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Palm Oil Consumption and Cardiovascular Health: A Review of Lipid Profile Alterations, Atherosclerosis Risk, and Dietary Context

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A B S T R A C T

Palm oil is the most widely consumed vegetable oil globally, accounting for approximately 40% of the world's edible oil trade. Despite its widespread use in the food, cosmetic, and pharmaceutical industries, its effects on cardiovascular health remain contested in the scientific literature. The high content of saturated fatty acids — principally palmitic acid (44–45%) — has been associated with elevated low-density lipoprotein (LDL) cholesterol, a recognized risk factor for atherosclerosis and coronary heart disease (CHD). Conversely, palm oil also contains oleic acid and bioactive tocotrienols with established antioxidant and cardioprotective properties. This study employs a qualitative literature review methodology to synthesize published scientific evidence on the relationship between palm oil consumption and cardiovascular health outcomes, with specific emphasis on lipid profile alterations, blood pressure changes, endothelial function, and coronary heart disease risk. Peer-reviewed articles from PubMed, Scopus, and Google Scholar were systematically reviewed based on predefined inclusion criteria. The findings indicate that excessive palm oil consumption is associated with elevated LDL cholesterol and increased cardiovascular risk, particularly when combined with diets high in other saturated fats or when the oil is repeatedly heated. However, moderate consumption within a well-balanced, fiber-rich diet does not significantly elevate cardiovascular risk. Population-level effects differ considerably, with Asian dietary patterns associated with milder adverse outcomes than Western dietary patterns. The review recommends limiting palm oil intake, avoiding repeated reheating, and substituting palm oil with oils higher in unsaturated fatty acids to promote cardiovascular health

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INTRODUCTION

Palm oil (Elaeis guineensis) is the world's most produced and traded vegetable oil, with global output exceeding 77 million metric tons annually (Alhaji et al., 2024). Its widespread adoption stems from its high oxidative stability, semisolid consistency at room temperature, and relatively low production cost compared to alternative vegetable oils (Bianchi et al., 2018). It is used extensively in processed foods, baked goods, margarines, instant noodles, cosmetics, and biofuels. However, the nutritional composition of palm oil — and particularly its high saturated fat content — has placed it at the center of ongoing scientific and public health debate regarding its effects on cardiovascular disease (CVD) (Banerjee et al., 2020; Ismail et al., 2018).

Chemically, palm oil is composed of approximately 50% saturated fatty acids, 40% monounsaturated fatty acids (predominantly oleic acid), and 10% polyunsaturated fatty acids (principally linoleic acid). The primary saturated component, palmitic acid (C16:0), constitutes roughly 44–45% of the total fatty acid profile and has been extensively studied for its role in modulating blood lipid concentrations. Palmitic acid has been consistently associated with elevated LDL cholesterol levels — widely termed "bad cholesterol" — which contribute to atherosclerotic plaque formation and increase the risk of coronary heart disease (CHD), myocardial infarction, and stroke (Annevelink et al., 2023; Carta et al., 2017; Jiang et al., 2025; Murru et al., 2022).

At the same time, palm oil contains unique bioactive compounds — most notably tocotrienols, a subclass of vitamin E — that possess potent antioxidant, anti-inflammatory, and cardioprotective properties not found in most other edible oils (Ibraheem et al., 2014; Newport & Dayrit, 2025; Ye et al., 2020). These tocotrienols have been shown in preclinical and clinical studies to inhibit HMG-CoA reductase (the same enzyme targeted by statin drugs), reduce oxidative stress, and improve endothelial function. The coexistence of atherogenic and cardioprotective components within the same oil makes palm oil one of the most nuanced dietary fats in nutritional science (Ooi et al., 2025).

Cholesterol homeostasis is central to understanding the cardiovascular implications of palm oil consumption. Low-density lipoprotein (LDL) transports cholesterol to peripheral tissues; when present in excess, it accumulates in arterial walls, contributing to atherosclerosis. High-density lipoprotein (HDL), by contrast, facilitates reverse cholesterol transport from peripheral tissues to the liver for excretion, thereby conferring cardioprotective effects (Traore et al., 2023). Triglycerides are another important lipid fraction; elevated circulating triglyceride levels independently increase CVD risk, particularly when combined with low HDL cholesterol (Kosmas et al., 2023; Nordestgaard & Varbo, 2014).

Given these inconsistencies, a qualitative literature review is necessary to consolidate existing evidence, identify methodological sources of heterogeneity, and develop a nuanced understanding of when and how palm oil consumption affects cardiovascular health outcomes (Ismail et al., 2018). This study aims to systematically examine and synthesize published research on the relationship between palm oil consumption and cardiovascular health, with attention to alterations in lipid profiles, atherosclerosis risk, blood pressure, endothelial function, and the modifying roles of dietary context, processing methods, and population-specific factors.

LITERATURE REVIEW

The scientific literature on palm oil and cardiovascular health has produced conflicting findings. Some studies report that palm oil significantly raises total and LDL cholesterol compared to oils rich in unsaturated fatty acids, such as olive or canola oil. Other studies find that palm oil has a modest or neutral effect on the LDL/HDL ratio when consumed as part of a balanced diet. Still others highlight the anti-atherogenic potential of palm tocotrienols and red palm oil phenolics, suggesting that the net cardiovascular effect of palm oil depends heavily on the form consumed and the broader dietary environment (Abdulwaliyu et al., 2023).

METHODOLOGY

This study employs a descriptive qualitative literature review methodology to investigate the relationship between palm oil consumption and cardiovascular health outcomes. The qualitative approach was selected because the objective is to synthesize, critically evaluate, and interpret existing scientific knowledge rather than generate new numerical data. This methodology is well-suited to identifying patterns across heterogeneous studies, reconciling conflicting findings, and contextualizing results within broader dietary and lifestyle frameworks (Ismail et al., 2018; Judijanto, 2026a).

Literature Search Strategy

A comprehensive literature search was conducted across three major academic databases: PubMed/MEDLINE, Scopus, and Google Scholar. Search terms included combinations of the following keywords: "palm oil," "cardiovascular disease," "LDL cholesterol," "HDL cholesterol," "palmitic acid," "atherosclerosis," "coronary heart disease," "lipid profile," "tocotrienols," "saturated fat," and "dietary fat." The search was limited to English-language publications, with priority given to studies published between 2010 and 2025 to ensure currency and relevance. Earlier foundational studies were included when their contribution to the review's theoretical basis was substantial.

Inclusion and Exclusion Criteria

Studies were included if they: (1) examined the relationship between palm oil or its principal fatty acid components and one or more cardiovascular health outcomes (LDL/HDL cholesterol, triglycerides, blood pressure, atherosclerosis, CHD, or CVD mortality); (2) employed recognized study designs including randomized controlled trials (RCTs), prospective or retrospective cohort studies, cross-sectional studies, systematic reviews, or meta-analyses; and (3) provided clear descriptions of palm oil exposure levels and study populations. Studies were excluded if they focused exclusively on non-food uses of palm oil (e.g., industrial applications), lacked cardiovascular outcome measures, or were published in non-peer-reviewed outlets without verifiable methodology.

Data Extraction and Analysis

Data extracted from included studies encompassed: study design; sample population characteristics (size, age, health status, country/region); type and quantity of palm oil consumed; cardiovascular outcome measures assessed; and principal findings. Thematic analysis was applied as the primary analytical framework, following three sequential stages: data reduction (selection of the most pertinent information), thematic categorization (grouping findings by cardiovascular outcome or mechanistic pathway), and interpretive synthesis (identification of patterns, contradictions, and contextual moderators across studies) (Judijanto, 2026a).

Quality Assurance

Data triangulation was employed to enhance the validity and reliability of findings. Specifically, findings from individual experimental studies were cross-referenced with systematic reviews and meta-analyses, and mechanistic evidence from biochemical studies was integrated with population-level epidemiological data. Potential sources of bias — including publication bias, industry funding, and population heterogeneity — were explicitly considered when interpreting the results (Ismail et al., 2018).

RESULTS

Palm Oil Composition and Lipid Profile Alterations

The most consistently studied cardiovascular outcome associated with palm oil consumption is its effect on blood lipid profiles. A substantial body of evidence from RCTs and meta-analyses indicates that palm oil consumption elevates LDL cholesterol concentrations compared to oils rich in unsaturated fatty acids. A meta-analysis of clinical trials published in Circulation demonstrated that consuming palm oil significantly increased LDL cholesterol compared with vegetable oils high in mono- or polyunsaturated fats, including soybean, olive, and canola oil. This effect is primarily attributed to palmitic acid, which reduces the expression and activity of hepatic LDL receptors, thereby impairing LDL clearance from the bloodstream and allowing LDL particles to accumulate in circulation (Abumrad et al., 2021; Albitar et al., 2024; Annevelink et al., 2023; He et al., 2025).

Recent molecular research has further elucidated the mechanisms through which palmitic acid contributes to endothelial dysfunction and atherosclerosis. A 2024 study published in Advanced Science demonstrated that palmitic acid accelerates endothelial cell injury by activating pro-inflammatory signaling cascades, upregulating adhesion molecule expression, and promoting monocyte recruitment — all of which are early steps in atherosclerotic plaque formation. These findings corroborate earlier epidemiological associations between high saturated fat intake and incident CHD, extending the evidence from population-level correlations to cellular and molecular mechanisms (Kris-Etherton et al., 2004; Kurhaluk et al., 2026; Ramírez-Alarcón et al., 2026).(Babalola et al., 2025)
Palm oil also elevates HDL cholesterol, however, which partially offsets the adverse LDL effect. Several studies have reported that while palm oil consumption increases both LDL and HDL, the LDL/HDL ratio — a key predictor of cardiovascular risk — may not worsen significantly when palm oil

replaces carbohydrates rather than unsaturated fats in the diet. A 2018 systematic review published in PLOS ONE concluded that the evidence linking palm oil consumption directly to increased CHD incidence remained inconsistent, with many studies confounded by overall dietary quality and lifestyle factors (Ismail et al., 2018; Mente et al., 2009; Ooi et al., 2025; Unhapipatpong et al., 2021).

Comparative Lipid Effects Relative to Other Dietary Fats

A recurring finding in the comparative literature is that palm oil occupies an intermediate position in the spectrum of dietary fats with respect to cardiovascular risk. Compared to vegetable oils high in unsaturated fatty acids — such as olive oil, canola oil, and sunflower oil — palm oil consistently produces greater elevations in LDL cholesterol. The American Heart Association's Presidential Advisory on Dietary Fats explicitly recommends replacing saturated fats, including those from palm oil, with polyunsaturated fats to reduce CVD risk, citing evidence of a 30% reduction in CHD events with such substitution (Briggs et al., 2017; Clifton & Keogh, 2017; Ismail et al., 2018; Sacks et al., 2017).

However, relative to animal fats such as butter, lard, and beef tallow — which are rich in both palmitic and stearic acids — palm oil demonstrates a less pronounced adverse effect on the LDL/HDL ratio. This intermediate profile suggests that, while palm oil is not cardioprotective compared with unsaturated oils, it may be preferable to solid animal fats in dietary contexts where substitution with unsaturated oils is not feasible (Abdulwaliyu et al., 2023; Arias et al., 2023; Ooi et al., 2025; Sulaiman et al., 2022).

Trans fatty acids, whether industrially produced or naturally occurring, remain more harmful to the LDL/HDL ratio than palm oil's saturated fatty acids. This has led some food manufacturers to replace partially hydrogenated vegetable oils (a major source of trans fats) with palm oil, which — while still containing saturated fats — does not produce the LDL-raising, HDL-lowering effect characteristic of trans fats (Judijanto, 2025; Okpe, 2022; Sacks et al., 2017; Silva et al., 2025).

The Cardioprotective Role of Palm Tocotrienols

A distinctive feature of palm oil that differentiates it from most other saturated fat sources is its exceptionally high tocotrienol content. Palm oil, particularly red palm oil, is the richest natural source of tocotrienols, providing approximately 600–900 mg/kg of a tocotrienol-rich fraction (TRF). Unlike tocopherols (the more common form of vitamin E), tocotrienols possess a farnesyl side chain that enables superior membrane mobility and antioxidant potency (Londoño et al., 2026; Mathew et al., 2023; Ranasinghe et al., 2022; Zhang et al., 2026).

A systematic review published in Nutrition Reviews (2025) found that palm TRF supplementation was associated with significant reductions in total cholesterol, LDL cholesterol, and markers of oxidative stress in clinical trials. The proposed mechanisms include inhibition of HMG-CoA reductase activity (reducing endogenous cholesterol synthesis), suppression of nuclear factor kappa-B (NF-κB) inflammatory pathways, and protection of vascular endothelial cells from oxidative damage. A 2025 randomized controlled trial evaluating palm-based TRF supplementation reported statistically significant improvements in lipid profiles and reductions in plasma malondialdehyde (a biomarker of lipid peroxidation) among participants with mild hypercholesterolemia (Jumat et al., 2025; Looi et al., 2025; Trugilho et al., 2024, 2025).

These cardioprotective properties are primarily associated with red palm oil — the less refined product that retains its carotenoids, tocotrienols, and phenolic compounds — rather than refined, bleached, and deodorized (RBD) palm oil, which is the form most commonly used in processed food manufacturing. The degree of processing is therefore a critical determinant of palm oil's net cardiovascular effect: less-refined forms may confer protective benefits, whereas heavily refined forms deliver the atherogenic effects of palmitic acid, predominantly without the offsetting bioactive compounds (Madoromae & Lertcanawanichakul, 2025; Ooi et al., 2025; Sulaiman et al., 2022; Tan et al., 2025).

Repeated Heating and Oxidative Degradation

The method of palm oil use — particularly the common practice of repeated heating for deep frying — represents a significant and underappreciated source of cardiovascular risk. When palm oil is repeatedly heated to high temperatures, thermally induced oxidation produces a range of harmful compounds, including aldehydes, hydroxynonenal, malondialdehyde, polar compounds, and oxidized triacylglycerols. These oxidation products are not present in fresh palm oil and represent a qualitatively different risk profile (Loganathan et al., 2022; Machado et al., 2023; Mensah & Kudomor, 2026; Zhuang et al., 2022).

Evidence from animal and in vitro studies consistently demonstrates that consumption of repeatedly heated palm oil impairs endothelial function, promotes vascular inflammation, increases oxidative stress, and accelerates atherosclerosis progression (Ismail et al., 2018). A study found that palm oil subjected to four or more reheating cycles exhibited substantially elevated levels of total polar compounds, and that animals consuming such oil showed marked deterioration in lipid profiles and the aortic endothelium compared with those consuming fresh palm oil. These findings are particularly relevant to street food vending and industrial deep-frying, where oil reuse across multiple cycles is common practice, especially in Southeast and South Asia (Adam et al., 2008; Chandran & Manickam, 2026; Egbung et al., 2024; Zhao et al., 2026).

A study analyzing oxidative stability found that adding antioxidants such as α-tocopherol can meaningfully delay oxidative degradation of palm olein during microwave heating, suggesting that processing conditions and antioxidant additions may significantly modify the cardiovascular risk of heated palm oil (Dewi et al., 2024; Erickson et al., 2023; How et al., 2024; Machado et al., 2023).

Population and Dietary Context Effects

One of the most important findings across the reviewed literature is that the cardiovascular impact of palm oil is heavily modulated by the broader dietary context in which it is consumed. Studies conducted in Asian populations — where palm oil is typically consumed alongside diets rich in fish, vegetables, legumes, whole grains, and other sources of unsaturated fat — generally report milder adverse effects on lipid profiles and lower incidence of attributable CHD compared to studies in Western populations (Abdulwaliyu et al., 2023; Annevelink et al., 2023; Judijanto, 2025; Kurhaluk, 2025).

A study published in Population Health Metrics modeled the integrated economic and health effects of palm cooking oil consumption in Thailand and found that, while high palm oil intake was associated with elevated CVD risk at the population level, dietary pattern modifiers (notably co-consumption of polyunsaturated fat) substantially attenuated this risk (Keogh-Brown et al., 2019). Similarly, research found that individuals who consumed palm oil as part of a Mediterranean-style dietary pattern — characterized by high intake of olive oil, fish, fruits, vegetables, and legumes — did not demonstrate a significant increase in cardiovascular disease risk (Feingold, 2024; Guallar-Castillón et al., 2012; Ismail et al., 2018; Mocciaro et al., 2018).

These findings align with the broader consensus in nutritional science that no single food item should be evaluated in isolation from the overall diet. The cardiovascular risk of palm oil is amplified when consumed alongside diets already high in saturated fats, refined carbohydrates, and low in dietary fiber — a pattern associated with higher-risk lipid profiles and metabolic syndrome. Conversely, when substituted for trans fats or animal fats within a nutrient-dense, fiber-rich dietary framework, palm oil's adverse cardiovascular effects may be substantially diminished (Bazina et al., 2025; McClements, 2024; Mititelu et al., 2024; Sulaiman et al., 2022).

Genetic predisposition also modifies individual responses to palm oil. Certain polymorphisms in genes encoding apolipoprotein E (ApoE), lipoprotein lipase (LPL), and cholesterol ester transfer protein (CETP) are associated with differential LDL responses to saturated fat intake, meaning that some individuals may be inherently more susceptible to the LDL-raising effects of palmitic acid than others. This genetic heterogeneity partly explains the variability in individual and population-level responses to palm oil consumption observed across studies (Dabravolski et al., 2024; Ismail et al., 2018; Pérez-Beltrán et al., 2022; Wuni, 2024).

Long-Term Epidemiological Evidence

Longitudinal cohort studies provide important evidence on the long-term cardiovascular consequences of habitual palm oil consumption. A comprehensive prospective study conducted in Malaysia found that sustained high palm oil consumption — particularly in the context of diets also high in other saturated fats — was associated with increased incidence of hypertension and coronary heart disease over a follow-up period of more than 10 years. This association was most pronounced among individuals in the highest quintile of palm oil intake who also had low dietary fiber consumption and sedentary lifestyles (Abdulwaliyu et al., 2023; Gjermeni et al., 2025; Ismail et al., 2018; Kurhaluk, 2025).

A cohort analysis found that while palm oil consumption was positively correlated with LDL cholesterol at the population level, the association with incident CVD events was attenuated after adjustment for total dietary fat quality, physical activity, and smoking status — underscoring the importance of multivariate confounder control in interpreting epidemiological findings on palm oil (Abdulwaliyu et al., 2023; Eichelmann et al., 2024; Sawicki et al., 2024; Wang et al., 2024).

The literature review also identified significant heterogeneity across published studies, driven by differences in study design, follow-up duration, palm oil quantification methods, and cardiovascular endpoints examined. Studies relying on self-reported dietary intake introduce measurement error, while short-term RCTs may not capture the chronic effects of habitual palm oil consumption. These methodological limitations must be considered when interpreting cumulative evidence from the reviewed literature (Judijanto, 2026a).

DISCUSSION

Mechanistic Pathways Linking Palm Oil to Cardiovascular Disease

The principal mechanism through which palm oil increases CVD risk is palmitic acid-mediated upregulation of LDL cholesterol. At the hepatic level, palmitic acid suppresses LDL receptor expression by activating sterol regulatory element-binding protein-2 (SREBP-2) pathways and generating ceramide intermediates that inhibit receptor recycling. The net result is reduced clearance of LDL particles from circulation and sustained elevation of plasma LDL concentrations, which promotes subendothelial LDL retention and oxidative modification — the initiating event in atherosclerotic plaque formation (He et al., 2025).

At the vascular level, palmitic acid directly induces endothelial dysfunction by activating toll-like receptor 4 (TLR4)-mediated inflammatory signaling, increasing expression of intracellular adhesion molecule-1 (ICAM-1) and vascular cell adhesion molecule-1 (VCAM-1), and promoting monocyte-to-macrophage differentiation within the arterial intima. These processes accelerate atherosclerosis progression and increase the vulnerability of existing plaques to rupture — the proximate cause of acute myocardial infarction and ischemic stroke (Choroszy et al., 2023; Khoi et al., 2024; Kotlyarov & Kotlyarova, 2022).

The Dual Nature of Palm Oil: Risk and Protection

The simultaneous presence of atherogenic palmitic acid and cardioprotective tocotrienols within palm oil creates a genuinely complex risk-benefit profile that resists simple categorical judgment. The net cardiovascular effect depends on the relative bioavailability and activity of these opposing components, which in turn depend on the degree of oil processing, consumption quantity, co-consumed dietary components, and individual metabolic characteristics (Dewi et al., 2024; Ismail et al., 2018).

Red palm oil, which retains its full complement of tocotrienols, carotenoids, and phenolic antioxidants, may in fact exert a net neutral or even beneficial effect on cardiovascular health in moderate-consumption contexts, particularly given the evidence for tocotrienol-mediated HMG-CoA reductase inhibition and anti-inflammatory activity. Refined palm oil, stripped of these protective micronutrients during industrial processing, delivers the atherogenic fatty acid profile without the offsetting benefits — and may additionally contain processing-derived contaminants such as 3-monochloropropane-1,2-diol (3-

MCPD) fatty acid esters, which have been implicated in nephrotoxic and potentially carcinogenic effects at high exposure levels (Judijanto, 2026b).

Dietary Pattern as the Primary Moderator

The preponderance of evidence reviewed supports the conclusion that dietary pattern is the primary moderator of palm oil's cardiovascular effects. When consumed within a nutrient-poor, high-saturated-fat dietary context — typical of many ultra-processed food-dependent Western diets — palm oil contributes meaningfully to atherogenic dyslipidemia. When consumed within a nutrient-dense, high-unsaturated-fat dietary context — as in traditional Southeast Asian or Mediterranean dietary patterns — its adverse cardiovascular effects are substantially attenuated (Sacks et al., 2017).

This dietary context dependency has important implications for public health messaging. Blanket recommendations to eliminate palm oil without addressing overall dietary quality may be less effective than targeted guidance that emphasizes reducing total saturated fat intake, avoiding ultra-processed foods containing repeatedly heated palm oil, and substituting palm oil with polyunsaturated-fat-rich oils in home cooking and food manufacturing (McClements, 2024).

Limitations of the Existing Evidence Base

Several limitations were identified in the reviewed literature. First, publication bias is a recognized concern: studies reporting adverse cardiovascular effects of palm oil are more likely to be published than those with null or beneficial findings, potentially skewing the overall body of evidence toward overestimation of risk. Second, many studies — particularly those in Western countries — are partially funded by industries with commercial interests in alternative vegetable oils, raising questions about potential bias in study design, reporting, and conclusions. Third, the heterogeneity of palm oil products used across studies (red palm oil vs. refined palm oil, palm olein vs. palm stearin, fresh vs. repeatedly heated) makes direct comparison difficult, as these products have substantially different nutritional and toxicological profiles. Fourth, most available RCTs are short-duration (4–16 weeks), making it difficult to establish long-term cardiovascular effects that may take years or decades to manifest clinically (Sacks et al., 2017).

CONCLUSIONS AND RECOMMENDATIONS

The relationship between palm oil consumption and cardiovascular health is multidimensional, context-dependent, and not reducible to a simple verdict of harmful or benign. The high palmitic acid content of palm oil is associated with elevated LDL cholesterol and increased atherosclerosis risk, particularly in high-consumption contexts and when combined with diets already rich in saturated fat and low in dietary fiber. Repeated heating of palm oil generates oxidative degradation products that independently contribute to vascular inflammation and endothelial dysfunction, adding a processing-related dimension to its cardiovascular risk profile.

However, palm oil also contains tocotrienols — bioactive vitamin E forms with demonstrable HMG-CoA reductase inhibitory and anti-inflammatory properties — that may partially offset the atherogenic effects of its saturated fatty acid content, particularly in less-refined forms such as red palm oil. Population-level evidence suggests that Asian dietary contexts, characterized by higher consumption of fish, vegetables, and unsaturated fats, are associated with attenuated cardiovascular effects of palm oil compared to Western dietary contexts.

Based on the synthesized evidence, the following evidence-based recommendations are proposed:

- Moderate palm oil consumption, limiting daily intake to levels consistent with national dietary guidelines on saturated fat (less than 10% of total energy intake).
- Avoid repeated reheating of palm oil for frying, and replace oil after limited use cycles in both household and commercial food preparation.
- Prefer less refined palm oil (such as red palm oil) where feasible, to retain cardioprotective tocotrienol and carotenoid content.
- Substitute palm oil with unsaturated fat-rich oils (olive oil, canola oil, sunflower oil) in cooking applications where high heat is not required.
- Evaluate palm oil within overall dietary quality rather than in isolation, and address accompanying risk factors, including total saturated fat intake, dietary fiber consumption, physical activity, and smoking.

Future research should prioritize long-term prospective cohort studies with standardized assessments of palm oil exposure, comparative trials using different forms and levels of palm oil refinement, and investigations of gene-diet interactions that may explain individual variability in lipid responses to palm oil consumption.

FURTHER STUDY

Further research on the topic of Palm Oil Consumption and Cardiovascular Health: A Review of Lipid Profile Changes, Atherosclerosis Risk, and Dietary Context to improve research and increase insight for readers and authors

REFERENCES

Abdulwaliyu, I., Okoduwa, S. I. R., Sangodare, R., Arekemase, S. O., Batari, M. L., & Muhammad, A. (2023). Review of Studies on Palm-Oil Consumption in Relation to Risk of Cardiovascular Diseases. JNFS: Journal of Nutrition and Food Security, 8(1), 137–151. https://publish.kne-publishing.com/index.php/JNFS/article/download/11779/11143

Abumrad, N. A., Cabodevilla, A. G., Samovski, D., Pietka, T., Basu, D., & Goldberg, I. J. (2021). Endothelial Cell Receptors in Tissue Lipid Uptake and Metabolism. Circulation Research, 128(3), 433–450. https://doi.org/10.1161/CIRCRESAHA.120.318003

Adam, S. K., Soelaiman, I. N., Umar, N. A., Mokhtar, N., Mohamed, N., & Jaarin, K. (2008). Effects of repeatedly heated palm oil on serum lipid profile, lipid peroxidation and homocysteine levels in a post-menopausal rat model. McGill Journal of Medicine : MJM : An International Forum for the Advancement of Medical Sciences by Students, 11(2), 145–151. http://www.ncbi.nlm.nih.gov/pubmed/19148313

Albitar, O., D'Souza, C. M., & Adeghate, E. A. (2024). Effects of Lipoproteins on Metabolic Health. Nutrients, 16(13), 2156. https://doi.org/10.3390/nu16132156

Alhaji, A. M., Almeida, E. S., Carneiro, C. R., da Silva, C. A. S., Monteiro, S., & Coimbra, J. S. dos R. (2024). Palm Oil (Elaeis guineensis): A Journey through Sustainability, Processing, and Utilization. Foods, 13(17), 2814. https://doi.org/10.3390/foods13172814

Annevelink, C. E., Sapp, P. A., Petersen, K. S., Shearer, G. C., & Kris-Etherton, P. M. (2023). Diet-derived and diet-related endogenously produced palmitic acid: Effects on metabolic regulation and cardiovascular disease risk. Journal of Clinical Lipidology, 17(5), 577–586. https://doi.org/10.1016/j.jacl.2023.07.005

Arias, A., Rizo Patron, A., Simmons, S., Bell, H., & Alvarez, V. (2023). Palm Oil and Coconut Oil Saturated Fats: Properties, Food Applications, and Health. World Journal of Food Science and Technology, 7(1), 9–19. https://doi.org/10.11648/j.wjfst.20230701.12

Babalola, O. O., Akinnusi, E., Ottu, P. O., Bridget, K., Oyubu, G., Ajiboye, S. A., Waheed, S. A., Collette, A. C., Adebimpe, H. O., Nwokafor, C. V., Oni, E. A., Aturamu, P. O., & Iwaloye, O. (2025). The impact of ultra-processed foods on cardiovascular diseases and cancer: Epidemiological and mechanistic insights. Aspects of Molecular Medicine, 5, 100072. https://doi.org/10.1016/j.amolm.2025.100072

Banerjee, A., Das, D., Paul, R., Roy, S., Bhattacharjee, A., Prasad, S. K., Banerjee, O., Mukherjee, S., & Maji, B. K. (2020). Altered composition of high-lipid diet may generate reactive oxygen species by disturbing the balance of antioxidant and free radicals. Journal of Basic and Clinical Physiology and Pharmacology, 31(3). https://doi.org/10.1515/jbcpp-2019-0141

Bazina, N., Ahmed, T., Almdaaf, M., Abu Hallalah, H. M. O., & Jibia, S. (2025). Chemical Changes in Deep-Fat Frying: Reaction Mechanisms, Oil Degradation, and Health Implications. Food Science & Nutrition, 13(10). https://doi.org/10.1002/fsn3.70969

Bianchi, A. E., Zortea, T., Cazzarotto, C. J., Machado, G., Pellegrini, L. G., Dos Santos Richards, N. S. P., Baldissera, M. D., Silva, A. S., Galvão, A. C., & Paula MacEdo, V. (2018). Addition of palm oil in diet of dairy ewes reduces saturates fatty acid and increases unsaturated fatty acids in milk. Acta Scientiae Veterinariae, 46(1). https://doi.org/10.22456/1679-9216.89180

Briggs, M., Petersen, K., & Kris-Etherton, P. (2017). Saturated Fatty Acids and Cardiovascular Disease: Replacements for Saturated Fat to Reduce Cardiovascular Risk. Healthcare, 5(2), 29. https://doi.org/10.3390/healthcare5020029

Carta, G., Murru, E., Banni, S., & Manca, C. (2017). Palmitic Acid: Physiological Role, Metabolism and Nutritional Implications. Frontiers in Physiology, 8. https://doi.org/10.3389/fphys.2017.00902

Chandran, M., & Manickam, L. (2026). Effect on thermo-oxidative degradation of palm olein during continuous and replenishment deep-frying methods. Journal of Food Measurement and Characterization. https://doi.org/10.1007/s11694-026-04326-6

Choroszy, M., Środa-Pomianek, K., Wawrzyńska, M., Chmielarz, M., Bożemska, E., & Sobieszczańska, B. (2023). The Role of Palmitic Acid in the Co-Toxicity of Bacterial Metabolites to Endothelial Cells. Vascular Health and Risk Management, Volume 19, 399–409. https://doi.org/10.2147/VHRM.S408897

Clifton, P. M., & Keogh, J. B. (2017). A systematic review of the effect of dietary saturated and polyunsaturated fat on heart disease. Nutrition, Metabolism and Cardiovascular Diseases, 27(12), 1060–1080. https://doi.org/10.1016/j.numecd.2017.10.010

Dabravolski, S., Orekhov, N. A., Melnichenko, A., Sukhorukov, V. N., Popov, M. A., & Orekhov, A. (2024). Cholesteryl Ester Transfer Protein (CETP) Variations in Relation to Lipid Profiles and Cardiovascular Diseases: An Update. Current Pharmaceutical Design, 30(10), 742–756. https://doi.org/10.2174/0113816128284695240219093612

Dewi, M., Martianto, D., Andarwulan, N., Kazimierczak, R., & Średnicka-Tober, D. (2024). Plant Sterol-Enriched Palm Oil Intervention to Improve Lipid Profile and Inflammation Status in Hyperlipidemic Individuals. Nutrients, 16(19), 3370. https://doi.org/10.3390/nu16193370

Egbung, J. E., Agiang, M. A., Bassey, S. O., Ukam, C. I.-O., & Oham, O. (2024). Effect of Short Time Repeated Heating on the Physicochemical Characteristics and Fatty Acid Profile of Palm Oil. JOCRES: Journal of Contemporary Research, 3(2), 183–191. https://www.researchgate.net/profile/Josephine-Egbung-2/publication/383602437_EFFECT_OF_SHORT_TIME_REPEATED_HEATING_ON_THE_PHYSICOCHEMICAL_CHARACTERISTICS_AND_FATTY_ACID_PROFILE_OF_PALM_OIL/links/66d30febfa5e11512c431d8f/EFFECT-OF-SHORT-TIME-REPEATED-HEAT

Eichelmann, F., Prada, M., Sellem, L., Jackson, K. G., Salas Salvadó, J., Razquin Burillo, C., Estruch, R., Friedén, M., Rosqvist, F., Risérus, U., Rexrode, K. M., Guasch-Ferré, M., Sun, Q., Willett, W. C., Martinez-Gonzalez, M. A., Lovegrove, J. A., Hu, F. B., Schulze, M. B., & Wittenbecher, C. (2024). Lipidome changes due to improved dietary fat quality inform cardiometabolic risk reduction and precision nutrition. Nature Medicine, 30(10), 2867–2877. https://doi.org/10.1038/s41591-024-03124-1

Erickson, M. D., Yevtushenko, D. P., & Lu, Z.-X. (2023). Oxidation and Thermal Degradation of Oil during Frying: A Review of Natural Antioxidant Use. Food Reviews International, 39(7), 4665–4696. https://doi.org/10.1080/87559129.2022.2039689

Feingold, K. R. (2024). The Effect of Diet on Cardiovascular Disease and Lipid and Lipoprotein Levels Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc. In K. R. Feingold, R. A. Adler, & S. F. Ahmed (Eds.), Endotext. https://www.ncbi.nlm.nih.gov/sites/books/NBK570127/

Gjermeni, E., Fiebiger, R., Bundalian, L., Garten, A., Schöneberg, T., Le Duc, D., & Blüher, M. (2025). The impact of dietary interventions on cardiometabolic health. Cardiovascular Diabetology, 24(1), 234. https://doi.org/10.1186/s12933-025-02766-w

Guallar-Castillón, P., Rodríguez-Artalejo, F., Tormo, M. J., Sánchez, M. J., Rodríguez, L., Quirós, J. R., Navarro, C., Molina, E., Martínez, C., Marín, P., Lopez-Garcia, E., Larrañaga, N., Huerta, J. M., Dorronsoro, M., Chirlaque, M. D., Buckland, G., Barricarte, A., Banegas, J. R., Arriola, L., … Moreno-Iribas, C. (2012). Major dietary patterns and risk of coronary heart disease in middle-aged persons from a Mediterranean country: The EPIC-Spain cohort study. Nutrition, Metabolism and Cardiovascular Diseases, 22(3), 192–199. https://doi.org/10.1016/j.numecd.2010.06.004

He, Y., Li, S., Jiang, L., Wu, K., Chen, S., Su, L., Liu, C., Liu, P., Luo, W., Zhong, S., & Li, Z. (2025). Palmitic Acid Accelerates Endothelial Cell Injury and Cardiovascular Dysfunction via Palmitoylation of PKM2. Advanced Science, 12(5). https://doi.org/10.1002/advs.202412895

How, Y. H., Nyam, K. L., & Soo, W. X. (2024). Effect of butylated hydroxyanisole and α-tocopherol on the oxidative stability of palm olein during microwave heating. International Journal of Food Science and Technology, 59(9), 6340–6349. https://doi.org/10.1111/ijfs.17374

Ibraheem, Z. O., Satar, M., Abdullah, N. A., Rathore, H., Tan, Y. C., Uldin, F., Basri, R., Abdullah, M. H., & John, E. (2014). Antioxidant and cardio protective effect of palm oil leaves extract (standardized ethanolic fraction) in rats' model of saturated fats induced metabolic disorders. Pakistan Journal of Pharmaceutical Sciences, 27(1), 1–9.

Ismail, S. R., Maarof, S. K., Siedar Ali, S., & Ali, A. (2018). Systematic review of palm oil consumption and the risk of cardiovascular disease. PLOS ONE, 13(2), e0193533. https://doi.org/10.1371/journal.pone.0193533

Jiang, H., Na, C., Zhu, Y., Bi, Y., Yang, R., Yang, R., Yang, H., Niu, M., Huang, X., & Yang, J. (2025). Multiple Roles of Palmitic Acid in Cardiovascular Diseases. Journal of Inflammation Research, Volume 18, 14515–14533. https://doi.org/10.2147/JIR.S530054

Judijanto, L. (2025). Reconciling Scientific Evidence with Perception: The Case for Palm Oil's Evidence-Based Health Benefits Across Multiple Physiological Systems. JCPMR: Journal of Clinical Practice and Medical Research, 1(3), 61–66. https://doi.org/10.59324/jcpmr.2025.1(3).11

Judijanto, L. (2026a). Balancing risks and benefits; A review of palm oil consumption and cardiovascular health outcomes. Open Access Journal of Science, 9(1), 46–56. https://doi.org/10.15406/oajs.2026.09.00287

Judijanto, L. (2026b). Tocotrienol-Rich Fractions from Palm Oil: A Review of Cardioprotective, Neuroprotective, and Anti-Cancer Potentials. Biomedical: Journal of Scientific & Technical Research, 64(4), 56764–56774. https://doi.org/10.26717/BJSTR.2026.64.010081

Jumat, N. F., Adib Ridzuan, N. R., Sheikh Abdul Kadir, S. H., & Abdul Satar, N. (2025). Antioxidant Effects of Tocotrienol-rich Fractions Supplementation on Obesity-induced Oxidative Stress in Female Reproductive System: A Systematic Review. Malaysian Journal of Medicine and Health Sciences, 21(6). https://doi.org/10.47836/mjmhs.v21.i6.1355

Keogh-Brown, M. R., Jensen, H. T., Basu, S., Aekplakorn, W., Cuevas, S., Dangour, A. D., Gheewala, S. H., Green, R., Joy, E. J. M., Rojroongwasinkul, N., Thaiprasert, N., Shankar, B., & Smith, R. D. (2019). Evidence on the magnitude of the economic, health and population effects of palm cooking oil consumption: An integrated modelling approach with Thailand as a case study. Population Health Metrics, 17(1). https://doi.org/10.1186/s12963-019-0191-y

Khoi, C.-S., Lin, T.-Y., & Chiang, C.-K. (2024). Targeting Insulin Resistance, Reactive Oxygen Species, Inflammation, Programmed Cell Death, ER Stress, and Mitochondrial Dysfunction for the Therapeutic Prevention of Free Fatty Acid-Induced Vascular Endothelial Lipotoxicity. Antioxidants, 13(12), 1486. https://doi.org/10.3390/antiox13121486

Kosmas, C. E., Rodriguez Polanco, S., Bousvarou, M. D., Papakonstantinou, E. J., Peña Genao, E., Guzman, E., & Kostara, C. E. (2023). The Triglyceride/High-Density Lipoprotein Cholesterol (TG/HDL-C) Ratio as a Risk Marker for Metabolic Syndrome and Cardiovascular Disease. Diagnostics, 13(5), 929. https://doi.org/10.3390/diagnostics13050929

Kotlyarov, S., & Kotlyarova, A. (2022). Involvement of Fatty Acids and Their Metabolites in the Development of Inflammation in Atherosclerosis. International Journal of Molecular Sciences, 23(3), 1308. https://doi.org/10.3390/ijms23031308

Kris-Etherton, P. M., Hecker, K. D., & Binkoski, A. E. (2004). Polyunsaturated Fatty Acids and Cardiovascular Health. Nutrition Reviews, 62(11), 414–426. https://doi.org/10.1111/j.1753-4887.2004.tb00013.x

Kurhaluk, N. (2025). Palm oil as part of a high-fat diet: advances and challenges, or possible risks of pathology? Nutrition Reviews, 83(2), e547–e573. https://doi.org/10.1093/nutrit/nuae038

Kurhaluk, N., Kołodziejska, R., Mazur, Z., Lukash, O., Yakovenko, O., & Tkaczenko, H. (2026). Functional Foods as Modulators of Epigenetic Mechanisms Affecting Metabolic Health in Adolescence. International Journal of Molecular Sciences, 27(4), 2066. https://doi.org/10.3390/ijms27042066

Loganathan, R., Tarmizi, A. H. A., Vethakan, S. R., & Teng, K.-T. (2022). A Review on Lipid Oxidation in Edible Oils. MJAS: Malaysian Journal of Analytical Sciences, 26(6), 1378–1393. https://www.researchgate.net/profile/Radhika-Loganathan/publication/368477125_A_REVIEW_ON_LIPID_OXIDATION_IN_EDIBLE_OILS/links/642b754f609c170a13f0499d/A-REVIEW-ON-LIPID-OXIDATION-IN-EDIBLE-OILS.pdf

Londoño, N., Casas-Forero, N., Garzón-Méndez, A., Rojas-Díaz, D., Olivares-Tenorio, M., Romero, H., & García-Núñez, J. (2026). Tocotrienols: A Review From Source to Therapeutic Applications. Food Frontiers, 7(2). https://doi.org/10.1002/fft2.70154

Looi, A. D., Palanisamy, U. D., Moorthy, M., & Radhakrishnan, A. K. (2025). Health Benefits of Palm Tocotrienol-Rich Fraction: A Systematic Review of Randomized Controlled Trials. Nutrition Reviews, 83(2), 307–328. https://doi.org/10.1093/nutrit/nuae061

Machado, M., Rodriguez-Alcalá, L. M., Gomes, A. M., & Pintado, M. (2023). Vegetable oils oxidation: mechanisms, consequences and protective strategies. Food Reviews International, 39(7), 4180–4197. https://doi.org/10.1080/87559129.2022.2026378

Madoromae, H., & Lertcanawanichakul, M. (2025). Red Palm Oil: Nutritional Composition, Bioactive Properties, and Potential Applications in Health and Cosmetics: A Narrative Review. Molecules, 30(22), 4402. https://doi.org/10.3390/molecules30224402

Mathew, A. M., Bhuvanendran, S., Nair, R. S., & K Radhakrishnan, A. (2023). Exploring the anti-inflammatory activities, mechanism of action and prospective drug delivery systems of tocotrienol to target neurodegenerative diseases. F1000Research, 12, 338. https://doi.org/10.12688/f1000research.131863.1

McClements, D. J. (2024). Designing healthier and more sustainable ultraprocessed foods. Comprehensive Reviews in Food Science and Food Safety, 23(2). https://doi.org/10.1111/1541-4337.13331

Mensah, E. O., & Kudomor, I. (2026). Thermal Degradation and Safety of Repeatedly Heated Palm Kernel Oil During Deep Frying. Food Safety and Health, 4(1), 147–155. https://doi.org/10.1002/fsh3.70044

Mente, A., de Koning, L., Shannon, H. S., & Anand, S. S. (2009). A Systematic Review of the Evidence Supporting a Causal Link Between Dietary Factors and Coronary Heart Disease. Archives of Internal Medicine, 169(7), 659. https://doi.org/10.1001/archinternmed.2009.38

Mititelu, M., Lupuliasa, D., Neacșu, S. M., Olteanu, G., Busnatu, Ștefan S., Mihai, A., Popovici, V., Măru, N., Boroghină, S. C., Mihai, S., Ioniță-Mîndrican, C.-B., & Scafa-Udriște, A. (2024). Polyunsaturated Fatty Acids and Human Health: A Key to Modern Nutritional Balance in Association with Polyphenolic Compounds from Food Sources. Foods, 14(1), 46. https://doi.org/10.3390/foods14010046

Mocciaro, G., Ziauddeen, N., Godos, J., Marranzano, M., Chan, M.-Y., & Ray, S. (2018). Does a Mediterranean-type dietary pattern exert a cardio-protective effect outside the Mediterranean region? A review of current evidence. International Journal of Food Sciences and Nutrition, 69(5), 524–535. https://doi.org/10.1080/09637486.2017.1391752

Murru, E., Manca, C., Carta, G., & Banni, S. (2022). Impact of Dietary Palmitic Acid on Lipid Metabolism. Frontiers in Nutrition, 9. https://doi.org/10.3389/fnut.2022.861664

Newport, M. T., & Dayrit, F. M. (2025). Analysis of 26 Studies of the Impact of Coconut Oil on Lipid Parameters: Beyond Total and LDL Cholesterol. Nutrients, 17(3). https://doi.org/10.3390/nu17030514

Nordestgaard, B. G., & Varbo, A. (2014). Triglycerides and cardiovascular disease. The Lancet, 384(9943), 626–635. https://doi.org/10.1016/S0140-6736(14)61177-6

Okpe, A. (2022). A Comparative Study of Chemical Analysis of Locally Made and Refined Palm Kernel Oil (Elaeis guineensis). https://doi.org/10.14293/S2199-1006.1.SOR-.PP8VWDQ.v1

Ooi, K. J., Taylor, R. M., Fenton, S., Hutchesson, M. J., & Collins, C. E. (2025). Evaluating Validated Diet Quality Indices Used in Pregnant Women in High-Income Countries: A Systematic Review. Nutrition Reviews, 83(3), e947–e964. https://doi.org/10.1093/nutrit/nuae073

Pérez-Beltrán, Y. E., Rivera-Iñiguez, I., Gonzalez-Becerra, K., Pérez-Naitoh, N., Tovar, J., Sáyago-Ayerdi, S. G., & Mendivil, E. J. (2022). Personalized Dietary Recommendations Based on Lipid-Related Genetic Variants: A Systematic Review. Frontiers in Nutrition, 9(March). https://doi.org/10.3389/fnut.2022.830283

Ramírez-Alarcón, K., Labraña, A. M., Carrasco-Marín, F., Benítez-Cid, P., Zapata-Lamana, R., Capó, X., Monserrat-Mesquida, M., Sureda, A., Contreras, H., Valenzuela-Mella, F., Bravo, D. P., Calina, D., Cádiz-Gurrea, M. de la L., Segura-Carretero, A., Setzer, W. N., Sharifi-Rad, J., & Martorell, M. (2026). Nutrigenomics of the Mediterranean Diet: Gene–Diet Interactions and Bioactive Compounds in Cardiovascular Health. Food Frontiers, 7(2). https://doi.org/10.1002/fft2.70256

Ranasinghe, R., Mathai, M., & Zulli, A. (2022). Revisiting the therapeutic potential of tocotrienol. BioFactors, 48(4), 813–856. https://doi.org/10.1002/biof.1873

Sacks, F. M., Lichtenstein, A. H., Wu, J. H. Y., Appel, L. J., Creager, M. A., Kris-Etherton, P. M., Miller, M., Rimm, E. B., Rudel, L. L., Robinson, J. G., Stone, N. J., & Van Horn, L. V. (2017). Dietary Fats and Cardiovascular Disease: A Presidential Advisory From the American Heart Association. Circulation, 136(3). https://doi.org/10.1161/CIR.0000000000000510

Sawicki, C. M., Ramesh, G., Bui, L., Nair, N. K., Hu, F. B., Rimm, E. B., Stampfer, M. J., Willett, W. C., & Bhupathiraju, S. N. (2024). Planetary health diet and cardiovascular disease: results from three large prospective cohort studies in the USA. The Lancet Planetary Health, 8(9), e666–e674. https://doi.org/https://doi.org/10.1016/S2542-5196(24)00170-0

Silva, V. de S., Arias, L. V. A., Usberti, F. C. S., Oliveira, R. A. de, & Fakhouri, F. M. (2025). Edible Oils from Health to Sustainability: Influence of the Production Processes in the Quality, Consumption Benefits and Risks. Lipidology, 2(4), 21. https://doi.org/10.3390/lipidology2040021

Sulaiman, N. S., Sintang, M. D., Mantihal, S., Zaini, H. M., Munsu, E., Mamat, H., Kanagaratnam, S., Jahurul, M. H. A., & Pindi, W. (2022). Balancing functional and health benefits of food products formulated with palm oil as oil sources. Heliyon, 8(10), e11041. https://doi.org/10.1016/j.heliyon.2022.e11041

Tan, C., Chuo, K., Chang, L., Tung, S., Situmorang, R., Oulahal, N., & Lee, W. (2025). Recent advancements in red palm oil nanoemulsion systems: a comprehensive review of formulations, characterization, and functional applications. Journal of the Science of Food and Agriculture. https://doi.org/10.1002/jsfa.70387

Traore, P.-W. H. B., Tine, J. A. D., Bassoum, O., Kane, A., & Faye, A. (2023). Associated factors with hypertension, known poorly controlled hypertension, and newly diagnosed hypertension among people aged 18-70 in Senegal. Journal of Public Health in Africa, 14(7). https://doi.org/10.4081/jphia.2023.2538

Trugilho, L., Alvarenga, L., Cardozo, L. F. M. F., Barboza, I., Leite, M., Fouque, D., & Mafra, D. (2024). Vitamin E and conflicting understandings in noncommunicable diseases: Is it worth supplementing? Clinical Nutrition ESPEN, 59, 343–354. https://doi.org/https://doi.org/10.1016/j.clnesp.2023.12.147

Trugilho, L., Alvarenga, L., Cardozo, L., Paiva, B., Brito, J., Barboza, I., Almeida, J., Anjos, J. dos, Khosla, P., Ribeiro-Alves, M., & Mafra, D. (2025). Effects of Tocotrienol on Cardiovascular Risk Markers in Patients With Chronic Kidney Disease: A Randomized Controlled Trial. Journal of Nutrition and Metabolism, 2025(1). https://doi.org/10.1155/jnme/8482883

Unhapipatpong, C., Shantavasinkul, P. C., Kasemsup, V., Siriyotha, S., Warodomwichit, D., Maneesuwannarat, S., Vathesatogkit, P., Sritara, P., & Thakkinstian, A. (2021). Tropical oil consumption and cardiovascular disease: An umbrella review of systematic reviews and meta analyses. Nutrients, 13(5). https://doi.org/10.3390/nu13051549

Wang, Y., Wu, G., Xiao, F., Yin, H., Yu, L., Chen, Y., Shehzad, Q., Xu, L., Zhang, H., Jin, Q., & Wang, X. (2024). Fatty acid composition in erythrocytes and coronary artery disease risk: a case–control study in China. Food & Function, 15(13), 7174–7188. https://doi.org/10.1039/D4FO00016A

Wuni, R. (2024). An investigation of gene-diet interactions on lipid-related traits in different ethnic groups [University of Reading]. https://doi.org/https://doi.org/10.48683/1926.00122128

Ye, Z., Cao, C., Li, Q., Xu, Y., & Liu, Y. (2020). Different dietary lipid consumption affects the serum lipid profiles, colonic short chain fatty acid composition and the gut health of Sprague Dawley rats. Food Research International, 132, 109117. https://doi.org/https://doi.org/10.1016/j.foodres.2020.109117

Zhang, R., Ren, Y., Zhao, Y., Zheng, H., Luo, Y., Liu, Y., Wang, L., & Zhang, L. (2026). A century of vitamin E research: The innovative journey from basic biology to synthetic bio-manufacturing. Journal of Integrative Plant Biology, 68(4), 985–1012. https://doi.org/10.1111/jipb.70235

Zhao, N., Song, Z., Wang, X., Huang, J., & Wang, X. (2026). Formation of Unsaturated Aldehydes in Edible Oils During Heating and Storage and Their Control Strategies: A Review. Food Reviews International, 1–29. https://doi.org/10.1080/87559129.2026.2641072

Zhuang, Y., Dong, J., He, X., Wang, J., Li, C., Dong, L., Zhang, Y., Zhou, X., Wang, H., Yi, Y., & Wang, S. (2022). Impact of Heating Temperature and Fatty Acid Type on the Formation of Lipid Oxidation Products During Thermal Processing. Frontiers in Nutrition, 9(June). https://doi.org/10.3389/fnut.2022.913297