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Review

Dietary Determinants of Cardiovascular Disease in Indonesia: A Narrative Review

Faktor-Faktor Determinan Diet terhadap Penyakit Kardiovaskular di Indonesia: Sebuah Tinjauan Naratif

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Abstract: Cardiovascular diseases (CVDs) have emerged as a critical public health crisis in Indonesia, accounting for approximately one-third of total national mortality. While clinical management has advanced, the prevalence of heart disease remains high and is increasingly affecting the younger, productive-age population, precipitating an immense economic strain. This narrative review aims to synthesize recent evidence (2017–2023) regarding the multi-dimensional dietary determinants of CVD and evaluate national strategies for risk mitigation. A narrative review design was employed, a structured literature search of PubMed and ScienceDirect databases for English-language literature. Out of 312 identified records, 10 primary studies—including cross-sectional, prospective cohort, and meta-analysis designs—were selected based on robust methodological criteria to analyze the association between dietary intake and cardiovascular risk factors. The synthesis identifies that the Indonesian diet is heavily characterized by excessive refined carbohydrate consumption and high intake of trans-fatty acids (TFA) from fried foods, which act as primary drivers of dyslipidemia. Additionally, findings indicate that animal protein consumption is positively correlated with metabolic syndrome risk in men, whereas isocaloric substitution with plant-based proteins significantly lowers mortality risk. Consequently, the CVD pandemic in Indonesia is fundamentally driven by modifiable nutritional quality issues rather than caloric quantity alone. The study concludes that addressing the escalating burden of CVD in Indonesia requires urgent, multi-sectoral interventions focused on replacing refined carbohydrates and trans-fats with culturally tailored, plant-based nutritional strategies to safeguard national public health and economic productivity.

Keywords: Cardiovascular Disease, Dietary Pattern, Nutrition-Specific, Public Health Strategy, Risk Factors.

1. INTRODUCTION

Globally, the rising prevalence of cardiovascular disease (CVD) has emerged as a significant concern, especially in Indonesia. CVDs are the leading cause of both morbidity and mortality, responsible for approximately a third of all deaths in the country (1). According to the Ministry of Health of the Republic of Indonesia in 2017, the common non-communicable diseases (NCDs) that lead to death are stroke, heart disease, and cancer. The primary risk factors for vascular disease in Indonesia include high blood pressure, smoking, a high body mass index (BMI), and high total cholesterol (2).

This figure is made more worrying by the fact that heart disease not only affects the elderly but has also been found among younger age groups (3). The younger population plays a crucial role as the productive age group among the working population. Based on data from Statistics Indonesia, as February 2018, the total number of workers in

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Indonesia was 133.94 million (4). Meanwhile, the economic burden on the country is substantial, as the state must bear significant costs for handling CVD problems. According to Healthcare BPJS data, the cost of financing critical diseases was Rp 14.3 trillion in 2015 and rose to Rp 14.6 trillion in 2016. Specifically, the cost of financing heart disorders was the highest among all critical diseases, reaching Rp 6.9 trillion (48.25%) in 2015 and increasing to Rp 7.4 trillion (50.7%) in 2016 (5). The Healthcare BPJS deficit for the previous two years has been pegged at Rp 16.5 trillion, largely a result of Indonesians having a high prevalence of chronic illnesses (5).

This economic strain is comparable to trends in developed nations. Data from the United States shows that one American dies of Infarction Heart Disease (IHD) every 60 seconds, costing approximately $200 billion annually. The total cost not only stems from hospitalizations and treatment but also includes loss of productivity (6). To combat this public health crisis, this narrative review needs to address the root causes, especially in dietary intake, and take a holistic view. Despite extensive global evidence, a consolidated synthesis focusing on dietary quality and its relevance to Indonesian dietary patterns remains limited. This review aims to outline the prevalence of CVD in Indonesia, summarize evidence from important systematic reviews and cohort studies regarding dietary determinants, and propose strategies at national levels to tackle the rising pandemic of CVD risk factors. Given that dietary habits—specifically excessive fat, sodium, and sugar intake—are fundamentally linked to these diseases, this review consolidates existing research to map these complex variables and identify strategic solutions within the Indonesian context.

2. METHODS

This study adopts a narrative review framework grounded in interpretative and thematic synthesis to critically analyze and synthesize existing literature on the relationship between dietary patterns and cardiovascular disease risks. Rather than merely aggregating data, this approach involves a critical interpretation of findings to identify recurring themes, patterns, and contradictions within the existing literature, with a specific focus on the Indonesian context relative to global trends. A structured literature search strategy was employed using two primary electronic databases, PubMed and ScienceDirect, to identify relevant studies published between January 1, 2017, and September 10, 2023. The search protocol utilized a combination of key terms related to diet and consumption—such as "dietary pattern," "intake," "nutrient," and "consumption"—paired with cardiovascular health indicators including "cardiovascular disease," "cardiometabolic disease risk," and "cardiovascular causes" using an “AND” command.

The target population for this study was the general adult population, with a specific focus on the Indonesian demographic context relative to global trends. The study encompassed individuals from diverse socio-economic backgrounds to ensure a comprehensive understanding of how varying lifestyles impact CVD prevalence. The main intervention focus was on dietary intake and nutritional patterns linked to cardiometabolic health. The primary outcomes assessed included the prevalence of CVD risk factors (hypertension, hypercholesterolemia, and high BMI), mortality rates associated with specific nutrients (SFA, TFA, and sodium), and the efficacy of dietary substitutions in reducing cardiometabolic burden. Data extracted from selected studies were synthesized thematically, categorizing determinants into macronutrient quality (carbohydrates, proteins, fats) and micronutrient imbalances (sodium, potassium). This interpretative process allowed for the construction of a cohesive narrative

regarding nutrition-specific drivers of CVD, facilitating the development of integrated strategic interventions. To ensure the robustness and relevance of the review, specific eligibility criteria were established. The review prioritized studies with rigorous methodological designs, specifically cross-sectional studies, prospective cohort studies, and meta-analyses. Non-English language articles were excluded to maintain linguistic consistency. Furthermore, the selection process prioritized recent publications from the last six years and widely cited international guidelines to capture the most current and impactful evidence.

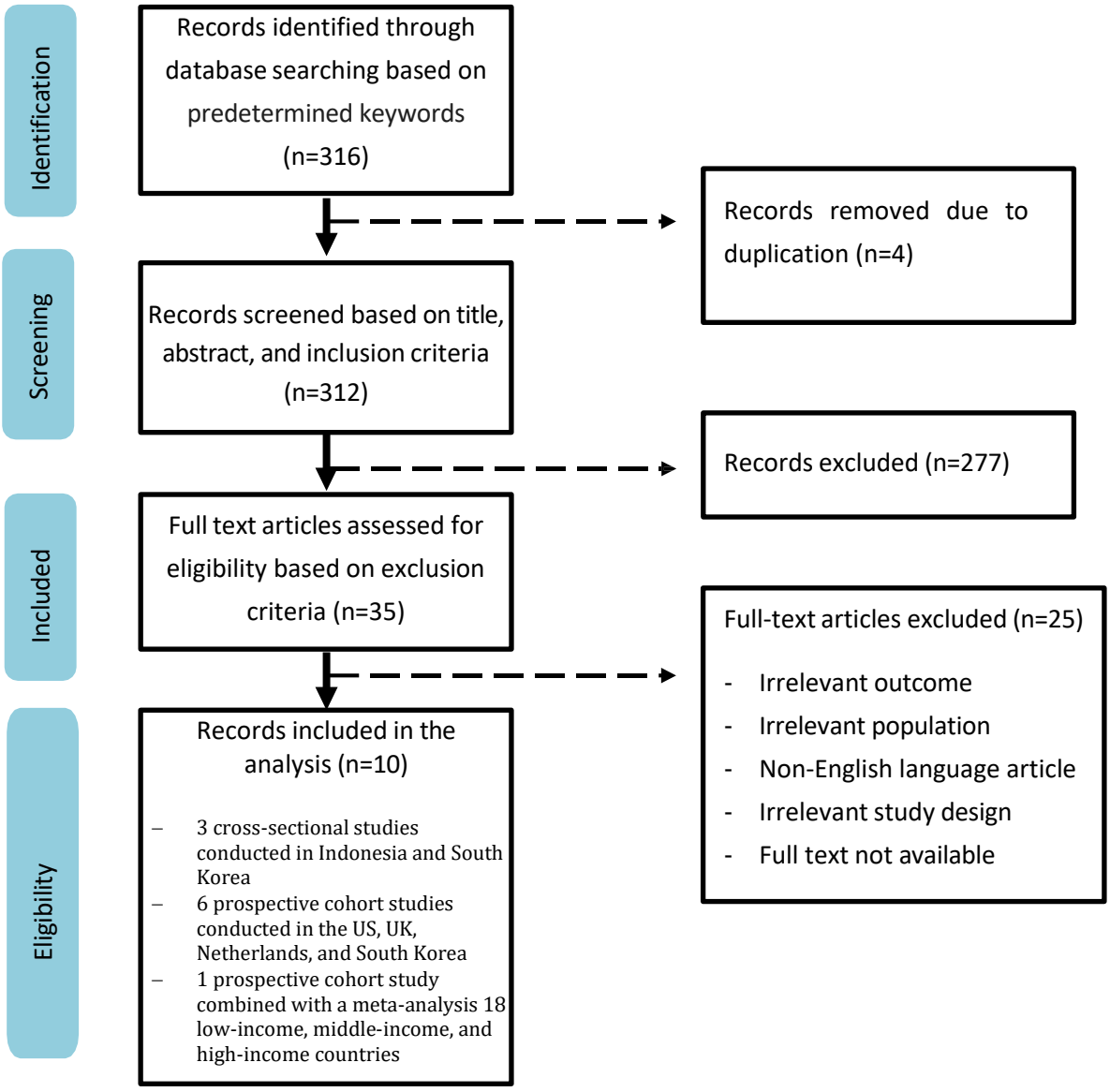

Figure 1. Flowchart of study selection.

The screening and selection procedure followed a rigorous multi-stage process. Initially, 316 records were identified through database searching based on predetermined keywords. After removing 4 duplicates, 312 records were screened based on title, abstract, and inclusion criteria. Of these, 277 records were excluded due to lack of relevance to the study objectives. Subsequently, 35 full-text articles were

assessed for eligibility. A total of 25 full-text articles were excluded for specific reasons: irrelevant outcome, irrelevant population, non-English language, irrelevant study design, or full text not available. This resulted in the final inclusion of 10 articles that best met the study's objectives. Among these, there are 3 cross-sectional studies conducted in Indonesia and South Korea, 6 prospective cohort studies conducted in the US, UK, Netherlands, and South Korea, and 1 prospective cohort study combined with a meta-analysis conducted from 18 low-income, middle-income, and high-income countries.

3. RESULTS

A nationwide study found that the prevalence of coronary heart disease and stroke diagnosed by physicians varied by region, ranging from 0.7 to 2.2% for coronary heart disease and 4.1 to 14.7% for stroke. Nationally, the prevalence of heart disease is 1.8%, with North Kalimantan (2.2%) and DI Yogyakarta (2.0%) and Gorontalo (2.0%). According to the age group, the highest prevalence of heart disease occurred in the 75-year age group (4.7%), followed by the 65-74 year age group (4.6%) and the 55-64 year age group (3.9%). The prevalence in the female group was higher (1.6%) than in the male group (1.3%) (7). The following table 1 summarizes the reporting of nutrition causes related to heart disease risk as identified in the review:

Table 1. Comprehensive Synthesis Matrix of CVD Dietary Determinants

Author & Year	Study Design	Sample Size (N)	Determinant Category	Key Results
Sari *et al.* 2022 (8)	Cross-sectional	479 adults (Indonesia)	Sodium & Potassium	High 'Noodle, oil, and salty sea products' pattern associated with high Na intake ($p < 0.001$). Low Na:K ratios linked to vegetable/milk patterns.
Murni *et al.* 2022 (9)	Cross-sectional	179 obese adolescents (Indonesia)	Fiber, Fat, Sugar	98% had inadequate fiber intake; 65% exceeded fat limits. Fiber intake correlated with HDL-cholesterol levels ($p=0.033$).
Chung *et al.* 2020 (10)	Cross-sectional	13,485 adults (Korea)	Protein Source	Animal protein intake positively associated with metabolic syndrome risk in men; plant protein beneficial for BP management.
Kwon *et al.* 2020 (11)	Cohort Study	42,192 adults (Korea)	Macronutrients	U-shaped association between carbs/fat and mortality; minimal risk at 50-

Author & Year	Study Design	Sample Size (N)	Determinant Category	Key Results
				60% carbs and 30-40% fat intake.
Li *et al.* 2020 (12)	Prospective Cohort	210,145 adults (USA)	Dietary Inflammation	Higher Empirical Dietary Inflammatory Pattern (EDIP) scores linked to increased risk of CVD, CHD, and stroke.
Zhuang *et al.* 2019 (13)	Prospective Cohort	521,120 adults (USA)	Dietary Fats	Marine omega-3 PUFA inversely associated with CVD mortality; SFA/TFA positively associated. Replacing SFA with plant MUFA lowers risk.
Dehghan *et al.* (14)	Prospective Cohort	135,335 adults (18 countries)	Fats & Carbohydrates	High carbohydrate intake (>70% of energy) associated with higher total mortality risk; fats associated with lower mortality.
Seidelmann *et al.* (15)	Cohort / Meta-analysis	15,428 (Cohort) + 432,179 (Meta)	Carbohydrates	U-shaped association; mortality increased when carbohydrates were exchanged for animal-derived fat or protein.
Gao *et al.* 2021 (16)	Prospective Cohort	116,806 adults (UK)	Dietary Pattern	High intake of chocolate/confectionery and sugar-sweetened beverages associated with higher total CVD and mortality risk.
Li *et al.* 2023 (17)	Prospective Cohort	131 adults (Netherlands)	Fatty Acids (Dairy)	Specific FFAs from dairy intake (e.g., C15, C16:1 t9) associated with cardiometabolic risk factors (e.g., plasma cholesterol and triglycerides).

4. DISCUSSION

Hypertension, a major risk factor, shows a national prevalence of 8.84% based on doctor diagnosis. It is highest in the age group 75 years or more (25.26%) and higher in females (11.57%) compared to males (6.07%). By region, the prevalence of hypertension in rural areas (8.06%) is lower than in urban areas (9.46%). Unlike heart disease, stroke prevalence was slightly higher in males (11.0 per mil) than females (10.9 per mil) and significantly higher in urban areas (12.6 per mil) compared to rural areas (8.8 per mil). These trends indicate that as the population ages and urbanizes, the burden of CVD increases. In men, hypertension was the leading risk factor, attributing to 35%-40% of all strokes and 20% of all CHD, followed by smoking. In women, hypertension accounted for 25% of all CHD and 39% of all stroke events (7). Notably, regarding education, the highest prevalence was found in the group that finished diploma education and higher education (2.1%). Based on the area of residence, the prevalence of heart disease in urban areas is higher (1.6%) than in rural areas (1.3%) (7). These trends are exacerbated by aging; as individuals get older, the potential for experiencing multiple CVD comorbidities increases. The synthesis of the included studies reveals that CVD in Indonesia is driven by an interplay of specific nutritional determinants and lifestyle factors. CVD prevalence in Indonesia varies significantly by region and demographics. In 2019, CVD accounted for approximately 38% of the total causes of death per 100,000 population in Indonesia, which is higher than in the rest of the Southeast Asian region (7). Another study finding is that nationally, the proportion of sodium and fat intake of the population that exceeds 2,000 mg and 67 grams is 18.3% and 26.5%, respectively. According to gender, the highest consumption of sodium was found in men (19.9%) compared to women (16.7%). The proportion of the population consuming more sodium was seen higher in the urban population compared to the rural population (20.6% vs 16.0%). Meanwhile, according to the ownership quintile, the population who consumed more sodium was the highest in the upper-middle quintile (20.6%) and the lowest was in the lowest quintile (14.5%). Based on the place of residence, the proportion of urban residents consuming fat more than 67 mg is higher than that of rural residents (33.3% compared to 19.6%) (7).

The following discussion synthesizes the reporting of nutrition causes related to heart disease risk as identified in the review. Both the quality and quantity of carbohydrates are critical. Furthermore, dietary patterns characterized by high intakes of chocolate, confectionery, butter, and low-fiber bread were associated with increased total CVD risk (HR 1.40). In contrast, dietary patterns characterized by sugar-sweetened beverages had a non-linear relationship with CVD risk (HR 1.14) (16). In the Indonesian context, where rice is a staple, high carbohydrate intake (>70% of energy) has been associated with higher total mortality risk in the PURE study (14). However, data associating macronutrient intake proportion and all-cause mortality remain conflicting. The ARIC study showed a U-shaped association between carbohydrate intake and mortality. Investigating 42,192 participants from KNHANES, found that time to exceed 1% of the all-cause mortality rate was the longest in participants with 50-60% carbohydrate intake. This study found a U-shaped association between all-cause mortality and carbohydrate intake as well as fat intake, with minimal risk observed at 50-60% carbohydrate and 30-40% fat intake (11). High carbohydrate diets, common in Asian countries, are often high in refined carbohydrates such as white rice. These diets may reflect poor food quality and confer a chronically high glycemic load, which can have negative metabolic consequences.

Protein source plays a pivotal role in cardiometabolic health. A study found that animal protein intake was positively associated with abdominal obesity (OR 1.60), reduced HDL-C (OR 1.43), and elevated fasting glucose (OR 1.32) in Korean men. Plant protein consumption was linked to higher blood pressure in men, but inversely associated with waist circumference in Western populations (10). A systematic review suggested the isocaloric substitution of plant-based protein for animal-based protein was inversely associated with the risk of all-cause and CVD mortality (18). The deep-frying culture in Indonesia contributes significantly to Trans-Fatty Acid (TFA) and Saturated Fatty Acid (SFA) intake. SFA and TFA are associated with an increased risk of CHD. Diets high in these fats may increase Lipoprotein(a) levels. A panel of ten medium- and long-chain FFAs were associated with dairy intake and CMD risk (17). Furthermore, associations between dietary inflammatory potential and plasma profiles have been investigated. Dietary patterns with a higher proinflammatory potential biomarker (CRP, interleukin 6) were associated with a higher incidence of CVD, CHD, and stroke. A higher Empirical Dietary Inflammatory Pattern (EDIP) score was associated with higher plasma triglyceride levels and a significant decrease in HDL cholesterol (12). It was reported that isocalorically replacing 5% of energy from SFAs with plant MUFAs was associated with 15%, 10%, 11%, and 30% lower total mortality, CVD, cancer, and respiratory disease mortality, respectively. This highlights the importance of fat quality over mere quantity (13).

Excess sodium intake is a pervasive issue. An Indonesian study showed that more than 80% of participants were estimated to consume more Na than the recommended value using two 24-h urine excretions (8). Furthermore, no participants met the recommended value for K intake. A study revealed that the 'Noodle, oil, and salty sea products' dietary pattern in Indonesia was strongly associated with high sodium intake ($p < 0.001$) in both men and women. The 'Meat, vegetable, oil, and fruit' pattern statistically significantly contributed to the high K intake in men. The 'Noodle, oil, and salty sea products' pattern is linked to reduced sodium intake avoidance. Insufficient potassium intake exacerbates the risk, as low Na:K ratios are critical for maintaining normal blood pressure (8).

Based on the evidence synthesized above, addressing the prevalence of cardiovascular risk in Indonesia requires a multi-faceted strategy that fundamentally reshapes nutritional habits and policy frameworks. A primary avenue for intervention involves a strategic substitution of dietary fats. Evidence suggests that diets low in trans-fatty acids (TFA) and saturated fatty acids (SFA) are critical for CVD prevention. Consequently, national guidelines should strongly encourage the isocaloric replacement of SFAs with monounsaturated fatty acids (MUFAs) derived from plant sources and polyunsaturated fatty acids (PUFAs) rich in linoleic acid and marine omega-3s. Given that fat quality is more determinant of health outcomes than mere quantity, public health messaging should focus on reducing SFA intake to less than 10% of total energy while simultaneously eliminating industrial TFAs found in processed and fried foods, which are ubiquitous in Indonesian diets (13).

Parallel to fat modification, a transition in protein sources offers a long-term approach to promoting healthy aging and reducing cardiometabolic risks. Because of the low protein consumption among the Indonesian population (specifically in the elderly), increasing the protein-rich diet should be recommended. With animal protein intake positively associated with abdominal obesity and metabolic syndrome in certain demographics, shifting toward plant-based proteins—such as soy, nuts, beans, and legumes—presents a viable solution. A recommended daily intake of over 50% plant

protein relative to total protein, alongside a reduction in red meat consumption to fewer than three servings per week, has been shown to improve blood pressure, insulin resistance, and overall lipid profiles (19). This shift not only aligns with CVD prevention goals but also addresses the broader issue of protein quality in the Indonesian diet.

Furthermore, these nutritional strategies must be supported by robust educational and policy initiatives. Comprehensive educational programs targeting children and adolescents are essential, as dietary habits formed early in life track into adulthood. The urgency of these dietary reforms is underscored by the shifting epidemiology of heart disease toward the younger, productive-age population, precipitating an immense economic strain on the nation. Data from Healthcare BPJS reveals that financing for heart disorders is the highest among critical diseases, rising to Rp 7.4 trillion in 2016. To disrupt this trajectory, interventions cannot remain reactive. Sustainable risk reduction requires integrated school-based nutritional education, as dietary habits are established early in life. Study found that 98% of obese adolescents had inadequate fiber intake and 65% exceeded fat limits (9).

Schools should integrate curricula that emphasize the reduction of salt, sugar, and deep-fried food consumption, utilizing platforms like the Integrated Guidance Posts (Posbindu and Posyandu) for broader community outreach. Since food habits are formed during childhood, educational programs initiated in primary school are vital. Finally, on a policy level, there is a need for alignment with evidence-based dietary patterns such as the DASH (Dietary Approaches to Stop Hypertension), Mediterranean, or Nordic diets. These patterns, characterized by high intakes of anti-inflammatory foods like green leafy vegetables, yellow vegetables, whole grains, coffee, tea, and wine, provide a proven template for reducing non-communicable disease burdens. This approach should be adapted to the local Indonesian culinary context to ensure cultural appropriateness and adoption.

5. CONCLUSION

The CVD in Indonesia is a multi-dimensional challenge driven primarily by poor dietary quality, specifically the excessive intake of refined carbohydrates, trans-fats, and sodium. This review emphasizes that while specific nutritional interventions are vital, long-term success depends on multi-sectoral convergence—integrating education, policy, and community-based health monitoring. Furthermore, dietary patterns with high intake of carbohydrates, fat (specifically SFA and TFA), and insufficient potassium have an adverse effect on heart disease.

The high prevalence of risk factors in younger populations (productive age) and urban areas necessitates urgent action. Promoting food-based dietary guidelines that are culturally appropriate—such as reducing the consumption of noodles, fried foods, and salty dried fish while increasing plant-based proteins—can significantly mitigate the future socio-economic burden of cardiovascular diseases. If restricting carbohydrate intake is a chosen approach for weight loss, the replacement of carbohydrates with predominantly plant-based fats and proteins should be considered as a long-term approach to promote healthy aging. Therefore, implementing the recommended nutritional strategies is a critical investment in national human capital. To ensure these interventions are effective, the scientific focus must shift from observation to validation.

Future research should prioritize high-quality randomized controlled trials to verify the long-term effects of dietary substitutions within Indonesia's specific socio-cultural context, particularly the clinical efficacy of replacing refined carbohydrates with plant-based proteins and fats to promote healthy aging. In addition, studies should assess the effectiveness of multi-sectoral convergence—integrating education, policy, and community-based health monitoring—and rigorously examine how global dietary frameworks such as the DASH or Mediterranean diets can be adapted to local culinary traditions to maximize adherence and public health impact. Finally, future investigations should explicitly quantify the cost-effectiveness of these nutritional interventions to provide robust economic evidence for policymakers and ensure that public health strategies are both clinically effective and fiscally sustainable.

CONFLICT OF INTEREST

The authors declare that there were no conflicts of interest in this study.

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