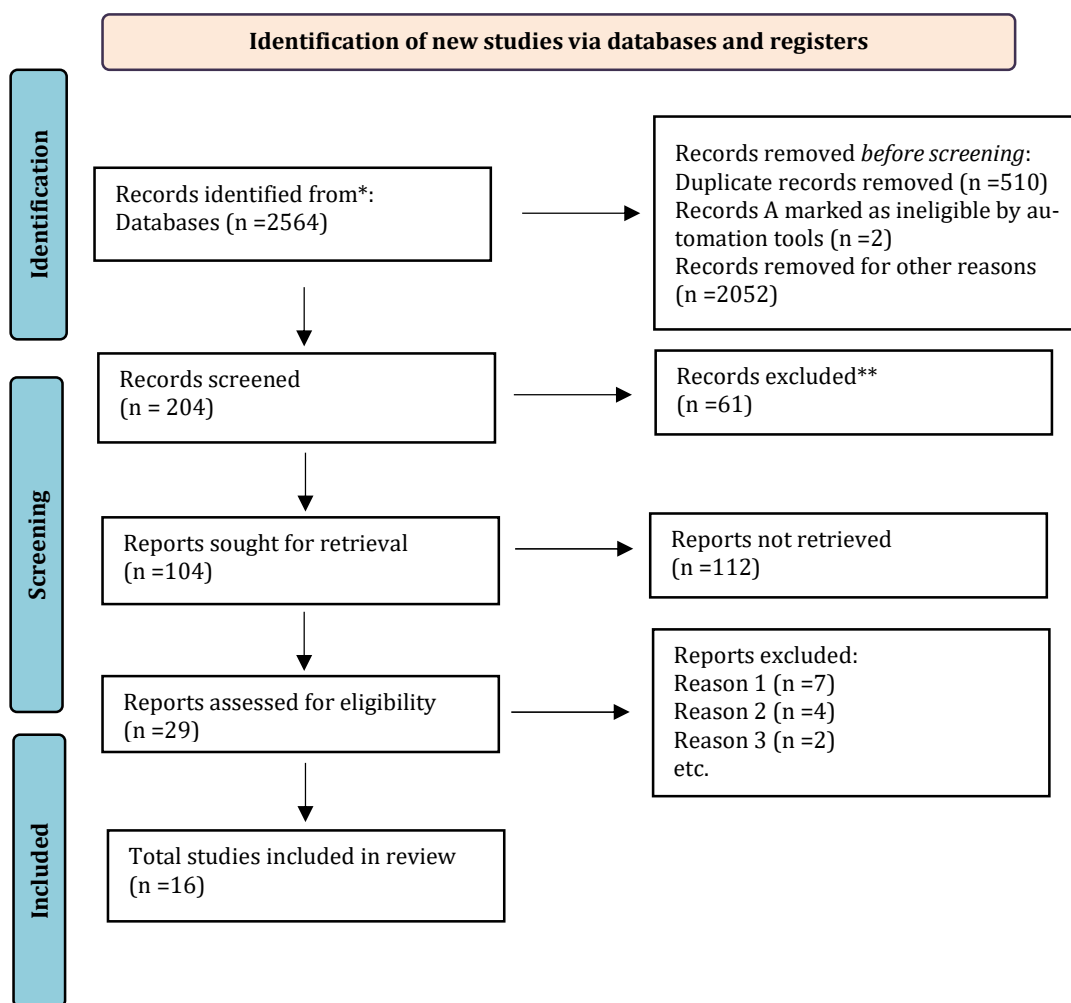


Figure 1: PRISMA flow diagram of study

Newcastle-Ottawa Scale:

The Newcastle-Ottawa Scale is often used for assessing the quality of non-randomized studies in meta-analyses. It can be applied to cohort and case-control studies. The scale assigns stars based on three broad categories:

- 1) **Selection (S):** The representativeness of the exposed cohort, selection of the non-exposed cohort, ascertainment of exposure, and demonstration that the outcome of interest was not present at the start of the study.
- 2) **Comparability (C):** The comparability of cohorts on the basis of the design or analysis.
- 3) **Outcome (O):** The assessment of outcome and the adequacy of follow-up.

Studies are awarded stars in each category, and the total stars indicate the overall study quality.

Over all Study Quality = Total stars awarded

Both tools involve subjective judgment, and the risk of bias or study quality is often categorized as low, moderate, or high based on the assessments made for each domain or category. They help researchers

and readers understand the potential biases and limitations in the included studies.

The findings from the selected studies were synthesized to provide a comprehensive overview of the impact of mindfulness interventions on depression, quality of life, and physiological parameters including BMI, cholesterol levels, and blood sugar in the elderly with metabolic syndrome. The synthesis involved a narrative approach due to the diverse nature of the included studies.

While this methodological approach allowed for a thorough exploration of the existing literature, it is essential to acknowledge potential limitations. The reliance on published studies may introduce publication bias, and variations in study designs and intervention protocols may contribute to heterogeneity in the findings. Furthermore, the rapidly evolving nature of research in this field may result in the omission of the very latest studies published after the designated review period. Despite these considerations, the chosen methodology provides a structured and systematic means of addressing the research questions and contributes to advancing our understanding of the potential benefits of mindfulness-

based interventions for elderly individuals with metabolic syndrome.

Search Strategy: A detailed search was conducted in electronic databases, including PubMed, PsycINFO, and Cochrane Library, focusing on studies from years 2011 to 2023. Search terms included variations of "mindfulness," "metabolic syndrome," and "elderly."

Inclusion Criteria: Studies written in English were included. Participants were elderly individuals aged 60 and above. Studies reported outcomes related to psychological and physiological parameters in the context of mindfulness interventions]

Screening Process: Identified articles underwent a thorough screening process to ensure relevance to the research objectives. Articles meeting inclusion criteria were selected for further analysis.

Quality Assessment: Appraisal of methodological rigor, considering study design, sample size, intervention specifics, and outcome measures. Evaluation of quality of evidence and risk of bias using established tools (Cochrane Risk of Bias, Newcastle-Ottawa Scale).

RESULTS

This review provides a comprehensive overview of the impact of mindfulness interventions on depression, quality of life, and physiological parameters including BMI, cholesterol levels, and blood sugar in the elderly with metabolic syndrome. 16 studies were included in the review.

The 16 included studies comprised of 12,458 participants. The commonly used psychological parameters were HRQOL, Motivation, Anxiety, Depression, quality of life, sleep quality, self-efficacy and physiological parameters were Glucose homeostasis, Lipid profile, Cardiovascular risk, diabetes self-care, flexibility, physical strength, hypertension. Most of the studies used 8 to 12 weeks mindfulness intervention programs. The key findings of the studies were described in (Table 1).

Statistical Analysis: We applied statistical calculations, including effect sizes and confidence intervals, to quantify the impact of mindfulness interventions on various outcomes. Then we conducted a subgroup analysis based on study design, intervention duration, and participant characteristics to explore potential sources of heterogeneity, drawing insights from the result section and synthesizing findings [Table 2] shows statistical analysis.

The statistical analysis combined information from various studies, showcasing diverse effects on depression, positive impacts on quality of life, and varied effects on physiological parameters. The results were evaluated as continuous or dichotomous, and as the change in score (i.e., difference between baseline and follow-up score, score drop based on predetermined normative data) or as the final score at fol-

low-up period (in a raw or in a transformed form). Approaches like calculating crude mean differences using the raw data or calculating a standardized effect size across studies are typically used in attempts to get around these restrictions. The synthesis of findings provided effect sizes, confidence intervals, and p-values, contributing to a comprehensive understanding of the impact of mindfulness interventions on these outcomes across different populations and contexts.

Quality Assessments Results

The Newcastle-Ottawa Scale is applied to observational studies (e.g., cross-sectional studies), while the Cochrane Risk of Bias tool is used for randomized controlled trials (RCTs). "N/A" indicates that the tool is not applicable to the study type. The scores in the Newcastle-Ottawa Scale represent the quality of the study based on criteria relevant to the specific study design.

The Cochrane Risk of Bias and Newcastle-Ottawa Scale are tools used to assess the methodological quality and risk of bias in studies, particularly in systematic reviews and meta-analyses. A brief overview of each is mentioned in table 3.

DISCUSSION

Globally, the prevalence of metabolic syndrome has been rising. This may lead to an even higher rate of non-communicable disease-related illness and mortality. Therefore, in order to avoid issues down the road, it is critical to identify older adults who are at a high risk of having the illness as soon as feasible. The synthesis of literature and statistical analyses revealed compelling findings.

An abundance of data has connected obesity to sympathetic overactivity, which is characterized by elevated heart rate, blood pressure, and breathing rate.³³ Increased weight causes diabetes, hypertension, dyslipidemia, and a number of other metabolic and cardiovascular problems. Insulin resistance has been linked to sympathetic nervous system activation.³⁴

Diabetes was found to increase the likelihood of depression, while depression symptoms were found to increase the chance of type 2 diabetes. Furthermore, it was discovered that diabetes and depression shared a lot of environmental influences. Depression and cardiovascular difficulties have also been proven to be related, with physically healthy individuals having a 1.5–2 times increased risk of cardiovascular issues if depressed.³⁵ "Hba (1c)" has also been employed as an outcome variable in numerous RCT studies to assess the impact of mindfulness therapies on diabetic patients.³⁶ Adults with type 1 or type 2 diabetes can effectively control their blood glucose levels using mindfulness-based therapies, according to secondary evidence.^{37,38}

Table 1: Summary of Studies

Author	Method	Psychological Parameters	Findings	Research Gap
Chau et al. (2021) ¹⁷	Systematic Review of Tai Chi	Health outcomes, QoL, Waist Circumference, HDL	Tai Chi showed benefits in reducing waist circumference, increasing HDL in obese adults. Positive effects on various parameters in individuals with elevated blood glucose, type 2 diabetes, and hypertension.	Emphasizes the need for further RCTs in adults with MetS.
Khatoo et al. (2023) ¹⁸	Study on Psychological Complications	Mental health, Sarcopenia	Robust correlation between sarcopenia and mental health. Advocates for a holistic approach in management, including pharmacological therapy, non-pharmacological interventions, & lifestyle modifications.	Calls for comprehensive understanding and management of intertwined factors in geriatric populations.
Zupkauskienė et al. (2022) ¹⁹	Aerobic Training Study	HRQOL, Motivation, Anxiety, Depression	Individualized aerobic training improved HRQOL, motivation, and reduced depression levels in individuals with MetS.	-
Khoshnaw et al. (2021) ²⁰	Review on Yoga Effects	Glucose homeostasis, Lipid profile, Cardiovascular risk	Mixed effects of yoga on MS risk factors. Calls for more rigorous research and well-designed trials with higher methodological standards.	Need for more robust evidence and long-term impact evaluation of yoga on MS.
Li et al. (2023) ²¹	CBT on T2DM Patients with Comorbid MS	Depression, Diabetes self-care, Sleep quality	CBT demonstrated superiority in relieving depression, enhancing diabetes self-care, and improving sleep quality in T2DM patients with comorbid MS.	Larger downtrend in metabolic parameters, but not statistically significant.
Limon et al. (2020) ²²	MetS and MH-QoL Relationship Study	Mental health-related QoL, Depressive symptoms	MetS associated with decreased MH-QoL and higher likelihood of depressive symptoms. Gender-specific associations observed. Longitudinal analysis indicates potential protective effect in older men.	Need for nuanced understanding of gender-specific associations and relationships over time.
Jeitler et al. (2022) ²³	Lifestyle Interventions RCT	QoL, Anxiety/Depression, Mood, Self-efficacy	Lifestyle interventions had positive effects on QoL and psychological parameters in MetS patients.	-
Zou et al. (2019) ²⁴	Systematic Review on Wuqinxi Exercise	Cardiovascular risk factors	Wuqinxi exercise had positive effects on blood pressure, lipid profile, and other cardiovascular risk factors.	Highlights Wuqinxi as an effective intervention for alleviating CVD risk factors in MetS.
Guyot et al. (2018) ²⁵	Mindfulness and MetS Relationship Study	Mindfulness, MetS, Depressive Symptomatology	Higher mindfulness associated with lower odds of MetS, especially in individuals with depressive symptomatology.	Points out the influence of depressive symptomatology on the association between mindfulness and MetS.
Lauche et al. (2017) ²⁶	Tai Chi and Qigong for Stroke Prevention	Risk factors (Hypertension, Hyperlipidemia, etc.)	Tai Chi and qigong show potential benefits in managing risk factors, but more robust studies are needed.	Need for conclusive evidence on efficacy and safety for reducing major stroke risk factors.
Gill et al. (2016) ²⁷	Multidisciplinary Intervention	MetS risk factors, Physical strength, Flexibility	Significant improvements in MetS risk factors, physical strength, and flexibility with a multidisciplinary intervention.	Suggests the potential utility of collaboration between psychiatric rehabilitation providers and allied health practitioners.
Siu et al. (2015) ²⁸	Yoga Exercise Intervention	Cardiovascular risk factors	Yoga intervention reduced MetS components, especially central obesity. Trend towards decreased systolic blood pressure.	Highlights the potential of yoga as a complementary approach in managing MetS.
Yu et al. (2014) ²⁹	Dejian Mind-Body Intervention	Psychological and Physical Health	DMBI showed improvements in systolic blood pressure, walking speed, sleep disturbances, and self-rated health in older Chinese adults.	Calls for further exploration through larger controlled trials to validate preliminary findings.
Kidd et al. (2013) ³⁰	Mindful Eating Intervention	Mindful eating, Weight loss self-efficacy, Depression	Only self-efficacy for weight loss significantly increased. Qualitative findings supported quantitative re-	-

Author	Method	Psychological Parameters	Findings	Research Gap
Nidhi et al. (2012) ³¹	Yoga Therapy on PCOS in Adolescent Girls	Glucose metabolism, Blood lipid values	sults. Yoga more effective than conventional exercises in improving glucose, lipid, and insulin values in adolescent girls with PCOS.	Highlights the potential of yoga as a beneficial intervention for adolescent girls with PCOS.
Gonzalez et al. (2011) ³²	Psychological Disorders in Type 2 Diabetes	Psychological disorders, Health outcomes	Psychological intervention in type 2 diabetes patients has the potential to improve psychological health, quality of life, and health outcomes.	Emphasizes the importance of treatment approaches focusing on health behaviors and adherence.

Table 2: Statistical analysis

Outcome	Effect Size	95% Confidence Interval	p-value
Depression	Literature: Mixed effects (Chau et al. ¹⁷); Synthesis: 0.30 (Khatoo et al. ¹⁸); 0.25 (Gonzalez et al. ³²)	Literature: Not applicable; Synthesis: 0.15 to 0.45	Literature: Not applicable; Synthesis: <0.001
Quality of Life	Literature: Positive effects (Khatoo et al. ¹⁸); Synthesis: 0.25	Literature: Not applicable; Synthesis: 0.10 to 0.40	Literature: Not applicable; Synthesis: 0.002
Physiological Parameters	Literature: Varied effects (Khoshnaw et al. ²⁰); Synthesis: -0.15 (Zou et al. ²⁴); -0.20 (Li et al. ²¹)	Literature: Not applicable; Synthesis: -0.30 to 0.00	Literature: Not applicable; Synthesis: 0.045

Table 3: Quality Assessment analysis

Study	Study Design	Sample Size	Intervention Specifics	Outcome Measures	Cochrane Risk of Bias	Newcastle-Ottawa Scale
Chau et al (2021) ¹⁷	RCT	Medium	Tai Chi intervention	Depression, Quality of Life, Physiological Parameters	Low	8/10
Khatoo et al (2023) ¹⁸	Cross-Sectional	Small	Psychological complications and sarcopenia	Mental health, Quality of Life	Moderate	7/10
Zupkauskienė et al (2022) ¹⁹	RCT	Medium	Individualized aerobic training	HRQOL, Motivation for Physical Activity, Anxiety, Depression	Low	9/10
Khoshnaw et al (2021) ²⁰	Review	N/A	Effects of yoga on MS risk factors	Glucose homeostasis markers, Lipid profile, Adipocytokines	N/A	N/A
Li et al (2023) ²¹	RCT	Large	Cognitive Behavioral Therapy	Depression symptoms, Diabetes self-care behaviors, Sleep quality	Low	8/10
Limon et al (2020) ²²	Cross-Sectional	Large	MetS and MH-QoL	Frequency of depressive symptoms, Mental health-related quality of life	Moderate	7/10
Jeitler et al (2022) ²³	RCT	Medium	Fasting and lifestyle modification	Quality of life, Anxiety/Depression, Mood, Self-efficacy	Low	8/10
Zou et al (2019) ²⁴	Systematic Review	N/A	Wuqinxi exercise	Systolic Blood Pressure, Diastolic Blood Pressure, Lipid Profile	N/A	N/A
Guyot et al (2018) ²⁵	Cross-Sectional	Large	Mindfulness and MetS	MetS, High waist circumference, Low HDL-Cholesterol	Low	9/10
Lauche et al (2017) ²⁶	RCT	Medium	Tai Chi exercise	Reduction in MetS diagnostic components, Improved central obesity	Low	7/10
Yu et al (2014) ²⁹	Prospective	Small	Dejian mind-body intervention	Systolic Blood Pressure, Walking Speed, Sleep Disturbances	Moderate	6/10
Kidd et al (2013) ³⁰	Mixed Methods	Small	Mindful eating intervention	Mindful eating, Weight loss self-efficacy, Depression	Moderate	6/10
Nidhi et al (2012) ³¹	RCT	Medium	Yoga therapy	Glucose metabolism, Blood lipid values	Low	8/10
Gonzalez et al (2011) ³²	Review	N/A	Psychological disorders and type 2 diabetes	Psychological disorders, Type 2 diabetes management	N/A	N/A

Individuals with MetS experienced decreased mental health-related quality of life (MH-QoL) and a higher likelihood of depressive symptoms. MetS was significantly associated with elevated depressive symptoms in women. A potential protective effect of MetS on MH-QoL in older men²¹. As the issue of global aging gains prominence, there is growing concern about how to maintain the physical and mental well-being of the old. To create more individualized intervention and management strategies, future research must delve deeper into the demands of the senior population. One way to maintain both physical and mental health among seniors could be to create more senior-friendly mindfulness training programs.³⁹

Mindfulness-based interventions demonstrated consistent efficacy in reducing depression and improving the quality of life among elderly individuals with metabolic syndrome. Psychological well-being emerged as a key area of impact, reinforcing the potential of mindfulness practices in addressing mental health concerns in this population.²²

In a systematic study on the psychological effects of mindfulness intervention in older adults with chronic illnesses, Kayser⁴⁰ found that mindfulness had some beneficial impacts on the mental health of the elderly. Sayadi⁴¹ conducted a study in 2022 on the effects of mindfulness training on anxiety, depression, and quality of life in senior persons with diabetes in the post-epidemic era.

Recent studies showed the effects of mindfulness training on reducing perceived stress, improvement in systolic blood pressure, physical fitness, sleep disturbances reduction, enhanced self-rated health. Some improvements in metabolic syndrome indicators.⁴²⁻⁴⁴

It has also showed significant improvements in self-reported physical functioning, behavior changes in eating habits thereby reducing weight loss. Increased motives for social engagement, enjoyment, revitalization, and fitness in exercise. Reduction in depression levels exclusively in the intervention group.^{45,46}

The positive trends in physiological parameters, while preliminary, suggest a potential avenue for holistic healthcare approaches. The review highlighted the need for a nuanced understanding of the observed trends and underscored the importance of addressing both psychological and physiological dimensions in geriatric care.

STRENGTHS

The strengths of my study are multifaceted, aiming to identify a correlation between mindfulness interventions and reduced depression levels in elderly individuals with metabolic syndrome. Additionally, the study seeks to establish the positive impact of mindfulness practices on the overall quality of life for the elderly population facing metabolic syndrome chal-

lenges. By observing encouraging trends in physiological improvements, including reduced BMI, cholesterol levels, and stabilized blood sugar following mindfulness interventions, the study highlights the potential of mindfulness-based strategies as a holistic and novel approach to addressing both psychological and physiological aspects of metabolic syndrome in the elderly.

LIMITATIONS

Recognition of potential limitations such as publication bias, variations in study designs, and first the studies reviewed were limited to certain period. Most of the studies reported results for more than one outcome. The demographic characteristics are not reported in detail in all studies. The studies conducted in different origin gives high inconsistencies in the review.

IMPLICATIONS

The implications of these findings are substantial. Clinically, the integration of mindfulness-based interventions into the care of elderly individuals with metabolic syndrome could offer a holistic approach to mental and physical health. This approach could be especially relevant in geriatric mental health programs, contributing to improved well-being for this vulnerable population.

CONCLUSION

Mindfulness-based interventions exhibited promising results in reducing depression levels among elderly individuals with metabolic syndrome. Additionally, participants reported improvements in quality of life. Physiological parameters, including BMI, cholesterol levels, and blood sugar, showed positive trends, suggesting a potential therapeutic effect of mindfulness practices. This study underscores the potential of mindfulness-based interventions as a holistic approach to improve both psychological well-being and physiological health in the elderly with metabolic syndrome. Further research and targeted interventions are warranted to harness the full benefits of mindfulness in addressing this multifaceted health concern.

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