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Fat Consumption in Modern Dietary Patterns: A Systematic Review of Trends and Health Consequences

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Abstract

Background: *Changes in fat consumption patterns in modern societies have been influenced by globalization, urbanization, and advancements in the food industry. Increased intake of saturated and trans fats has been associated with the rising prevalence of non-communicable diseases such as obesity, type 2 diabetes mellitus, and cardiovascular disease.*
Methods: *This study used a Systematic Literature Review (SLR) approach following PRISMA guidelines. Searches were conducted in PubMed, ScienceDirect, and Google Scholar using Boolean logic. Inclusion criteria covered observational studies, meta-analyses, and systematic reviews published between 2019 and 2025 that discussed fat consumption and its effects on public health.*
Results: *Consumption of saturated and trans fats was associated with an increased risk of metabolic syndrome, type 2 diabetes, and cardiovascular disease, whereas intake of monounsaturated fat (MUFA) and polyunsaturated fat (PUFA) showed protective effects on metabolic health. Low-carbohydrate diets were more effective than low-fat diets in improving lipid profiles, and fat derived from dairy products did not consistently increase cardiometabolic risk.*
Conclusion: *The type of fat consumed matters more for metabolic health than simply restricting total fat intake. Public education, evidence-based policy-making, and further research are needed to clarify the health impact of fat consumed from different dietary sources*

INTRODUCTION

Changing consumption patterns in modern society are marked by increasing fat intake, particularly from processed and fast food. In Indonesia, this phenomenon is reflected in rising consumption of high-fat, high-sugar foods, which has contributed to a range of health problems. Data from Indonesia's National Food Agency indicate that in recent years there has been a significant shift in the population's food consumption pattern: although tuber consumption has increased, rice remains dominant, while the contribution of fat from processed products shows

an increasing trend [1]. Excessive fat consumption, particularly saturated fat, has been linked to an increased risk of non-communicable diseases such as coronary heart disease and stroke. The Indonesian Ministry of Health has stated that saturated fat intake exceeding 10% of total daily energy can raise LDL cholesterol levels, which contributes to plaque formation in the coronary arteries [2].

In addition, the growing trend of consuming fast food high in fat and sodium has contributed to a rising prevalence of hypertension and type 2 diabetes among adolescents. Studies indicate that excessive fast-food consumption can increase the risk of type 2 diabetes mellitus and other related health problems [3]. This shift in dietary patterns requires serious attention given its impact on public health. According to the World Health Organization, more than 39% of adults worldwide are overweight, with 13% classified as obese as a result of diets high in fat and low in fiber [4]. Indonesia's Central Statistics Agency has further reported that fast-food consumption increased by 18% over the past five years, contributing to the rising trend of metabolic disease in the country [5]. A systematic analysis of trends in fat consumption and their health consequences is therefore important for formulating effective intervention strategies to improve dietary quality and public health.

Although the association between individual dietary fat subtypes and specific disease outcomes has been extensively studied, few reviews have synthesized this evidence specifically for the context of modern, rapidly changing dietary patterns, and literature syntheses addressing this issue within the Indonesian context remain particularly limited. This gap underscores the need for the present review. This study therefore aims to identify and analyze trends in fat consumption within modern dietary patterns and their impact on public health, with particular attention to their association with the prevalence of non-communicable diseases such as obesity, type 2 diabetes mellitus, and cardiovascular disease. It further examines nutrition recommendations issued by global health organizations and policies implemented across countries to address the adverse effects of excessive fat consumption. The scope of this review covers studies published within the last five years across various population groups in both developed and developing countries, drawn from PubMed, ScienceDirect, and Google Scholar, with a focus on fat-consumption patterns shaped by social, economic, and cultural factors, and on policies implemented to control fat consumption at the global and national levels.

METHODS

Study Design and Search Strategy

This study used a Systematic Literature Review (SLR) approach following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [6]. Searches were conducted in the PubMed, ScienceDirect, and Google Scholar databases using

Boolean logic to improve the relevance of the results. The search terms used were the following combination: ("dietary fat consumption" OR "fat intake") AND ("health impact" OR "metabolic risk"). The search was limited to articles published within the last five years (2019–2025) from reputable journals with a relevant impact factor.

Operational Definition of Modern Dietary Patterns

For the purposes of this review, "modern dietary patterns" were operationally defined as patterns of food and fat intake characteristic of contemporary, urbanized societies, marked by a measurable increase in the consumption of processed and ultra-processed foods (UPF), refined fats and oils, and fast food relative to traditional whole-food diets, consistent with the shift documented in Indonesian national data [1,3,5]. This definition primarily encompasses studies examining total dietary fat intake and fat subtypes (saturated, trans, monounsaturated, and polyunsaturated fat) within general population diets reflecting this transition, including Western-style diets characterized by a high intake of processed meat, refined carbohydrates, and added fats. Studies of structured, elective, or therapeutic dietary interventions not primarily characterized by a shift in overall fat quality or quantity — such as ketogenic/very-low-carbohydrate diets, plant-based or vegetarian/vegan diets, or other named dietary patterns — were included only where used explicitly as a comparator against a low-fat or conventional diet to characterize the metabolic effects of fat consumption (e.g., the low-carbohydrate versus low-fat diet comparison in Table 1, item 4). Studies evaluating named dietary interventions outside this fat-intake comparison framework were excluded.

Eligibility Criteria

Inclusion criteria were: (1) articles published in reputable scientific journals between 2019 and 2025; (2) observational studies, meta-analyses, or systematic reviews discussing fat consumption and its impact on public health; (3) articles written in English; (4) studies using valid methods with an adequate sample size; and (5) studies examining the association between fat consumption and non-communicable diseases such as obesity, diabetes, and cardiovascular disease. Exclusion criteria were: (1) articles not available in full text or available only as an abstract; and (2) articles that were not open access.

Study Selection and Data Extraction

The literature-selection process followed the PRISMA framework, comprising identification, screening, eligibility assessment, and inclusion of articles meeting the specified criteria, to ensure transparency and accuracy in study selection. Each stage of the search and selection process was documented systematically so that the review findings would be reliable

and reproducible in future research.

Data Synthesis

Data extracted from the included studies — author(s), year, objectives, key findings, method, and results — were tabulated and synthesized narratively according to thematic patterns identified across the studies. To enable a disaggregated analysis, extraction also captured, where reported: (1) the specific fat subtype under investigation (saturated fatty acids [SFA], monounsaturated fatty acids [MUFA], polyunsaturated fatty acids [PUFA], or industrial trans fatty acids); (2) the confounding variables adjusted for in each study's statistical models (e.g., total energy intake, refined-carbohydrate and free-sugar intake, physical activity, body mass index, smoking status); and (3) the study's country of origin and corresponding World Bank income classification (high-income country [HIC] versus low- and middle-income country [LMIC]), to assess geographic and socioeconomic representativeness of the evidence base. As this study relied entirely on previously published, publicly available literature, no ethical approval was required.

Risk-of-Bias and Methodological Quality Assessment

The methodological quality of the eleven included studies was appraised using tools appropriate to each study design. ROBINS-I (Risk Of Bias In Non-randomized Studies of Interventions) [7] was used for the cross-sectional and cohort studies, assessing domains including confounding, participant selection, exposure measurement, and outcome reporting. RoB 2 (the Cochrane risk-of-bias tool for randomized trials) was used for the single included randomized controlled trial, covering the randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting [8]. AMSTAR-2 (A MeaSurement Tool to Assess systematic Reviews) [9] was used to rate the methodological rigor of the included systematic reviews and meta-analyses. The editorial and narrative-review sources were not eligible for formal risk-of-bias appraisal and were considered only as supporting, contextual evidence rather than primary quantitative findings. Two reviewers independently applied the relevant tool to each study, and disagreements were resolved by discussion; overall judgments are summarized in Table 2.

RESULTS

The literature search and selection process, conducted using the PRISMA framework, is summarized in Figure 1.

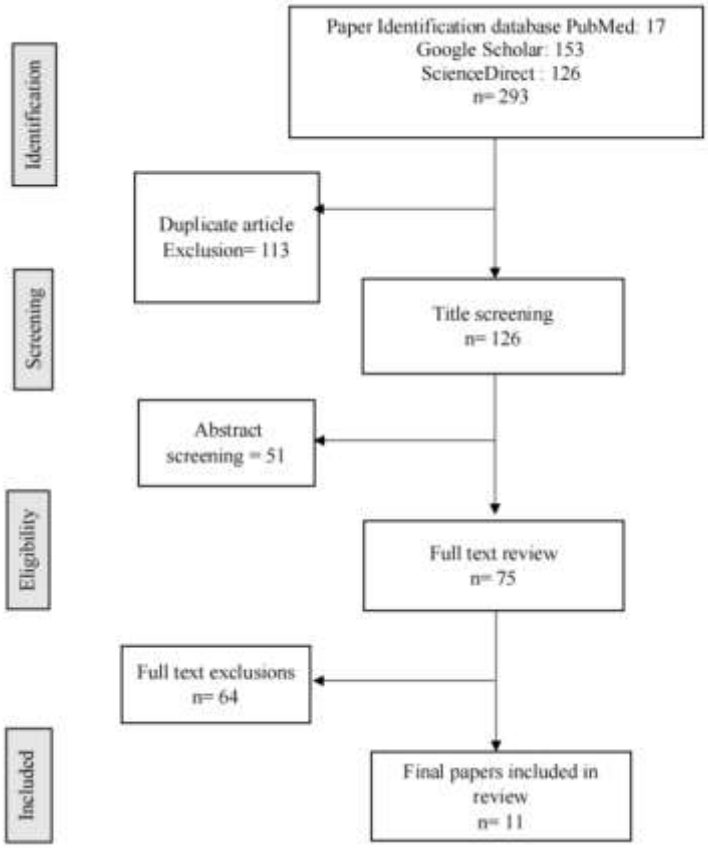

Figure 1. PRISMA flow diagram of study selection

Table 1 summarizes the characteristics and findings of eleven studies retrieved using the search strategy described that the included studies indicate a consistent pattern: the type rather than merely the amount of dietary fat consumed is associated with the occurrence of metabolic disease in modern populations. Saturated fat (SFA) intake was repeatedly linked to unfavorable metabolic outcomes, whereas monounsaturated fat (MUFA) and polyunsaturated fat (PUFA) intake was linked to more favorable outcomes across the study designs reviewed, ranging from cross-sectional and cohort studies to systematic reviews and randomized controlled trials. The methodological quality assessment (Table 2) indicated that most included observational studies carried a moderate overall risk of bias, driven mainly by residual confounding and the use of self-reported dietary-intake instruments (e.g., food-frequency questionnaires), which are prone to measurement error; none were judged at serious or critical risk. The included systematic reviews and meta-analyses received moderate AMSTAR-2 confidence ratings, generally reflecting incomplete reporting of a pre-registered protocol or of the list of excluded studies rather than fundamental flaws in the review process. The single randomized controlled trial was judged to raise some concerns, primarily because blinding and allocation-concealment details could not be fully confirmed from the available report. Overall, the body of evidence

was judged sufficiently consistent and methodologically adequate to support the narrative synthesis presented below, although the predominance of observational designs warrants appropriately cautious causal interpretation.

Table 1. Characteristics and Findings of Studies on Fat Consumption in Modern Diets

No	Author(s)	Year	Objective	Key Findings	Method	Result
1	Julibert et al. [10]	2019	To assess the association between dietary fat intake and components of MetS in Mediterranean adults at high cardiovascular disease (CVD) risk.	Different types of dietary fats play distinct roles in MetS components; dietary fat intake was associated with higher risk of hyperglycemia.	Cross-sectional study.	Dietary fat intake was associated with a higher risk of hyperglycemia among high-CVD-risk patients.
2	Wolters et al. [14]	2019	To analyze the effects of fat intake on gut microbiota and metabolic health.	High-fat diets, especially rich in saturated fats, negatively affect gut microbiota and metabolic health; polyunsaturated fats do not show similar negative effects.	Systematic review of studies examining fat intake, gut microbiota composition, and metabolic health indicators.	High-fat diets, especially saturated fats, can negatively impact gut microbiota and are associated with unhealthy metabolic conditions.
3	Kuda et al. [15]	2023	To highlight the role of various dietary fatty acids in metabolic health.	Saturated fats trigger hypothalamic inflammation and neuronal dysfunction, whereas polyunsaturated fats from fish reduce chronic disease risk.	Editorial summarizing recent findings on the effects of saturated and unsaturated fatty acids on inflammation, neuronal function, and chronic disease risk.	Consumption of fish rich in unsaturated fatty acids is associated with a reduced risk of chronic diseases.
4	Chawla et al. [16]	2020	To compare the effects of low-fat and low-carbohydrate diets on weight loss and lipid profiles.	Both diets are effective for weight loss; low-carbohydrate diets showed greater HDL increase and triglyceride reduction.	Systematic review and meta-analysis of randomized controlled trials comparing the two diets in adults.	Both diets effectively reduce weight, but low-carbohydrate diets showed greater improvements in HDL cholesterol and triglyceride levels compared to low-fat diets.
5	Schwab et al. [13]	2024	To investigate how changes in dietary fat quality affect lipid profiles and cardiometabolic risk.	Replacing saturated with unsaturated fats improves lipid profiles and reduces cardiovascular risk.	Randomized controlled trial analyzing lipidomic changes among participants who replaced saturated fats with unsaturated fats.	Improving dietary fat quality by replacing saturated fats with unsaturated fats contributed to favorable lipid profile changes that reduce cardiovascular disease risk.
6	Kim & Je [11]	2018	To evaluate the association between dietary fat intake and the risk of metabolic syndrome.	High saturated-fat intake linked to increased MetS risk; polyunsaturated-fat intake linked to decreased risk.	Systematic review and meta-analysis of observational studies assessing fat intake and metabolic syndrome incidence.	High intake of saturated fat was associated with an increased risk of metabolic syndrome, whereas polyunsaturated fat intake was associated with a decreased risk.
7	Salmerón et al. [17]	2001	To investigate the relationship between dietary fat intake and the risk of type 2 diabetes in women.	High trans-fat intake associated with increased diabetes risk; polyunsaturated fats associated with decreased risk.	Prospective cohort study following women over 14 years to assess fat intake and diabetes incidence.	High trans-fat intake was associated with an increased risk of type 2 diabetes, while polyunsaturated fat intake was associated with a decreased risk.

8	Julibert et al. [12]	2019	To evaluate the evidence on the impact of dietary fat intake on the incidence and reversal of MetS in adults.	Replacing saturated fat with MUFA and PUFA linked to lower MetS incidence; recommendations should focus on fat quality rather than fat quantity.	Systematic review using the MEDLINE database.	Replacing SFA with monounsaturated (MUFA) or polyunsaturated fatty acids (PUFA) was associated with a reduction in MetS risk; dietary recommendations should focus on fat quality rather than merely reducing total fat intake.
9	Unger et al. [18]	2019	To examine the effect of dairy-derived saturated fatty acids (SFA) on metabolic syndrome risk.	Current evidence does not fully support grouping all dietary saturated fats together; impact depends on source, food matrix, and composition.	Narrative review.	Current evidence is insufficient to support dietary guidelines that consolidate all dietary SFA into a single category to be reduced, regardless of food source, matrix, and composition.
10	Kratz et al. [19]	2013	To review data on the relationship between high-fat dairy consumption, obesity, and cardiometabolic disease.	Observational evidence does not support that high-fat dairy intake increases obesity or cardiometabolic risk; possible inverse association observed.	Systematic literature review of observational studies on dairy fat, high-fat dairy foods, obesity, and cardiometabolic disease.	Observational evidence does not support the hypothesis that dairy fat or high-fat dairy foods contribute to obesity or cardiometabolic risk; high-fat dairy consumption within typical dietary patterns was inversely associated with obesity risk.
11	Currenti et al. [20]	2022	To examine whether specific types and subtypes of dietary fats are associated with metabolic outcomes in a cohort of Italian adults.	Saturated fat intake may not harm cardiometabolic health; short-chain saturated fats (SCSFA) may have beneficial effects.	Cohort study.	SFA intake did not appear harmful to cardiometabolic health; in contrast, short-chain saturated fatty acids (SCSFA) might provide beneficial effects. Further research is needed to validate these findings.

As shown in Table 3, every included study for which the study population's origin could be confirmed was conducted in a high-income country, spanning Southern Europe (Spain, Italy), Central/Western Europe (the multi-country MyNewGut consortium), East Asia (Republic of Korea), and North America (United States); the country of origin for two sources (Schwab et al. and Kuda et al.) could not be fully verified from the citation details available to the authors and is flagged accordingly for the authors to complete. No study conducted in a low- or middle-income country (LMIC) met this review's eligibility criteria. Consequently, a formal quantitative subgroup analysis comparing HIC and LMIC evidence, as would ordinarily be used to test for regional heterogeneity, was not statistically possible; this absence of LMIC-based evidence is instead reported descriptively here as a substantive gap in the literature.

DISCUSSION

Overall, this review indicates that fat consumption in modern dietary patterns has a significant impact on metabolic and cardiovascular health. Saturated fat (SFA) intake was consistently associated with a higher risk of metabolic syndrome and type 2 diabetes, whereas monounsaturated fat (MUFA) and polyunsaturated fat (PUFA) intake was associated with a

reduced risk of chronic disease. Improving dietary fat quality, such as replacing saturated with unsaturated fat, contributed to healthier lipid profiles. Fat intake was also linked to gut microbiota composition, which plays a role in overall metabolic health. Compared with low-fat diets, low-carbohydrate diets were more effective at improving lipid profiles, while fat derived from dairy products did not consistently increase cardiometabolic risk.

Table 2. Risk-of-Bias and Methodological Quality Assessment of Included Studies

No	Author(s)	Design	Tool Applied	Overall Judgment	Key Concern(s)
1	Julibert et al. [10]	Cross-sectional	ROBINS-I	Moderate	Cross-sectional design limits causal inference; dietary intake assessed via FFQ.
2	Wolters et al. [14]	Systematic review	AMSTAR-2	Moderate	Substantial heterogeneity across primary studies; protocol registration not confirmed.
3	Kuda et al. [15]	Editorial	Not applicable	Not assessed	Narrative/editorial synthesis; not eligible for formal risk-of-bias appraisal.
4	Chawla et al. [16]	Systematic review and meta-analysis (RCTs)	AMSTAR-2	Moderate	Moderate heterogeneity among pooled trials; funding sources of primary trials not fully disclosed.
5	Schwab et al. [13]	Randomized controlled trial	RoB 2	Some concerns	Blinding and allocation-concealment procedures not fully verifiable from the available report.
6	Kim & Je [11]	Systematic review and meta-analysis (observational)	AMSTAR-2	Moderate	Included studies used heterogeneous exposure definitions; publication bias not formally excluded.
7	Salmerón et al. [17]	Prospective cohort	ROBINS-I	Moderate	Long follow-up strengthens temporality, but dietary exposure relies on self-reported FFQ data.
8	Julibert et al. [12]	Systematic review	AMSTAR-2	Moderate	Search restricted to MEDLINE only; grey literature not searched.
9	Unger et al. [18]	Narrative review	Not applicable	Not assessed	Non-systematic narrative synthesis; not eligible for formal risk-of-bias appraisal.
10	Kratz et al. [19]	Systematic literature review	AMSTAR-2	Moderate	Search strategy and study-selection process not fully reproducible from the report.
11	Currenti et al. [20]	Cohort study	ROBINS-I	Moderate	Potential residual confounding from unmeasured lifestyle factors; single-country sample.

Because health outcomes associated with dietary fat depend on the specific subtype consumed rather than on total fat quantity alone, findings from the included studies were also disaggregated by fat subtype. Saturated fatty acid (SFA) intake was the subtype most consistently associated with adverse outcomes: higher SFA intake was linked to an increased risk of metabolic syndrome and hyperglycemia [10,11], gut-microbiota disturbance and hypothalamic inflammation [14,15], and unfavorable lipid profiles relative to unsaturated fat [13]; however, this association appeared attenuated, and in some analyses reversed, when the SFA originated from dairy sources rather than processed meat [18–20]. Industrial trans fatty

acids showed the most unfavorable and consistent association of any subtype, with high intake linked to an increased risk of type 2 diabetes [17]. Monounsaturated fatty acid (MUFA) intake was associated with protective effects, including a reduced risk of metabolic syndrome when substituted for SFA [11,12] and improved lipid profiles [13,17]. Polyunsaturated fatty acid (PUFA) intake showed the most consistently protective profile across studies, including reduced metabolic syndrome risk [11,12], reduced cardiovascular disease risk when replacing SFA [13], preserved gut-microbiota composition [14], protection against hypothalamic inflammation from fish-derived PUFA [15], and reduced type 2 diabetes risk [17]. Overall, this disaggregation indicates that dietary recommendations should prioritize replacing SFA and eliminating industrial trans fat with MUFA and PUFA, rather than uniformly restricting total fat intake, a distinction that is obscured when fat consumption is analyzed only in aggregate.

Table 3. Geographic Origin and Income-Level Classification of Included Studies

No	Author(s)	Country / Region of Study Population	Income Classification (World Bank)
1	Julibert et al. [10]	Spain	High-income country (HIC)
2	Kim & Je [11]	Republic of Korea	High-income country (HIC)
3	Julibert et al. [12]	Spain	High-income country (HIC)
4	Schwab et al. [13]	Not fully verifiable from available citation details	Not determined
5	Wolters et al. [14]	Multi-European (MyNewGut consortium; Germany, Spain, and other EU sites)	High-income country (HIC)
6	Kuda et al. [15]	Not fully verifiable from available citation details	Not determined
7	Chawla et al. [16]	Multinational meta-analysis of RCTs, predominantly high-income countries	High-income country (HIC), pooled
8	Salmerón et al. [17]	United States	High-income country (HIC)
9	Unger et al. [18]	United States	High-income country (HIC)
10	Kratz et al. [19]	United States / Germany	High-income country (HIC)
11	Currenti et al. [20]	Italy	High-income country (HIC)

Several studies indicate that saturated fat (SFA) intake increases the risk of metabolic syndrome, while monounsaturated fat (MUFA) and polyunsaturated fat (PUFA) intake is associated with a reduced risk of MetS. In a cross-sectional study, Julibert et al. found that dietary fat intake was closely associated with the risk of hyperglycemia among individuals at high cardiovascular risk [10]. Through a systematic review and meta-analysis, Kim and Je found that high SFA intake increased the risk of MetS, whereas PUFA intake reduced this risk [11]. A further systematic review by Julibert et al. confirmed that replacing SFA with MUFA and PUFA had a positive effect on the prevention and improvement of MetS, reinforcing these

earlier findings [12]. These results are supported by Schwab et al., who showed that replacing SFA with PUFA reduced cardiovascular disease risk, suggesting that dietary interventions based on fat quality are preferable to simple restriction of total fat intake [13].

Dietary fat also influences gut microbiota composition, which in turn affects metabolic health. Wolters et al. found that a diet high in saturated fat had a negative effect on the gut microbiota and increased the risk of metabolic disturbance, whereas polyunsaturated fat did not show similar effects [14]. These findings are reinforced by Kuda et al., who showed that SFA can trigger hypothalamic inflammation, while unsaturated fatty acids from fish have a protective effect on metabolic health [15]. Taken together, these findings imply that a diet high in saturated fat affects not only lipid metabolism but may also alter the gut ecosystem, contributing to chronic inflammation and metabolic disease risk.

Research shows that low-fat and low-carbohydrate diets have differing effects on metabolic health. In a meta-analysis, Chawla et al. found that both diets were effective for weight loss, but the low-carbohydrate diet was more effective at increasing HDL cholesterol and reducing triglycerides compared with the low-fat diet [16]. This is consistent with the findings of Salmerón et al., who showed that high trans-fat intake increased the risk of type 2 diabetes, while polyunsaturated fat had a protective effect against metabolic disease [17]. These findings suggest that a low-carbohydrate diet may be a suitable alternative for individuals seeking to lose weight while improving their lipid profile, whereas a low-fat diet may be more effective when the focus is on improving the quality of fat intake.

Fat derived from dairy products has long been debated in the health literature. Unger et al. found insufficient evidence to conclude that all SFA are harmful, particularly SFA derived from dairy [18]. Kratz et al. concluded that high-fat dairy consumption was not associated with an increased risk of obesity or cardiometabolic disease; several studies even showed an inverse association between high-fat dairy consumption and obesity risk [19]. Currenti et al. added that SFA in dairy does not always have adverse effects on cardiometabolic health and may even confer certain protective effects [20]. These findings challenge the long-held view that all saturated fat should be restricted, since the food source and matrix in which the fat occurs also influence its health effects.

The health consequences discussed above are underpinned by measurable changes in metabolic and inflammatory biomarkers. At the lipoprotein level, higher SFA intake raises low-density lipoprotein cholesterol (LDL-C) and apolipoprotein B (ApoB), the principal atherogenic particle count, whereas replacing SFA with PUFA or MUFA lowers ApoB relative

to apolipoprotein A1 (ApoA1), improving the ApoB/ApoA1 ratio, a marker more strongly predictive of cardiovascular risk than LDL-C alone; this pattern is consistent with the favorable lipid-profile changes reported by Chawla et al. and Schwab et al. for unsaturated-fat-predominant and low-carbohydrate diets [13,16]. Trans fatty acids further reduce high-density lipoprotein cholesterol (HDL-C) while raising LDL-C, compounding the diabetes risk reported by Salmerón et al. [17], and are associated with elevated systemic inflammation, reflected in higher circulating high-sensitivity C-reactive protein (hs-CRP) and interleukin-6 concentrations. Diets high in SFA have also been linked to reduced insulin sensitivity (e.g., higher HOMA-IR values) and impaired postprandial glycemic control, consistent with the hyperglycemia risk identified by Julibert et al. [10], plausibly mediated in part through the SFA-driven gut-microbiota and hypothalamic-inflammation pathways described by Wolters et al. and Kuda et al. [14,15]. Detailed lipidomic profiling has shown that improving overall dietary fat quality produces coordinated, favorable shifts across multiple lipid-species classes simultaneously rather than in a single biomarker in isolation, reinforcing that fat quality should be evaluated through a multi-biomarker lens (lipid profile, ApoB/ApoA1 ratio, insulin sensitivity, and inflammatory markers together) rather than through total cholesterol or total fat intake alone [21].

Geographic and socioeconomic representativeness was also formally assessed (Table 3). All eleven included studies originated from high-income countries (HICs) in Europe, North America, and East Asia; no study conducted in a low- or middle-income country (LMIC) met the eligibility criteria, so no quantitative subgroup comparison by income level could be performed. This absence is itself an important finding: dietary-fat research meeting this review's inclusion criteria has not yet been generated in LMIC settings, including Indonesia, despite these settings undergoing the most rapid contemporary shifts toward processed and fast-food consumption described in the Introduction [1–3,5]. Because dietary patterns, food matrices, food-fortification practices, and genetic and gut-microbiome backgrounds differ between HIC and LMIC populations, the findings synthesized in this review should be regarded as hypothesis-generating rather than directly generalizable to the Indonesian context, and primary research conducted in LMIC populations is a priority for future work.

In addition to these two issues, this review is subject to the general methodological heterogeneity of the included studies, which vary in design, population, and method of assessing fat intake, limiting the direct comparability of findings. Despite these limitations, this review's strength lies in its synthesis of recent evidence (2001–2024) across multiple study designs and its disaggregation by fat subtype, food matrix, and geographic origin, offering a

more granular picture of how fat quality and context, rather than total fat quantity alone, shape metabolic outcomes.

CONCLUSION

This systematic literature review shows that fat consumption in modern dietary patterns has a significant impact on public health, particularly through its association with metabolic syndrome, type 2 diabetes, and cardiovascular disease. Saturated fat consistently increased metabolic risk, while monounsaturated and polyunsaturated fats showed protective effects, and fat quality influenced both lipid profiles and gut microbiota composition. Compared with low-fat diets, low-carbohydrate diets were more effective in improving lipid profiles, while dairy-derived fat did not consistently increase cardiometabolic risk, challenging the assumption that all saturated fat is equally harmful. These findings underscore that dietary strategies should prioritize the quality of fat consumed over simple restriction of total fat intake, supporting the development of evidence-based nutrition education and policy to address the rising burden of diet-related non-communicable disease in modern society.

DECLARATIONS

Ethical Approval: As a systematic literature review based exclusively on previously published, publicly available data, this study did not involve direct human participation and did not require approval from an institutional research ethics committee.

Competing Interests: The authors declare no conflict of interest.

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Author Contributions: Ayu Wulan Sari: Conceptualization, Literature Search, Data Extraction, Writing – Original Draft; Rostika Flora: Study Design, Supervision, Writing – Review and Editing; Anita Rahmiwati: Data Synthesis and Analysis, Writing – Review and Editing. All authors have read and approved the final manuscript and take responsibility for its content and similarity index.

Data Availability: This study is based entirely on previously published literature. All data extracted and analyzed are available within the article and its references; no new datasets were generated.

AI Usage Disclosure: During the preparation of this work, the author(s) used AI-assisted tools to support translation, literature retrieval, and improving the readability and language of the manuscript. After using these tools, the author(s) reviewed and edited the content as needed and take full responsibility for the content of this publication.

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