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Mediterranean Diet Counseling for Obesity and Metabolic Syndrome: A Narrative Review

Nadia Benaicha[1]*, Maryame El Khayari[2], Chaymae Bekri[3], Nadia El Karssi[3], Hassan Chaachouay[3]

[1]Department of Public Health, Faculty of Medicine, Moulay Ismail University, Errachidia, Morocco
[2]Department of Gastroenterology, Faculty of Medicine, Moulay Ismail University, Errachidia, Morocco
[3]Environment Research Team, Faculty of Sciences and Technology (FST), Moulay Ismail University, Errachidia, Morocco

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***Corresponding author:** Nadia Benaicha
Department of Public Health, Faculty of Medicine, Moulay Ismail University, Errachidia, Morocco

Abstract | **Review Article**

Background: Obesity and metabolic syndrome are major public health challenges worldwide and are associated with increased cardiovascular risk and type 2 diabetes. Lifestyle interventions remain the cornerstone of prevention and management. The Mediterranean diet has consistently been associated with improved cardiometabolic outcomes; however, translating evidence into effective counseling strategies in routine practice remains challenging. ***Objective:*** To summarize current evidence on Mediterranean diet counseling in adults with obesity and/or metabolic syndrome and to highlight practical implications for clinical practice and public health interventions. ***Methods:*** We conducted a narrative review of published studies addressing Mediterranean diet interventions, counseling strategies, adherence determinants, and cardiometabolic outcomes in adults. Evidence was synthesized to provide a practical overview for clinicians and multidisciplinary teams involved in lifestyle management. ***Results:*** Mediterranean diet counseling is associated with improvements in body weight, waist circumference, lipid profile, glycemic control, inflammatory markers, and overall cardiometabolic risk. Effective counseling strategies commonly include individualized nutritional education, goal setting, motivational interviewing, culturally adapted dietary plans, and structured follow-up. Barriers to adherence include socioeconomic constraints, limited access to healthy foods, low health literacy, and competing lifestyle priorities. Multidisciplinary approaches and community-based programs may enhance long-term adherence. ***Conclusion:*** Mediterranean diet counseling represents a feasible and evidence-based strategy for improving cardiometabolic health in adults with obesity and metabolic syndrome. Integrating structured counseling methods, culturally appropriate educational tools, and coordinated multidisciplinary care may optimize adherence and outcomes. Further research is needed to identify scalable models for implementation in low- and middle-income settings.

Keywords: Dietary counseling; Mediterranean diet; Metabolic syndrome; Obesity; Preventive Medicine.

INTRODUCTION

Obesity and metabolic syndrome (MetS) are major public health challenges worldwide. According to the World Health Organization (WHO), the prevalence of obesity has nearly tripled since 1975 [1]. MetS—which includes central adiposity, dyslipidemia, elevated blood pressure, and impaired glucose regulation—now affects more than one billion adults globally and significantly increases the risk of type 2 diabetes and cardiovascular disease [2,3].

It is well established that inadequate dietary habits can contribute to metabolic disturbances, leading to the development of obesity or the onset of metabolic syndrome; therefore, dietary patterns may also play a preventive role in these conditions. Western dietary habits are strongly associated with obesity and MetS [4]. In contrast, traditional dietary models such as the Mediterranean diet (MedDiet) consistently demonstrate protective effects [5,6]. Scientific interest in the MedDiet was first established by Ancel Keys and the Seven Countries Study, which highlighted the association between Mediterranean eating habits and lower cardiovascular mortality [7]. The MedDiet is characterized by high consumption of fruits, vegetables, legumes, whole grains, nuts, and olive oil; moderate consumption of fish and dairy products; and low intake of red and processed meats [8].

This narrative review aims to:

- define the Mediterranean diet and its key components;
- describe the epidemiology of obesity and MetS;
- examine the evidence linking the MedDiet to obesity and MetS;
- explain the underlying physiological mechanisms;
- and discuss clinical and public health implications, with a particular focus on Morocco.

METHODS

This narrative review followed a structured approach aligned with established methodological principles for narrative synthesis.

3.1. Literature Search Strategy

A comprehensive literature search was carried out in PubMed, Scopus, and Google Scholar, covering publications from January 2000 to December 2024. The search combined Medical Subject Headings (MeSH) and free-text terms, including:

- "Mediterranean diet"
- "obesity"
- "metabolic syndrome"
- "visceral adiposity"
- "insulin resistance"
- "inflammation"

Reference lists of key studies were also screened to identify additional relevant sources.

3.2. Inclusion and Exclusion Criteria

Inclusion criteria

Studies were included if they:

- Evaluated the Mediterranean diet or a validated MedDiet adherence score.
- Reported at least one metabolic outcome (BMI, waist circumference, visceral adiposity, glycemic markers, lipid profiles, blood pressure, or inflammatory/oxidative biomarkers).
- Were observational, randomized controlled trials (RCTs), meta-analyses, mechanistic studies, or narrative/systematic reviews.
- Involved adult populations.

Exclusion criteria

Studies were excluded if they:

- Focused exclusively on children or adolescents.
- Examined multicomponent lifestyle interventions without isolating the effect of the MedDiet.
- Provided no original data or mechanistic interpretation.
- Were commentaries, editorials, conference abstracts without full text, or non–peer-reviewed sources.

3.3. Screening and Selection Process

Titles and abstracts were initially screened to identify potentially relevant studies. Full-text articles were then examined to confirm eligibility. When uncertainty arose, inclusion decisions were based on conceptual alignment with the objectives of this review

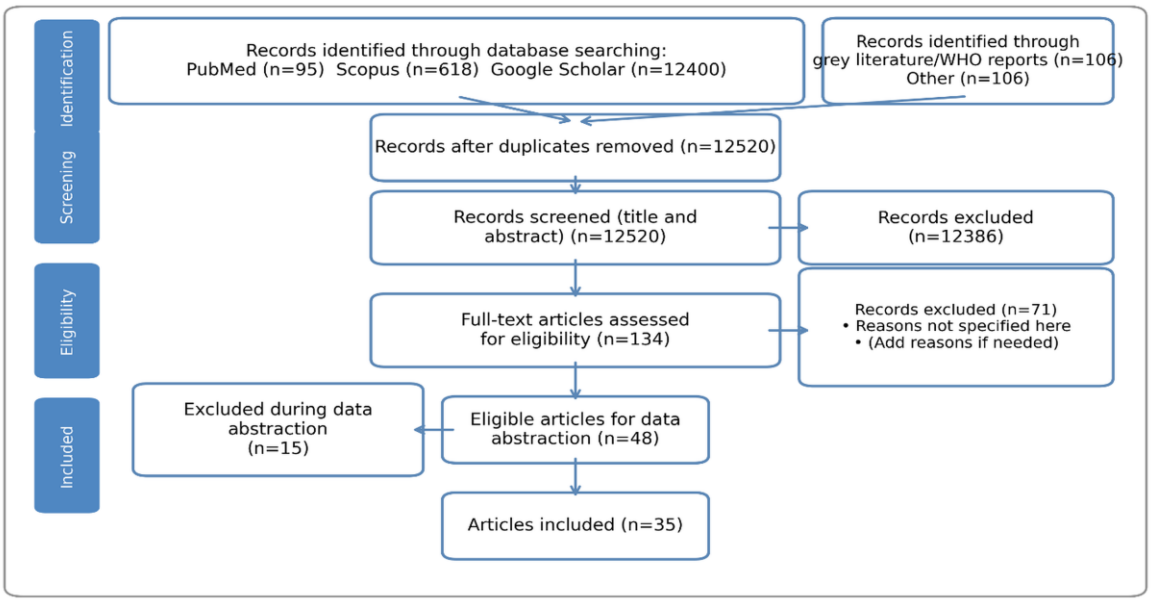

Figure 1: Flow diagram of literature search and narrative study selection process (January 1, 2014–December 31, 2025). (Adapted from Page MJ *et al.*, 2020)

RESULTS / NARRATIVE SYNTHESIS

4.1. The Mediterranean Diet: Definition and Core Principles

4.1.1. Historical Background

The Mediterranean diet (MedDiet) originates from the traditional eating habits of populations living around the Mediterranean basin. Since Keys' Seven Countries Study, the MedDiet has become one of the most extensively documented dietary models, supported by robust epidemiological and clinical evidence [8].

4.1.2. Key Components of the Mediterranean Diet

The MedDiet is primarily plant-based and emphasizes:

- a high intake of fruits, vegetables, legumes, nuts, and whole grains, providing fiber, antioxidants, and polyphenols;
- olive oil as the main source of fat, particularly extra-virgin olive oil, which is rich in monounsaturated fatty acids and anti-inflammatory bioactive compounds [15];
- moderate consumption of fish and seafood, key sources of omega-3 fatty acids;
- moderate intake of dairy products, mainly fermented;
- low consumption of red and processed meats, refined sugars, and ultra-processed foods [4].

In some cultural contexts, moderate consumption of red wine with meals is part of the tradition, although this recommendation varies depending on clinical and cultural considerations.

4.1.3. Nutrient Density and Glycemic Load

The MedDiet is characterized by:

- a high supply of antioxidants (polyphenols, carotenoids, vitamins C and E) [11,12];
- abundant dietary fiber, enhancing satiety and glycemic control;
- a favorable lipid profile (rich in MUFAs and PUFAs);
- a low glycemic load, limiting postprandial glucose excursions [8].

These features contribute to its metabolic and cardioprotective effects.

4.1.4. Adherence Scoring Systems

Several validated scoring tools exist to assess adherence to the MedDiet, including:

- The Mediterranean Diet Score (MDS);
- The Alternate Mediterranean Diet score (aMED);
- The PREDIMED adherence score [9,10].

Despite methodological differences, higher adherence scores are consistently associated with better metabolic outcomes [5,6].

4.1.5. Comparison with Western Diets

Western diets—typically high in ultra-processed foods, sugars, and saturated fats—promote inflammation, oxidative stress, and insulin resistance [4]. In contrast, the MedDiet is associated with improved lipid profiles, reduced inflammation, and lower cardiometabolic risk [5,8,11].

4.1.6. The Mediterranean Diet Pyramid

Table 1 was constructed by the authors based on key elements of the Mediterranean diet pyramid reported in previous studies [16,17].

Table 1: Structured presentation of the Mediterranean diet pyramid (adapted from Bach-Faig *et al.*, 2011)

Pyramid Level	Frequency of Consumption	Food Groups Included	Notes / Recommendations
Lifestyle Base	Daily lifestyle habits	Regular physical activity; shared meals / social eating	Core component of the Mediterranean lifestyle
Level 1	Daily	Fruits; vegetables; legumes; whole grains; nuts and seeds; olive oil (main fat source)	Emphasis on plant-based, minimally processed foods rich in fiber and polyphenols
Level 2	Daily / Moderate	Dairy products (preferably yogurt and cheese)	Moderate intake; prioritize fermented dairy
Level 3	Several times per week	Fish and seafood; poultry; eggs	Sources of lean protein and omega-3 fatty acids
Level 4	Occasional (moderate)	Red meat; processed meats (charcuterie)	Should be limited to reduce inflammation and cardiometabolic risk
Level 5 (Top)	Occasional	Sweets; pastries; ultra-processed snacks	To be consumed rarely
Optional	Moderate	Red wine, with meals only	Only if culturally acceptable and medically appropriate

4.2. Association Between the Mediterranean Diet and Obesity

4.2.1. Evidence from Observational Studies

During our literature search for this narrative review, we found that many observational studies report an inverse association between adherence to the Mediterranean diet (MedDiet) and obesity markers such as BMI, waist circumference, and visceral adiposity [5,6,18]. These associations remain significant even after adjusting for confounding factors such as physical activity, socioeconomic status, or total energy intake.

4.2.2. Evidence from Randomized Controlled Trials

In the PREDIMED trial, participants following a Mediterranean diet enriched with extra-virgin olive oil or nuts experienced significant reductions in waist circumference and improvements in metabolic biomarkers, compared with those following a low-fat diet [9]. We also found that other RCTs conducted in populations with obesity, diabetes, or hypertension confirm the consistent benefits of the MedDiet on body weight and fat distribution [8,15].

4.2.3. Findings from Meta-Analyses

Regarding meta-analyses, many confirm the beneficial effects of the MedDiet on body weight and fat distribution, showing reductions in body weight and waist circumference, modest but clinically meaningful reductions in BMI and preferential decreases in visceral adiposity [6,19]. Importantly, many benefits occur even without caloric restriction, highlighting the intrinsic metabolic advantages of the MedDiet [19].

4.2.4. Effects on Satiety and Energy Intake

Several components of the MedDiet contribute to improved satiety and optimized energy balance such as Fiber-rich foods increase satiety and stabilize blood glucose and minimally processed foods reduce exposure to hyper-palatable foods that promote overeating [4].

4.3. Association Between the Mediterranean Diet and Metabolic Syndrome

4.3.1. Evidence from Observational Studies

Observational evidence consistently shows that higher adherence to the MedDiet is associated with improvements in all components of metabolic syndrome (MetS). Several prospective studies report a 20–40% reduction in MetS incidence among individuals with high MedDiet adherence [6,16,20].

4.3.2. Evidence from Randomized Controlled Trials and Meta-Analyses

The PREDIMED trial demonstrated significant improvements in central obesity, fasting glucose, lipid profiles, blood pressure and insulin sensitivity [9,10]. For high-risk populations (prediabetes, diabetes, hypertension, NAFLD), we identified additional randomized controlled trials showing consistent metabolic benefits from adopting the MedDiet [8,15].

These findings were confirmed by numerous meta-analyses. These improvements translate into a 20–35% reduction in the likelihood of developing MetS.

- Abdominal obesity: reduction in visceral fat through anti-inflammatory and insulin-sensitizing effects [12,15].
- Dyslipidemia: improvements mediated by fiber, MUFAs, PUFAs, and polyphenols [11,15].
- Hypertension: enhanced endothelial function, reduced oxidative stress, and improved nitric oxide availability [8,11].
- Hyperglycemia: improved insulin signaling and glycemic control [10].

4.3.4. Effects on Individual Components of Metabolic Syndrome

Table 2: Mediterranean Diet and Metabolic Benefits

MetS Component	Effect of MedDiet	Evidence Level
Abdominal obesity	↓ visceral fat	Randomized controlled trials
Triglycerides	↓ TG	Meta-analyses
HDL	↑ HDL	Cohort studies
Blood pressure	↓ SBP/DBP (Systolic Blood Pressure/Diastolic Blood Pressure)	Randomized controlled trials
Fasting glucose	↓ glucose, ↑ insulin sensitivity	Randomized controlled trials

Abbreviations: TG, triglycerides; HDL, high-density lipoprotein; SBP, systolic blood pressure; DBP, diastolic blood pressure

4.3.5. Reversal of Metabolic Syndrome

Not only is the MedDiet associated with significant improvements in metabolic syndrome, but several RCTs show that it can also reverse MetS in a substantial proportion of individuals, through improvements in abdominal obesity, insulin resistance, and inflammatory markers [9,10].

6. PATHOPHYSIOLOGICAL MECHANISMS

6.1. Improvement of Insulin Sensitivity

The MedDiet enhances insulin sensitivity through several complementary pathways such as reduction of visceral adiposity, decreasing lipotoxicity and the release of inflammatory cytokines; increased adiponectin, promoting fatty acid oxidation and glucose uptake and the reduction of hepatic fat, leading to improved hepatic insulin responsiveness [8,15].

Large clinical trials such as PREDIMED and PREDIMED-Plus have documented improvements in fasting glucose, HOMA-IR, and postprandial glycemia among participants following the MedDiet [9,10].

6.2. Satiety, Appetite Regulation, and Energy Intake

Several components of the MedDiet act synergistically to improve satiety and appetite regulation. A high intake of dietary fibre slows gastric emptying and improves glycaemic control, while minimally processed foods reduce exposure to hyper-palatable stimuli that are common in Western diets. [4]. These are some mechanisms contributing to spontaneous reductions in energy intake without strict caloric restriction.

6.3. Effects on Lipid Metabolism

The MedDiet benefits are attributed to dietary fibers, omega-3 fatty acids, monounsaturated fats, and polyphenols found in olive oil, nuts, fish, fruits, and vegetables [11,15].

7. CRITICAL SYNTHESIS OF THE EVIDENCE

The convergence of findings from multiple research fields provides strong support for the MedDiet as an effective and biologically plausible dietary model for improving metabolic health [5–12,15].

7.1. Strength of the Evidence

7.1.1. Observational Studies

In this narrative review, we found that observational studies provide long-term insights into real-world dietary patterns. Across multiple populations, higher adherence to the MedDiet is consistently associated with lower body mass index (BMI), reduced waist circumference, lower triglyceride levels and improved fasting glucose [5,6,19]. These associations remain robust even after adjustment for major confounders such as physical activity, smoking status, socioeconomic factors, and total caloric intake.

7.1.2. Randomized Controlled Trials

Among the randomized trials identified in our literature search, the PREDIMED trial—one of the largest nutrition trials conducted to date—demonstrated improvements in visceral adiposity, fasting glucose, insulin sensitivity and lipid profiles [9]. The PREDIMED-Plus trial, incorporating caloric restriction, physical activity, and behavioral counseling, showed even greater improvements in weight loss, waist circumference reduction, better glycemic control, lower triglyceride levels and reduced blood pressure [10]. Other RCTs conducted in individuals with obesity, diabetes, hypertension, or NAFLD also confirm the superiority of the MedDiet in improving metabolic biomarkers and reducing cardiovascular risk [8,15].

7.1.3. Meta-Analyses

Meta-analyses, consistently confirm the metabolic benefits of the MedDiet. Key findings include significant reductions in waist circumference, lower triglyceride levels, improved HDL-cholesterol, reductions in fasting glucose and decreased prevalence and incidence of MetS [5,6].

7.2. Limitations of the Current Evidence

Despite the robustness of the data, several methodological limitations must be acknowledged such as heterogeneity in MedDiet definitions, population variability as most clinical trials have been conducted in Mediterranean countries. Cultural differences, food availability, and lifestyle habits may limit the generalizability of findings to non-Mediterranean settings. Another limit can be confounding lifestyle factors as higher adherence to the MedDiet is often associated with overall healthier lifestyles.

8. CLINICAL AND PUBLIC HEALTH IMPLICATIONS

8.1. Implications for Clinical Practice in Morocco

In Morocco, nutritional transition and rapid lifestyle changes have contributed to a substantial increase in obesity, type 2 diabetes, hypertension, dyslipidaemia and non-alcoholic fatty liver disease [21]. In the Moroccan context, the Mediterranean diet (MedDiet) represents a culturally appropriate and scientifically validated dietary model that can be recommended in clinical practice. Thus, the MedDiet is particularly suitable for Moroccan patients living with obesity, prediabetes, diabetes, hypertension or dyslipidaemia.

8.2. Public Health Implications for Morocco

At the national level, strengthening adherence to the MedDiet could serve as an effective strategy to reduce the growing burden of non-communicable diseases (NCDs) in Morocco. The main potential benefits include: a reduction in healthcare expenditures linked to metabolic and cardiovascular diseases; improved life expectancy and overall well-being of the population; enhanced food security through the use of local and seasonal produce—especially important in a global context of rising food prices from which Morocco is not exempt; preservation of Moroccan culinary heritage, including the promotion of shared family meals; and the advancement of sustainable food systems aligned with WHO recommendations. The MedDiet aligns closely with the national priorities of the National Programme for the Prevention and Control of NCDs.

8.3. Specific Relevance for Morocco

As in other Mediterranean countries, Morocco is experiencing a rapid westernization of dietary habits, characterized by increased consumption of refined oils, sugars and ultra-processed foods; decreased intake of legumes, whole grains, vegetables and traditional dishes; greater exposure to fast-food options; and a concerning rise in obesity, metabolic syndrome and diabetes.

Strengthening adherence to the MedDiet in Morocco could significantly reduce the national burden of metabolic diseases; improve cardiometabolic health at the population level; preserve traditional Moroccan dietary practices that are plant-based and fibre-rich; and support local agricultural production, including olive oil, legumes, fruits, vegetables and fish. Fortunately, Morocco benefits from substantial agricultural resources, making the MedDiet feasible and culturally coherent.

8.4. Barriers and Strategies in the Moroccan Context

The main barriers to MedDiet adoption include the wide availability of ultra-processed foods that, while not necessarily inexpensive, remain accessible—especially for households in which women and mothers work outside the home—leading to reduced time for traditional cooking (particularly in large cities);

insufficient nutrition education among the general population, making many Moroccans vulnerable to intensive marketing by multinational companies promoting high-sugar, high-salt and high-fat products.

Strategies adapted to the Moroccan context include the integration of nutrition education into schools and primary healthcare services; subsidies or financial incentives for healthy foods (olive oil, legumes, local fruits, fish); mass media campaigns promoting traditional Moroccan cuisine that can simultaneously support small farmers and local markets; regulation of advertising for ultra-processed foods, especially those targeting children and adolescents; and the development of quick and affordable MedDiet-inspired recipes adapted to urban lifestyles, disseminated through dietary guides.

Collectively, these initiatives could help mitigate the ongoing nutritional transition and promote healthy, sustainable and culturally relevant eating behaviours across the Moroccan population.

9. DISCUSSION

Our narrative review synthesizes current evidence on the benefit of the Mediterranean diet (MedDiet) on obesity and metabolic syndrome (MetS). Findings from epidemiological studies, randomized controlled trials (RCTs), and mechanistic research consistently indicate that the MedDiet represents a robust and effective dietary pattern for improving metabolic health [5–15]. This review also underscores the relevance of the MedDiet for Mediterranean countries, including Morocco, where rapid urbanization and dietary Westernization have led to increasing rates of obesity, MetS, and related disorders [16]. Reinforcing traditional dietary practices—closely linked to family conviviality—may play a key role in reducing the growing burden of cardiovascular diseases in the region.

Despite the strength of the evidence, several limitations must be acknowledged. Variability in the definitions and adherence scoring methods of the MedDiet across studies complicates direct comparisons. Moreover, many observational studies rely on self-reported dietary intake, which is susceptible to misclassification and recall bias. Additionally, most RCTs on the MedDiet have been conducted in Mediterranean populations; therefore, generalizability to non-Mediterranean contexts may vary depending on cultural adaptations, food availability, and socioeconomic factors. Finally, maintaining long-term adherence to the MedDiet can be challenging in environments saturated with Westernized dietary models and where the population may be particularly susceptible to the intensive marketing strategies employed by multinational fast-food corporations

Nevertheless, the strength, consistency, and biological plausibility of the evidence strongly support the MedDiet as a comprehensive dietary strategy for preventing and managing obesity and MetS. Future research should focus on enhancing adherence strategies, exploring culturally tailored interventions, and evaluating long-term outcomes in diverse populations. Furthermore, integrating the MedDiet into public health initiatives, clinical guidelines, and national nutrition policies could substantially improve metabolic health at the population level.

Overall, the Mediterranean diet emerges as a powerful nutritional model with broad preventive and therapeutic potential. We strongly recommend broader integration of the MedDiet into clinical practice and public health strategies, as this could significantly reduce the burden of metabolic diseases, particularly in regions undergoing rapid nutritional transition.

10. CONCLUSION

The Mediterranean diet (MedDiet) stands as one of the most extensively studied and scientifically validated dietary patterns for the prevention and management of obesity and metabolic syndrome (MetS). For Mediterranean countries—including Morocco—where rapid dietary Westernization has been accompanied by rising rates of obesity, type 2 diabetes, and MetS, restoring adherence to traditional dietary practices represents both a public health opportunity and a cultural asset. Integrating the MedDiet into national nutrition strategies, clinical guidelines, and public health interventions could meaningfully reduce the burden of non-communicable diseases.

In summary, the Mediterranean diet offers a comprehensive, evidence-based, and culturally coherent framework for improving metabolic health at both individual and population levels. Its preventive and therapeutic potential makes it a valuable component of modern clinical practice and public health policy. Broader adoption of the MedDiet—supported by nutrition education, improvements in food systems, and culturally adapted interventions—could play a decisive role in addressing the global and regional challenges posed by obesity and metabolic syndrome.

11. DECLARATIONS

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

Ethical Approval

This narrative review did not involve human participants, animal experimentation, or the collection of personal data. Therefore, ethical approval was not required. The work was conducted in accordance with the principles of the Declaration of Helsinki.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this manuscript, the authors used generative AI–assisted tools to support language editing, clarity, and organization of the text. All AI-assisted content was carefully reviewed, verified, and edited by the authors. The authors take full responsibility for the accuracy, integrity, originality, and scientific content of the manuscript

Author contributions

- Conceptualization: N.B.
- Literature search and synthesis: N.B., M.E.K., C.B., N.E.K., H.C.
- Writing—original draft: N.B.
- Writing—review and editing: all authors
- Final approval: all authors

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