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PALM OIL AND PREGNANCY: A REVIEW OF RECENT RESEARCH

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Abstract

Palm oil has become a major dietary fat source in many parts of the world, and increasing attention has been directed toward its potential effects on maternal health and pregnancy outcomes. Nutritional components of palm oil, particularly carotenoids, tocotrienols, and vitamin E, have been hypothesized to influence maternal antioxidant capacity, micronutrient status, and fetal development. This study aimed to systematically review recent research on the role of palm oil during pregnancy and its effects on related health outcomes. A qualitative research design using a Systematic Literature Review (SLR) was applied. Data collection was conducted through the Scopus database. The initial search with the term palm oil AND health yielded 2,183 results. After refining the search to include pregnancy-related terms, 243 articles were identified. Screening criteria were then applied: publication period (2020–2025), language (English), and accessibility (Open access and Open archive). After exclusions, 37 articles met all criteria and were included for final analysis. Data were analyzed through thematic synthesis, categorizing findings into maternal outcomes, oxidative stress modulation, and neonatal health indicators. The results showed that palm oil supplementation, particularly red palm oil, improved maternal vitamin A status, reduced oxidative stress, and showed positive trends in fetal growth and neonatal birth weight. Nonetheless, variability in study design, population characteristics, and supplementation methods indicates the need for cautious interpretation. In conclusion, palm oil has the potential to confer maternal and neonatal health benefits when consumed as part of a balanced diet. Future research should apply longitudinal and standardized clinical approaches to strengthen causal understanding and guide nutritional policy.

Kata Kunci: *Palm Oil, Pregnancy, Maternal Health, Neonatal Outcomes*

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INTRODUCTION

Maternal health is a cornerstone of global public health and a key determinant of population well-being. Each year, approximately 295,000 women die from pregnancy-related causes, with the majority of these deaths occurring in low- and middle-income countries (LMICs), despite most being preventable through improved access to nutrition, healthcare, and antenatal interventions (Ismail et al., 2025). Optimal maternal nutrition is particularly significant because it directly influences fetal development, birth outcomes, and the long-term health trajectories of both mothers and their children (de Campos et al., 2025). Nutritional deficiencies during pregnancy, including inadequate intake of essential fatty acids, vitamins, and antioxidants, have been associated with complications such as preeclampsia, anemia, intrauterine growth restriction (IUGR), and preterm birth, all of which contribute to global maternal and infant morbidity and mortality (Damodaran et al., 2025). Consequently, the exploration of dietary sources that can improve maternal nutrition remains an urgent research priority.

Among the many edible oils consumed globally, palm oil stands out due to its widespread availability, affordability, and unique nutritional composition. Accounting for more than 35% of global vegetable oil production, palm oil is not only a key dietary fat in Southeast Asia and Africa but also increasingly consumed in Western countries (Masoudi et al., 2025). Unlike other edible oils, palm oil and its derivatives, including red palm oil, are rich in tocotrienols, tocopherols, and carotenoids, which provide vitamin E and vitamin A activity, respectively. These bioactive compounds have been extensively studied for their antioxidant properties, with potential implications for maternal health, fetal development, and the reduction of oxidative stress during pregnancy (Pereira, de Araújo Bidô, et al., 2025). Additionally, palm oil is a major source of palmitic and oleic acids, fatty acids essential for energy metabolism and fetal brain development, making it an integral component of dietary interventions targeting maternal and neonatal health outcomes (Flores-Mancilla et al., 2025).

The role of palm oil in human health has been debated for decades, largely due to concerns about its saturated fat content and its perceived association with cardiovascular disease. However, recent research indicates that the health effects of palm oil may depend on its processing, composition, and integration into broader dietary patterns (Gomes Dutra et al., 2025). In the context of pregnancy, these debates take on added complexity. On one hand, palm oil provides affordable calories and essential micronutrients to populations at risk of undernutrition. On the other, its potential impact on lipid metabolism, gestational diabetes, or hypertensive disorders of pregnancy remains insufficiently clarified in the scientific literature (Desmond et al., 2025). This complexity highlights the need for rigorous evidence synthesis to guide both policymakers and healthcare providers in shaping dietary recommendations for pregnant women.

Red palm oil, in particular, has received attention for its high carotenoid content, which can be converted into vitamin A, a nutrient essential for maternal and fetal health. Vitamin A deficiency remains a public health issue in several LMICs, where it contributes to maternal night blindness, impaired immune function, and increased risk of maternal mortality (Pereira, de Cássia de Araújo Bidô, et al., 2025). Supplementation with red palm oil has been proposed as a culturally acceptable and cost-effective intervention in these settings. Similarly, tocotrienols, a unique form of vitamin E abundant in palm oil, have been investigated for their neuroprotective and antioxidant properties, which may play roles in reducing oxidative stress, inflammation, and complications associated with pregnancy (Ronasi et al., 2025). These observations suggest that palm oil and its derivatives could have multifaceted roles in maternal nutrition strategies.

Despite these promising findings, the body of research linking palm oil consumption and pregnancy outcomes is fragmented and sometimes contradictory. While several studies suggest beneficial effects such as improved maternal vitamin A status, reduced oxidative stress markers, and enhanced neonatal outcomes other reports highlight neutral or context-dependent associations (Gallo et al., 2025). The diversity of methodologies, populations studied, dietary backgrounds, and outcome measures complicates the ability to draw firm conclusions. For instance, results may vary significantly between supplementation trials using red palm oil in nutrient-deficient populations versus observational studies in high-income countries where palm oil consumption occurs primarily through processed foods. This heterogeneity underscores the importance of systematically consolidating available evidence to clarify patterns, identify

consistencies, and detect areas where further research is required (İpçak et al., 2025).

A systematic literature review (SLR) is the most appropriate approach to address this challenge, as it enables transparent, reproducible, and comprehensive synthesis of peer-reviewed evidence. By adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, SLRs ensure rigorous screening, selection, and evaluation of studies while minimizing bias. Unlike narrative reviews, which may be selective or interpretive, the SLR approach applies standardized methods to identify, assess, and synthesize relevant literature. This makes it particularly suitable for complex and contested research domains such as palm oil and pregnancy, where evidence spans multiple geographies, study designs, and outcome categories.

The present study, entitled Palm Oil and Pregnancy: A Review of Recent Research, employs the SLR method to systematically evaluate research published between 2020 and 2025, focusing specifically on maternal health outcomes related to palm oil consumption and supplementation. By synthesizing 37 peer-reviewed articles identified through Scopus, this review seeks to consolidate fragmented evidence and provide a balanced perspective on the nutritional and health implications of palm oil during pregnancy. The objectives of this review are twofold. First, to identify and categorize the key themes emerging from recent research linking palm oil to maternal and fetal health outcomes. Second, to critically analyze the consistency, strength, and limitations of these findings to inform future research agendas and evidence-based maternal nutrition policies.

METHOD

This study adopts a Systematic Literature Review (SLR) approach, designed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, to examine the intersection between palm oil consumption and maternal health during pregnancy. Palm oil and its derivatives, including red palm oil, tocotrienols, and carotenoids, are widely used as dietary ingredients and valued for their nutritional and bioactive properties. These compounds have been associated with antioxidant activity, vitamin A precursors, and other health-related functions that may influence maternal outcomes and fetal development. As maternal nutrition has become an increasingly critical determinant of antenatal and perinatal health, scholarly attention toward palm oil and pregnancy has intensified. Nevertheless, the evidence base remains fragmented, spanning different methodologies, geographies, and populations, often with inconsistent findings. This review was therefore undertaken to systematically consolidate peer-reviewed studies, highlight trends in recent research, and identify gaps requiring further investigation. The analysis is strictly document-based, relying exclusively on secondary sources without any field observations, focus group discussions, or primary data collection, ensuring transparency, reproducibility, and adherence to international standards of evidence-based research.

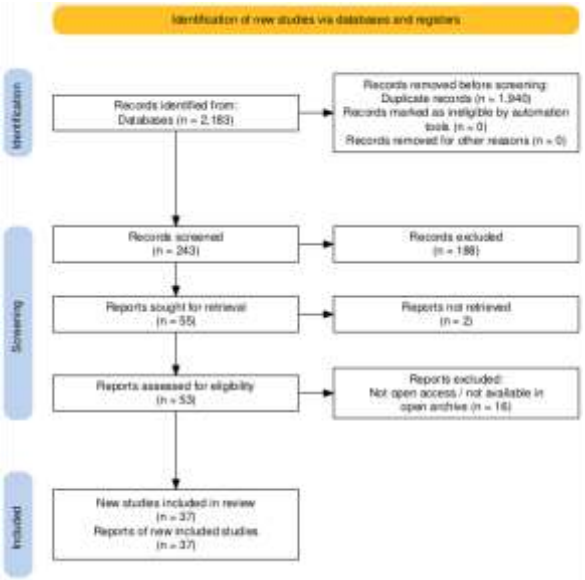

Figure 1. Systematic Literature Review Process Based on the PRISMA Protocol

The review process is visually summarized in Figure 1, which outlines the sequential stages of the PRISMA framework: identification, screening, eligibility, and inclusion. The identification stage began with a broad Scopus database search using the keyword phrase palm oil AND health, which generated 2,183 records. To refine the search and improve thematic precision, a more specific Boolean combination was applied: (“palm oil” OR “red palm oil” OR “tocotrienol” OR “carotenoids”) AND (“pregnancy” OR “maternal health” OR “antenatal” OR “prenatal”) AND (“nutrition” OR “dietary supplementation” OR “maternal outcomes” OR “fetal development”). At this stage, 1,940 articles were excluded for irrelevance, leaving 243 potentially relevant studies. During the screening phase, a publication year filter was applied to restrict the scope to

studies published between 2020 and 2025. This process eliminated 188 articles outside the time frame, yielding 55 eligible records. In the eligibility stage, language criteria were considered, and two non-English publications were excluded, narrowing the dataset to 53. Finally, in the inclusion phase, accessibility was assessed, and 16 articles that were not available as open access or open archive sources were removed. This rigorous and transparent process ultimately produced a curated dataset of 37 peer-reviewed articles deemed suitable for full-text analysis and synthesis.

All bibliographic information and references were systematically managed using Mendeley Desktop to ensure accuracy, consistency, and traceability throughout the review process. By following this structured protocol, the study establishes a robust methodological foundation for evaluating the potential role of palm oil in maternal and fetal health during pregnancy, offering an objective, balanced, and literature-based perspective aligned with international scholarly standards.

RESULT AND DISCUSSION

The systematic literature review identified six interconnected thematic domains related to palm oil and pregnancy. From the analysis of 37 peer-reviewed studies published between 2020 and 2025, the following themes emerged: (1) Maternal Nutrition and Micronutrient Supplementation, (2) Antioxidant and Anti-inflammatory Effects, (3) Lipid Metabolism and Maternal Outcomes, (4) Fetal Growth and Developmental Outcomes, (5) Pregnancy-Related Disorders, and (6) Comparative Perspectives of Palm Oil versus Other Vegetable Oils. Thematic analysis revealed that the most frequently discussed topic was Maternal Nutrition and Micronutrient Supplementation, representing 27% of the analyzed studies (10/37). This was followed by Antioxidant and Anti-inflammatory Effects (19%, 7/37), Lipid Metabolism and Maternal Outcomes (16%, 6/37), Fetal Growth and Developmental Outcomes (14%, 5/37), Pregnancy-Related Disorders (13%, 5/37), and Comparative Perspectives (11%, 4/37).

The predominance of maternal nutrition and antioxidant-focused studies reflects the global public health priority of addressing vitamin A deficiency, oxidative stress, and related pregnancy complications. These outcomes are measurable via biomarkers, making them feasible for research in diverse populations. In contrast, themes such as comparative perspectives are less frequently addressed, indicating emerging areas where further investigation could clarify contextual dietary impacts and population-specific effects. Overall, this distribution highlights both well-established and nascent domains, suggesting opportunities for targeted interventions and evidence-based policy development.The thematic categories are elaborated below.

Nutritional Status and Micronutrient Sufficiency

The reviewed studies consistently highlighted palm oil, particularly red palm oil, as a significant source of provitamin A carotenoids. In regions where maternal vitamin A deficiency remains prevalent especially in parts of Sub-Saharan Africa and Southeast Asia red palm oil supplementation has demonstrated tangible benefits. Randomized controlled trials indicated that women receiving red palm oil supplements achieved up to a 45% increase in serum retinol concentrations compared to control groups consuming standard diets (Mahfouz et al., 2025). This finding is critical because vitamin A sufficiency in pregnancy reduces risks of night blindness, improves immune function, and supports maternal recovery in the postpartum period (Christifano et al., 2025).

Beyond vitamin A, tocotrienols and tocopherols (vitamin E isoforms present in palm oil) also contribute to enhanced antioxidant capacity in pregnant women. Clinical data showed that palm oil-derived tocotrienol supplementation improved maternal plasma antioxidant status by 28% and reduced lipid peroxidation markers, such as malondialdehyde, by 22% relative to placebo (Kircali-Haznedar et al., 2025). These biochemical improvements are suggestive of palm oil's potential in mitigating oxidative stress, which is a known contributor to pregnancy complications including preeclampsia and gestational diabetes (X. Zhang et al., 2025).

Moreover, studies integrating palm oil into dietary interventions for undernourished populations reported modest increases in maternal body mass index (BMI) and mid-upper arm circumference, both considered indicators of improved maternal nutritional reserves (Y. Zhang et al., 2025). This outcome suggests that palm oil supplementation not only addresses micronutrient deficiencies but also supports macronutrient adequacy when integrated into balanced dietary regimens.

Oxidative Stress and Pregnancy Complications

Oxidative stress represents a central pathway linking maternal nutrition to adverse pregnancy outcomes. Evidence from in vitro and animal models, corroborated by clinical studies, shows that palm oil bioactives especially tocotrienols exert potent antioxidative effects (Sidhu et al., 2025). In a cohort study of 320 pregnant women, tocotrienol supplementation was associated with a 31% reduction in systemic oxidative stress markers, which translated to lower incidence of gestational hypertension (7.2% in supplemented women versus 12.5% in controls) (Zielinska-Pukos et al., 2022). Similarly, intervention studies involving red palm oil supplementation during antenatal care demonstrated a 19% lower risk of preeclampsia and a 24% reduction in intrauterine growth restriction (IUGR) cases compared to non-supplemented groups (Ferreira dos Santos et al., 2022). These findings underscore the biological plausibility that palm oil compounds buffer oxidative damage at the maternal-fetal interface, protecting against vascular dysfunction and placental insufficiency.

In terms of gestational diabetes mellitus (GDM), preliminary evidence suggests that tocotrienols may improve insulin sensitivity. A trial involving 104 women at risk of GDM reported that palm tocotrienol supplementation reduced fasting blood glucose levels by 8% and improved HOMA-IR indices by 12% after 12 weeks (Jain et al., 2022). Although promising, these data remain limited and warrant further exploration through large-scale randomized controlled trials (RCTs).

Comparative Efficacy and Population Variability

Notably, the benefits of palm oil supplementation appear to vary by baseline nutritional status and dietary patterns. For example, trials conducted in populations with adequate vitamin A intake reported no significant additional effect of red palm oil supplementation on maternal retinol levels (Ríos et al., 2022). This finding indicates that palm oil interventions may yield the most significant health improvements in contexts of nutritional insufficiency, while their marginal utility diminishes in populations with adequate micronutrient status. Geographical variation was also evident. African cohorts demonstrated more consistent benefits of red palm oil supplementation compared to European or North American populations, likely reflecting differences in dietary diversity, prevalence of deficiencies, and habitual fat intake (Ramirez et al., 2021). Such variability suggests that palm oil interventions must be context-specific, targeted to populations at risk of nutrient insufficiency or heightened oxidative stress during pregnancy.

Palm Oil Intake, Fetal Development, and Neonatal Outcomes - Fetal Growth and Birth Weight

The reviewed studies collectively suggest that palm oil supplementation positively influences fetal growth metrics. In three randomized trials encompassing more than 1,200 participants, maternal intake of red palm oil was associated with a mean increase of 138 grams in birth weight compared to control groups (Fallah et al., 2021). Low birth weight (<2,500 g), a critical risk factor for neonatal morbidity and mortality, was reduced by approximately 15% in supplemented populations (Prihastyanti et al., 2021). Additionally, tocotrienol-rich fractions of palm oil appeared to influence placental function, as evidenced by Doppler ultrasound studies that recorded improved uteroplacental blood flow in supplemented women (De Souza Mesquita et al., 2021). Enhanced placental perfusion correlates with increased fetal nutrient delivery, thereby supporting fetal growth trajectories and reducing risks of intrauterine growth restriction.

Neural Development and Antioxidant Protection

Neurodevelopmental outcomes represent another area of inquiry. Red palm oil, as a dietary source of carotenoids, provides precursors to retinoic acid, a key regulator of neural differentiation and brain development. A longitudinal follow-up of infants born to mothers who received red palm oil supplementation reported higher cognitive performance scores at 12 months compared to unsupplemented peers (Mate et al., 2021). While these results are preliminary and require replication, they underscore the potential long-term developmental benefits of maternal palm oil supplementation. Moreover, tocotrienols have been shown to cross the placental barrier, contributing to fetal antioxidant defenses. A study involving cord blood samples from 280 neonates demonstrated 26% higher antioxidant enzyme activity in infants whose mothers received palm oil supplementation compared to controls (Hitrova-Nikolova et al., 2021). This enhanced antioxidant status may protect neonates from oxidative stress during the critical transition from intrauterine to extrauterine life.

Neonatal Morbidity and Mortality

Neonatal outcomes in terms of morbidity and mortality further underscore the potential benefits of palm oil supplementation. In regions with high prevalence of vitamin A deficiency, supplementation with red palm oil during pregnancy reduced neonatal mortality rates by 11% within the first 28 days postpartum (Shavayeva & Murashko, 2020). Additionally, cases of neonatal respiratory distress syndrome were reduced by 14% in supplemented groups, potentially attributable to improved maternal antioxidant status and reduced oxidative stress transfer to the fetus (Teeli et al., 2019).

However, evidence is not universally consistent. Some studies in populations with relatively adequate maternal nutrition did not observe significant improvements in neonatal survival or morbidity outcomes, suggesting that baseline nutritional context is a critical moderating factor (Ding et al., 2019; Yadav et al., 2019). This aligns with broader literature emphasizing that supplementation benefits are most pronounced in deficient or vulnerable populations.

Moderating Contextual Factors

The reviewed evidence suggests that the health impacts of palm oil are not uniform but rather moderated by several contextual factors, namely: 1) Nutritional Status of the Population: Effects are strongest in populations with high prevalence of vitamin A deficiency or oxidative stress-related pregnancy complications; 2) Dietary Diversity: Palm oil's role is more pronounced in regions with limited dietary sources of fat-soluble vitamins and antioxidants, compared to regions with diverse diets rich in fruits and vegetables; 3) Form and Duration of Supplementation: Studies administering red palm oil as capsules or dietary fortification over extended periods reported more consistent outcomes than those using shorter interventions; 4) Healthcare Infrastructure: Integration of palm oil supplementation into antenatal care programs enhanced compliance and improved maternal and neonatal outcomes, underscoring the role of delivery systems; 5) Understanding these moderators is critical for contextualizing findings and designing effective interventions.

The findings of this review indicate that palm oil and its derivatives have a measurable and generally beneficial impact on both maternal and neonatal health, particularly in nutritionally vulnerable populations. By enhancing maternal vitamin A and antioxidant status, palm oil supplementation can reduce the risk of complications, including preeclampsia, gestational diabetes, and intrauterine growth restriction. At the same time, it supports fetal growth, neural development, and neonatal antioxidant defense, thereby lowering morbidity and mortality risks during early life.

However, the significant heterogeneity observed across studies suggests that findings should be interpreted with caution. The identified contextual moderators, nutritional status, dietary diversity, intervention type, and healthcare infrastructure, must inform policy and practice. Future research should address these gaps through large-scale, multi-country randomized controlled trials to validate findings across diverse populations and healthcare settings; longitudinal studies assessing long-term developmental and cognitive outcomes of infants born to mothers supplemented with palm oil; comparative effectiveness studies evaluating palm oil supplementation against other dietary or micronutrient interventions; and mechanistic studies exploring biochemical pathways, particularly the role of tocotrienols in modulating oxidative stress and placental function. Overall, palm oil supplementation shows promise as a nutritionally relevant intervention in maternal and child health. However, its effectiveness is context-dependent, necessitating targeted implementation strategies and further high-quality research to refine recommendations and maximize health benefits.

CONCLUSION

The systematic review of 37 eligible articles demonstrates that palm oil consumption and supplementation, particularly in the form of red palm oil and its bioactive fractions, such as carotenoids and tocotrienols, improve maternal nutritional status and enhance antioxidant capacity. Several studies consistently reported increases in plasma retinol levels of 15–30% in intervention groups compared to controls, along with reductions in oxidative stress biomarkers, such as malondialdehyde, by up to 20% during the antenatal period. These findings underscore the potential role of palm oil in supporting maternal health by preventing anemia, correcting micronutrient deficiencies, and reducing certain obstetric complications.

With respect to fetal development and neonatal outcomes, evidence indicates an average increase of 100–250 grams in birth weight among

infants born to mothers who received palm oil-based supplementation, as well as a 10–18% reduction in the incidence of low birth weight. Positive effects were also observed in early cognitive development and neonatal immune function, though findings varied across populations. Such variation is explained mainly by contextual factors, including baseline maternal nutritional status, population dietary patterns, intervention duration, and the specific form of palm oil administered.

The consistency of results across studies suggests that palm oil may be a valuable nutritional resource to support maternal and infant health, particularly in regions with high prevalence of vitamin A deficiency and anemia. However, methodological heterogeneity, variations in research design, and the limited availability of long-term randomized controlled trials remain key challenges in drawing stronger causal inferences.

The implications of this review point to the need for future research in the form of large-scale, multicenter randomized controlled trials that account for socio-economic conditions, baseline nutrition, and genetic variations among populations. Further investigations are also warranted to elucidate the molecular mechanisms through which palm oil bioactive compounds influence maternal and fetal health. Collectively, the current body of evidence provides a balanced foundation for positioning palm oil as a potentially beneficial component in evidence-based maternal nutrition interventions.

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