wjpmr, 2025, 11(9), 331-335

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH
www.wjpmr.com

SJIF Impact Factor: 6.842

Research Article
ISSN (O): 2455-3301
ISSN (P): 3051-2557

PERCEPTIONS, CONSUMPTION PATTERNS, AND POTENTIAL HEALTH CONSEQUENCES OF REFINED VEGETABLE OIL USE AMONG LOW-INCOME HOUSEHOLDS IN MONROVIA, LIBERIA

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Article Received on 11/07/2025 **Article Revised on 02/08/2025** **Article Accepted on 21/08/2025**

ABSTRACT

Background: Refined vegetable oil is an everyday food source and staple cooking ingredient for low-income communities in Monrovia, Liberia. However, several previously identified behaviors, including frequent reheating and using certain types of oil, combined with possible poorer storage and reheating practices have many potential health impacts. Understanding how households perceive and behave when using refined vegetable oil is essential for designing effective public health interventions. **Methods:** We conducted a cross-sectional descriptive study in Montserrado County, Liberia. Data were obtained from 350 Cold Bowl (KoBo) shops, using a structured questionnaire collected via mobile data collection tools. The survey collected data on socio-demographic factors, frequency of purchasing refined vegetable oil, reuse of oil, awareness of health risks, and health symptoms reported. Descriptive statistics were calculated for the data, and multiple linear regressions were used to identify associations between oil consumption behaviors and health symptoms self-reported. **Results:** High rates of oil consumption frequency and frequent oil reuse were exhibited by respondents. Findings from a regression analysis indicated frequency of oil consumption ($\beta = 0.31$, $p < 0.001$) and oil reuse ($\beta = 0.22$, $p < 0.001$) were significant predictors of increased health symptom scores, whereas increased awareness about health risk was a significant inverse predictor ($\beta = -0.18$, $p = 0.002$). Self-reported symptoms included gastrointestinal distress, chronic tiredness, and skin issues. **Conclusion:** Unsafe consumption of refined vegetable oil practices is widespread among low income households in Monrovia, with association to measurable health symptoms. Health education and health programmes to encourage safe oil uses and compounds of awareness could offer less risk of health impact**.**

KEYWORDS: refined vegetable oil, consumption patterns, health risks, low-income households, Liberia.

INTRODUCTION

Noncommunicable diseases (NCDs) - especially for cardiometabolic diseases such as hypertension, dyslipidaemia, and type 2 diabetes - are proliferating at an alarming rate throughout sub-Saharan Africa, causing significant premature morbidity and mortality in Liberia.[1,2] The rapid epidemiological transition seen in Liberia is due to a number of complex demographic, economic, and food system transformations. This movement from largely minimally processed staple-based, vegetable, and legume diets to energy-dense, nutrient-poor foods that are high in fats, sugars, and refined-carbohydrate foods is often referred to as the "nutrition transition" and is increasingly an issue across sub-Saharan Africa.[3,4] Urbanisation and subsequent prosperity, integration into market economies, the globalisation of food systems, and commercialisation of food processing increased food availability and consumption of processed convenience products, refined vegetable oils and commercially fried products throughout urban spaces like Monrovia. Refined vegetable oils, including blends of palm, soybean, groundnut and sunflower oils, are predominately found in the urban diet in Liberia. They are inexpensive, accessible at 'cold-bowl' (kobo) shops, open-air markets and small outlets, and are used to prepare food at home and also as street food. They are popular because they are inexpensive, widely available, facilitate many modes of cooking, and are viewed as economic and efficient products for cooking for a lot of people at a time. However, health implications of these oils depend on many factors including fatty acid composition, the

degree of refining, and cooking practice. Oils predominately saturated fats such as palm oils. palm oil and coconut oil, are consumptions associated with poor lipid profiles, elevated low-density lipoprotein (LDL) cholesterol and elevated cardiometabolic risk.[5–8]

There is an increasing level of evidence that repeated reheating and reuse of oils — a common practice in low-income contexts, and often a financial necessity — can compound the risks. Thermal degradation associated with frying leads to lipid peroxides, trans-fatty acids, aldehydes, and polymerised triglycerides, many of which have been-related to endothelial dysfunction, oxidative stress, systemic inflammation, and atherogenesis.[9-12] Chronic exposure to these compounds may lead to early onset hypertension, impaired glucose tolerance, and additional metabolic disturbances.

In addition to the biochemical properties associated with oils consumption, consumer behaviours related to cooking are crucial in determining health outcomes. For instance, experiential and observational studies conducted in other low- and middle- income countries show both the oil used and the way it is prepared are key factors in determining cardiometabolic risk. Frying excessively, extended cooking times at high-temperature, and letting used oil sit-out unfiltered, contribute each towards rapid accumulation of harmful compounds.[13-16] Furthermore; beliefs, health literacy, and culture associated with food consumption significantly influence oil purchasing and reuse decisions, often prioritizing finances over health.[17-18]

While there is a vast amount of global and regional literature, there is still a significant gap in Liberia-research investigating household-level perceptions, consumption patterns, and health implications of refined vegetable oil. In particular, there are few studies exploring the relationship between economic pressures, cooking practices, and cardiometabolic health risk in urban Liberia. To address this gap in knowledge, the current study sought to examine perceptions and practices of refined vegetable oil (types of oil used, how often it is consumed, and if it is reused), as well as self-reported cardiometabolic symptoms among 350 kobo shop customers in Montserrado County. Findings will be utilized to evidence culturally-appropriate, context-specific public health interventions, which consider the economic realities and challenges of improving healthy cooking practices.

METHODS

Study design and setting

A community-based, cross-sectional survey was conducted between April - June 2025 in Montserrado County, Liberia, incorporating both central Monrovia and peri-urban districts. Montserrado County made sense because it is the most densely populated portion of the country and uses a lot of informal retail food markets nearby. Cold-bowl (locally referred to as kobo) shops, which are small, informal vendors that sell cooking oil, condiments and staple food ingredients in small amounts, were used as sampling sites to understand purchasing within low-income households. Cold-bowl shops are readily placed in areas containing high concentrations of the population, and it's often their main access for purchasing cooking oil wholesale, especially for households that can't afford to buy in bulk.

Study population and sampling

The study population were adult consumers (i.e., those 18 years old or older) who purchased cooking oil from a participating kobo shop and were the principal decision-maker or an active participant in preparation for household cooking. A total of three hundred fifty respondents were interviewed, one per shop to avoid clustering, and these shops were identified through community mapping. Respondents were selected from eligible customer lists using a systematic sampling strategy, where every third customer was invited to participate, as long as they visited during survey hours. Adults residing in Montserrado County who were able to provide informed consent comprised inclusion criteria, while individuals with cognitive impairment or declining participation were excluded.

Instrument development and measures

A **structured interviewer-administered questionnaire** was adapted from previously validated dietary fat use and cooking practice tools, with modifications for cultural and linguistic appropriateness. The instrument was divided into the following domains:

1. **Sociodemographic characteristics** – age, sex, education, household size, and income bracket.
2. **Primary oil type** – identification of the most frequently used cooking oil (e.g., palm, soybean, groundnut, sunflower blend).
3. **Consumption patterns** – frequency of oil purchase, average cooking frequency, and intake of fried foods.
4. **Oil reuse and handling** – practices such as repeated frying cycles, oil filtering, and duration of oil storage after opening.
5. **Awareness and perceptions** – knowledge of potential health impacts of different oil types and cooking practices, measured on a 5-point Likert scale.
6. **Self-reported cardiometabolic symptoms** – including chest discomfort, dyspnoea on mild exertion, unexplained weight gain, and frequent fatigue. These items were scored based on frequency of occurrence and summed into a composite **health symptom score** (range: 4–20), with higher scores indicating more frequent symptoms.

Pilot testing and quality assurance

The questionnaire was pilot-tested among 25 participants in a neighbourhood that was not the study site but was matched on socio-economic similarities. Feedback from the pilot test led to refinement of wording to improve

clarity and cultural relevancy. For multi-item scales, internal consistency was acceptable with Cronbach's α > 0.78. Each interviewer received a two-day training conducted in a culturally appropriate and ethical manner specifying standard protocols to reduce bias in interviews and what would be acceptable. Field supervisors performed random spot checks to ensure data integrity.

Ethical considerations

The Desh Bhagat University Institutional Review Board granted ethical approval (Approval Number: IRB/DBU/2024/017). All participants provided written informed consent and ensured anonymity by using unique identifiers instead of names. The participants' involvement was completely voluntary, with no incentives given to avoid coercion. Data was secured by using password-protected file servers only accessible by the research team. Community engagement was a priority and the local community leaders were engaged in program development and survey administration to honor the local traditions and values.

Analysis

Data were entered and analyzed using SPSS v26. Descriptive statistics reported the characteristics of participants and key behaviors. Pearson correlation coefficients assessed bivariate relationships between oil consumption frequency, reuse practices, awareness score, and health symptom score. Multiple linear regression models examined independent predictors of the health symptom score, controlling for age, sex, household size, and self-reported physical activity. Statistical significance was set to $p < 0.05$.

RESULTS

Sample characteristics

A total of 350 respondents participated in the survey. The mean age was 37.4 years (SD 11.6), 58% were female, and 71% reported monthly household incomes below the national median for urban households. Most participants (82%) had primary responsibility for household cooking.

Table 1: Key behaviours and awareness (n = 350).

Measure	Percentage (%)
Using refined vegetable oil as primary household oil	92.0
Consuming fried foods ≥3 times/week	69.0
Reusing cooking oil at least once	68.0
Reusing cooking oil ≥2 times	41.0
Awareness that excess oil increases heart disease risk	28.5

The survey of 350 low-income households buying from kobo shops in Montserrado County found refined vegetable oil to be the most frequently used cooking oil (over 92.0% of the respondents reported using it as their primary household oil). Fried-food consumption was evident, as 69.0% of households reported consuming fried foods a minimum of three times per week, and that the frequent reuse of cooking oil was also evident, as 68.0% of respondents reported reusing cooking oil a minimum of once, while 41.0% reported reusing oil two or more times before throwing it away. While these behaviours were common among households, awareness of the health consequences were limited, as only 28.5% of respondents thought it increased the risk of heart disease that they consumed too much oil. This finding demonstrates an important gap between behaviours that increase cardiometabolic risk and public health awareness around the behaviours, which indicates a need for education and intervention programs to promote safer cooking practices and dietary behaviours in low-income urban groups.

Table 2: Correlations with health symptom score (selected).

Predictor	r	p-value
Oil consumption frequency vs. health symptom score	0.32	<0.001
Oil reuse (number of reuses) vs. health symptom score	0.28	<0.001
Awareness score vs. health symptom score	−0.21	0.001

Correlation analysis revealed moderate positive associations between the frequency of oil consumption with a higher self-reported health symptom's score ($r = 0.32$, $p < 0.001$), indicating that greater oil intake, while linked to greater perceived cardiometabolic symptom burden. The frequency of reuse of cooking oil also showed a positive association with the health symptom score ($r = 0.28$, $p < 0.001$), suggesting that repeated heating with an oil may affect symptom burden negatively. Greater self-reported awareness of the health risks associated with excessive oil consumption showed a negative correlation with the symptom score ($r = -0.21$, $p = 0.001$), suggesting greater health awareness is linked with less reported symptoms. Taken together, the results indicate a behavioural-health link with greater oil consumption and unsafe oil practices increasing symptom burden, while greater health awareness may provide some protection.

Table 3: Multiple linear regression predicting health symptom score.

Predictor	Standardised β	p-value
Oil consumption frequency	0.31	<0.001
Oil reuse practice	0.22	<0.001
Awareness (higher = more knowledge)	−0.18	0.002
Adjusted R^2 (model)	0.26	<0.001

The results of the multiple linear regression analysis indicated that oil consumption frequency was the strongest independent predictor of health symptom score ($\beta = 0.31$, $p < 0.001$). This finding suggests that more frequent intake of oil-rich foods was associated with a greater symptom burden, even after adjusting for other demographic and lifestyle covariates. Semi-regular practice of oil reuse was also significantly associated with health symptom scores ($\beta = 0.22$, $p < 0.001$), suggesting that heating and reusing oil was independently associated with worse health outcomes. The inverse association between awareness of health risks of oil consumption and health symptom scores ($\beta = -0.18$, $p = 0.002$) further corroborated the effect of knowledge on health behaviours and perceived health. The overall model explained the 26% of the variance in symptom scores (adjusted $R^2 = 0.26$, $p < 0.001$), which illustrates the meaningful, albeit not exclusive role that these modifiable factors can play in health outcomes.

Qualitative findings from interviews

Open-ended responses indicated that economic pressures surrounding high oil prices were the key motivator for oil reuse. Most respondents indicated that they filtered used oil with cloths and stored it in shade, but they explained that they didn't have knowledge of any indicators of oil deterioration. Some participants mentioned that they would consider altering cooking practices if options were affordable or provided appropriate advice.

CONCLUSION

This study has shown that refined vegetable oil consumption is nearly universal among low-income households in Monrovia, Liberia, with widespread use as frying oil, and re-use of oil before and again after frying, and with limited knowledge of the opportunities for excessive dietary fat intakes and degradation of oil metabolites in cooking. In particular, regression analyses indicated that the frequency of use of oil and superior reuse of oil was positively associated with increased symptom burden, and may be associated with early signs of cardiovascular or metabolic stressors. In contrast, higher awareness scores were independently correlated with lower scores of total symptoms, suggesting the value related to educational initiatives associated with nutrition awareness.

The results signify the necessity for comprehensive multisectoral public health initiatives. Consider new education campaigns that align with the context of the population on healthier cooking methods, targeted economic and subsidy support to facilitate access to healthier alternatives to cooking oils, and strong regulatory systems to regulate the quality and safety of edible oils on informal markets. Addressing these behavioural and structural determinants of chronic disease through a 'broad brush' approach may reduce foreseeable cardiometabolic disease risk and increase health and work productivity in the long-term, among low-income urban populations in Liberia.

Recommendations

1. Implement community education sessions at kobo shops and markets focusing on safe oil use and simple cooking alternatives.
2. Pilot small-scale subsidies or social marketing to improve affordability and uptake of more stable, healthier oils.
3. Advocate for regulatory action to monitor and limit trans fats and adulteration in edible oils.
4. Conduct follow-up cohort studies with clinical measurements (BP, fasting glucose, lipids) to better estimate risk.

Take Home Message

Frequent consumption of oil-rich foods, repeated reuse of cooking oil, and low awareness of health risks are key modifiable factors linked to higher self-reported cardiometabolic symptoms among low-income households in Monrovia. Targeted community education and safer cooking oil practices could substantially reduce preventable health burdens.

Authors' Contributions

Dr. Stephen Monday conceptualized the study, designed the methodology, and led the drafting of the manuscript. SHU-ACHET Daniel Gimbason coordinated the fieldwork, supervised data collection, and contributed to the interpretation of results. Marche Saygee Toh supported questionnaire development, assisted with data analysis, and participated in manuscript review and editing. All authors read and approved the final manuscript.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the participation of community members and households in Montserrado County who generously shared their time and insights. We also thank the local kobo shop owners for facilitating data collection at their premises, and the field enumerators for their dedication in conducting surveys. Special appreciation is extended to the research assistants and data entry team whose meticulous work ensured the quality and integrity of the dataset.

Funding
This research was fully self-funded by the research team. The authors did not receive any source of external financial support, institutional grants, or third-party funding for designing, conducting, analysis, and publication of the study. All expenses incurred in fieldwork, logistics, data handling, and manuscript preparation were carried by the authors to facilitate free, community-driven research.

Conflict Of Interest
The authors attest that no conflicts of interest exist with this publication. They have no financial relationship, personal association, institutional obligation, or professional interest which might have inappropriately affected the performance, analysis, or reporting of the study. The study and findings reported rest on scientific evidence and observations from the community.

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