



# Availability of Vegetable Edible Oils and Potential Health Implications in Kenya

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**How to cite this paper:** Tuei, V.C. (2023) Availability of Vegetable Edible Oils and Potential Health Implications in Kenya. *Open Access Library Journal*, 10: e9756. <https://doi.org/10.4236/oalib.1109756>

**Received:** January 11, 2023  
**Accepted:** February 3, 2023  
**Published:** February 6, 2023

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## Abstract

Vegetable edible oil is an indispensable nutritional source for humans especially for fatty acids and vitamin E and is commonly used in cooking. The sources of vegetable edible oils are varied and include the seeds, pulps, fruits, and plumules of various plants. Palm, soybean, sunflower and rapeseed (canola) oils top the oils traded globally. In this article, review of literature on the availability of vegetable edible oils and its potential human health implications in Kenya was explored. Kenya is a net importer of edible oils mainly in the form of palm oil. Consequently, the main edible oils refiners in Kenya majorly produce palm oil/olein edible derivatives. This dominance of palm oil/olein, oil mainly rich in saturated fatty acids in the Kenyan market, raises health concerns as palm oil has been postulated to raise low density lipoprotein cholesterol that gives rise to hypercholesterolemia in comparison to vegetable edible oils with lower saturated but higher unsaturated fatty acids that are cardioprotective such as in corn and sunflower oils. Inarguably, the increasing availability of edible oils and fats is driving their higher consumption, along with deep-fried foods that are rich in *trans* fats. Therefore, it is an opportune time for a more holistic approach to dietary recommendations and safety considerations of edible oils and plausible movement from the current palm oil-dominated market towards the incorporation of a greater variety of edible oils and/or as palm oil blends with pure vegetable edibles oils as the importance of fatty acid intake is associated with a number of non-communicable diseases which are increasingly becoming a threat in Kenya.

## Subject Areas

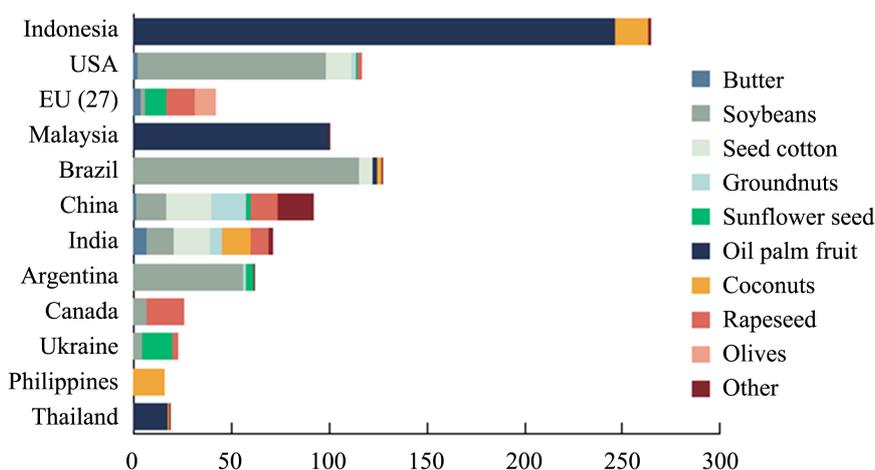
Nutrition and Health

## Keywords

Plant Oils, Fats, Availability, Health, Kenya

## 1. Introduction

The sources of vegetable edible oils are varied and include the seeds, pulps, fruits, and plumules of various plants and as one of the three major energy sources for human life, it is majorly used in cooking [1]. Vegetable edible oils are also a nutritional source of omega-3 and omega-6 fatty acids and the fat-soluble vitamins E and K and they are packaged in some instances in health supplement capsules [1]. Non-food industrial uses of vegetable edible oils include cosmetics, paints, detergents, lubricants, oleochemicals and biosediel [2]. Vegetable edible oils are heavily traded with imports representing 40% of global consumption [3]. Palm oil, soybean oil, sunflower oil and rapeseed (canola) oil accounted to 92% of vegetable edible oils traded in world markets on average in 2019-2020 and the remaining 8% included diverse, locally important oils such as olive oil, cottonseed oil, peanut oil, safflower oil and palm kernel oil [3]. Consequently, palm oil, soybean oil, rapeseed (canola) oil and sunflower oil also currently top the global edible oil consumption chart [2]. Indonesia and Malaysia are the major palm oil exporters while major soybean oil exporters are Argentina, Brazil, European Union and the USA [2] [3] (Figure 1). On the other hand, Canada and Russia are major exporters of rapeseed (canola) oil, while European Union and Ukraine export majorly sunflower oil [2] [3] (Figure 1). For the case of Kenya, it remains a net importer of vegetable edible oils as local production has not grown to meet the local demand [4]. For instance, the country's vegetable oil requirement is estimated to be 600,000 metric tonnes valued at over KSh 54 billion which about 95 percent of this is in the form of palm oil, which is imported mainly from Indonesia and Malaysia [4]. The COVID-19 pandemic, ongoing war between Russia and Ukraine, and the US dollar inflation has seen Kenya consumers face rising prices of cooking oil due to shortages mainly in crude palm oil and sunflower oil imports [3] [5].



**Figure 1.** Top edible oil producing countries and what they produce in million metric tonnes. Figure adapted from Breaking Down Fats and Oils Report, July 2021 by Forum for the Future. Source: Oil crops: FAOSTAT 2019, Butter: US Department of Agriculture; Economic Research Service; 2020.

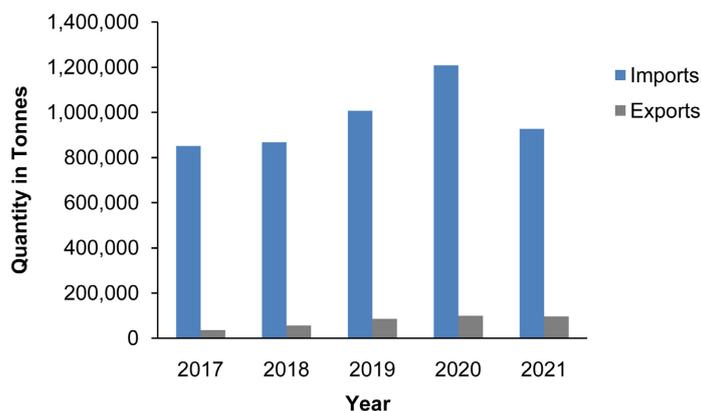
Despite vegetable edible oils having contributed more to the global increase in energy availability since the 1980s than any other food group [6], the human populace now faces the impact of nutritional transitions [7] which have been implicated as a key driver of the increased prevalence of non-communicable diseases (NCDs), particularly cardiovascular diseases (CVD), type 2 diabetes mellitus (T2DM), and cancer in low and middle-income countries such as Kenya [8] [9] [10]. The resulting major shifts in diet are towards increased refined carbohydrates, added sweeteners, edible oils/fats, animal-source foods and reduced legumes, other vegetables, and fruits [7]. Additionally, it has been reported that replacement of saturated fats with unsaturated fats, especially polyunsaturated fatty acids, and/or high-quality carbohydrates can reduce coronary heart disease risk [11] [12]. Since the vegetable edible oils contain complex chemical components, and are generally rich in fatty acids, microelements and active compounds, and flavor substances [1], it necessitates a careful assessment of potential health impacts of the different vegetable edible oils when consumed by humans. In this article, review of literature on the availability of vegetable edible oils and its potential human health implications in Kenya was explored.

## 2. Literature Search Strategy

An electronic search of articles, reports, reviews, and chapters was undertaken in Medline (using PubMed interface), Scopus, Google Scholar and Clarivate Web of Science through September 2022 investigating the availability of vegetable edible oils and health implications in Kenya with the search terms such as “vegetable/plant oils”, “cooking oil”, “saturated fatty acids”, “unsaturated fatty acids”, “*trans* fatty acids”, “monounsaturated fatty acids”, “polyunsaturated fatty acids”, “palm oil”, “coconut oil”, “soybean oil”, “sunflower oil”, “rapeseed/canola oil”, “corn/maize oil”, “market”, “imports”, “exports”, “production”, “cultivation”, “availability”, “edible oil industry”, “heating”, “safety”, and “consumption” in combination with “non-communicable diseases”, “cardiovascular diseases”, “type 2 diabetes mellitus”, “obesity”, “cancer”, “nutrition transition”, “health”, “disease”, “mortality” and “Kenya”.

## 3. Availability of Vegetable Edible Oils in Kenya

Kenya is a net importer of vegetable edible oils as local production has not grown to meet the local demand [4]. The country’s vegetable oil requirement is estimated to be 600,000 metric tonnes valued at over KSh 54 billion which about 95 percent of this is in the form of palm oil, which is imported mainly from Indonesia and Malaysia and animal oil and fats make up roughly the balance of 5 percent [4]. This scenario makes Kenya to heavily depend on importation, high import bill and foreign exchange drain notwithstanding [5] (Figure 2). However, there have been efforts in the country to promote palm oil production and currently about 13,704,593 metric tonnes of fresh fruit bunch is produced which is still very low to meet the country’s oil demand [4]. Additionally, the Kenya



**Figure 2.** Quantities of imports and exports of animal and vegetable oils and fats in Kenya. Source: Economic Survey 2022 by the Kenya National Bureau of Statistics.

Government, through the Nuts and Oil Crops Directorate of Agriculture and Food Authority in the Ministry of Agriculture, Livestock, Fisheries and Cooperatives also plays a major role in development, promotion and regulation of nuts and oil crops industry in Kenya [4] [13]. Other oil crops being cultivated in Kenya are majorly coconut (copra), cashew nut, groundnuts/peanuts, sunflower, soybeans, simsim (sesame), cotton seed, rapeseed (canola) and maize/corn germ [4] [14] (Table 1). The Government of Kenya's general agricultural policy calls for food self-sufficiency by 2030, but there appears to be little hope in the vegetable-oil sector and oil refiners in Kenya will likely increase imports of crude vegetable oil especially crude palm oil, because Malaysia and Indonesia oil is cheaper when compared to edible oils from USA and other European countries [14]. The key players in the vegetable oil industry in Kenya comprise processors who extract the oil from the seeds and also produce oil cake for use in animal feeds, and refiners who convert crude oils into a form suitable for human consumption [13]. The major edible oil manufacturers in Kenya are Bidco Africa Limited, Kapa Oil Refineries Limited, Menengai Oil Refineries, Giloil Company Limited, Palmac Oil Refiners, and Pwani Oil Products Limited which their major raw imports are crude palm oil and semi-processed crude palm oil as palm olein while some also process though to a smaller extent, coconut (copra), sunflower, soybean, corn and rapeseed (canola) oils amongst other edible oils and oil products [13]. These companies have varied edible oils and fat products and most are palm oil/palm olein derivatives such as frying shortening (white/yellow fats), liquid cooking oil or pure/blended margarine and spreads and the pure vegetable oils as corn, rapeseed (canola), soybean and sunflower oils amongst others. Some of the large vegetable oil refiners are also involved in growing of vegetable oil crops and supporting small scale farmers in better farming methods to increase the vegetable oil production in Kenya [4] [13] [14]. The COVID-19 pandemic, ongoing war between Russia and Ukraine, and the US dollar inflation has seen Kenya consumers face rising prices of cooking oil due to shortages mainly in crude palm oil and sunflower oil imports [3] [5] and this warrants a consideration for local solutions in the long-term for the country to be able to meet its

**Table 1.** Area cultivated and production of select vegetable oil crops/nuts in Kenya.

Vegetable Oil Crops/Nuts	Area (Ha)		Quantity (Metric Tonnes)	
	2020	2021	2020	2021
Macadamia nuts	7142	7180	39,133	42,562
Coconut	84,906	77,566	110,013	86,554
Cashew nuts	22,690	23,158	12,668	9121
Peanuts	11,098	14,275	10,071	12,897
Bambara groundnuts	287	285	450	465
Simsim (Sesame)	12,526	4881	10,773	2862
Rapeseed (Canola)	4091	4236	14,268	14,431

Source: Nuts and Oil Crops Validated Statistical Report 2021 by Nuts and Oil Crops Directorate, Kenya Agriculture and Food Authority.

demand of edible oils. Indeed, the average producer price of 20 liters of vegetable oil rose from KSh 3965 in 2020 to KSh 4641 in 2021, a 17% cost increase [5]. On the other hand, Kenya applies external tariffs ranging from zero (0) for oilseeds and crude oils to thirty five (35) percent for refined oils as harmonized by the East Africa Community Customs Union from July 2022 and also provides preferential tariff treatment on refined edible oils manufactured from locally sourced materials which impacts on producer pricing and affordability of vegetable edible oils [14].

#### **4. Potential Health Implications on the Availability of Vegetable Edible Oils in Kenya; Palm Oil as a Predominant Oil of Consumption**

In the last few decades, Kenya like many other developing countries has experienced a nutritional transition characterized by departure from traditional diets (mostly rich in dietary fiber, fruits, and vegetables) to the adoption of “western diet” typically characterized by high red/organ meats, sugar, cholesterol, oils/fats, and salt content [8] [15]. These nutrition transitions have been associated with the increased prevalence of NCDs, particularly CVD, T2DM, and cancer in low and middle-income countries such as Kenya [8] [9] [10] [16]. Additionally, the nutritional transitions are closely intertwined with the increasing patterns of urbanization, sedentary lifestyles/physical inactivity and improved availability and affordability of the different food products in the market such as the edible vegetable fats and oils [17]. In particular, the transition towards diets high in saturated fats in low and middle-income countries has been marked by a rapid expansion in the global edible oil production and consumption [7].

Edible vegetable fats and oils are mainly rich in triacylglycerols which contain fatty acids in the glycerol backbone and are of different types depending on the type of oil or fat [12]. The fatty acids are either saturated or unsaturated and mainly exist as mixtures but of different proportions in the triacylglycerols.

Whereas, vegetable edible oil is an indispensable nutritional source for humans especially for fatty acids and vitamin E, microelements and other bioactives as biophenols, and phytosterols [1] [18], those vegetable oils low in saturated fatty acids are recommended by dietary guidelines and those high in saturated fatty acids (predominantly of animal origin with the addition of palm and coconut oil) are discouraged [12] [18]. Albeit lack of full scientific consensus, the basis for these dietary recommendations of edible oils and fats has been that saturated fatty acids increases total and low density lipoprotein (LDL) cholesterol, a risk factor for CVD induction, insulin insensitivity, and its negative effects on the blood whereas replacing saturated fatty acids with monounsaturated fatty acids and polyunsaturated fatty acids is cardioprotective [12] [18].

As a mere of fact, Kenya's edible oils and fats consumption landscape is dominated by palm oil/olein and derivatives sold as frying shortening (white and yellow fats), refined frying palm oil/olein (liquid oils), and pure or blended margarine and spreads which are often fortified with vitamins such as vitamins A and D [4] [19]. Apart from its use as cooking oil, palm oil is also a common ingredient in a large variety of processed food products, ranging from baked and fried goods to instant noodles and coffee whiteners [6]. Palm oil is relatively high in saturated fatty acids and second after coconut oil (on average, approximately 50% and particularly palmitic acid) and relatively low in polyunsaturated fatty acids (on average, approximately 10%) compared with vegetable oils such as soybean, corn, rapeseed (canola) and sunflower oils [6]. Although it's still contentious, palm oil has been reported to raise LDL cholesterol that gives rise to hypercholesterolemia in comparison to vegetable oils with lower saturated fatty acids, supporting the notion that it is desirable to substitute palm oil with vegetable oils with superior fatty acid profiles (richer in monounsaturated and polyunsaturated fatty acids and lower in saturated fatty acids) in diets [6] [20]. However, palm oil also contains vitamin E, carotenoids and antioxidants that are cardioprotective and also can prevent cancer and deter aging [20]. The dominance of palm oil in Kenya is further enhanced by the ease to utilize highly saturated tropical oils such as palm and coconut oils to substitute partially hydrogenated vegetable oils (e.g. margarines) in food processing. This substitution with palm and coconut oils has been reported to provide comparable oxidizability, stability and texture to partially hydrogenated vegetable oils in the midst of removal of *trans* fats in the form of partially hydrogenated vegetable oils from the food chain given the strength of evidence on their negative health impacts [6] [21]. For instance, epidemiological and clinical trials have consistently shown that *trans* fatty acids of industrial origin, mainly elaidic acid, have detrimental effects on cardiovascular health [22] [23]. Consequently, the World Health Organization has called for the elimination of industrial *trans* fats from partially hydrogenated vegetable oils and several countries have implemented legislation to meet this but progress on this legislation in Kenya and the East Africa Community is unknown [2]. On the other hand, the other vegetable oils for consumption in Kenya albeit to a smaller consumer market share as compared to

palm oil/olein and coconut oils are mainly corn oil, rapeseed (canola) oil, soybean oil and sunflower oils [4]. These vegetable oils are low in saturated fatty acids and have moderate levels of monounsaturated (e.g. oleic acid) and high levels of polyunsaturated fatty acids (e.g. the essential fatty acids, linoleic and linolenic acids) [18]. In particular, some polyunsaturated fatty acids have been shown to have a beneficial role as biological mediators related to cardiovascular conditions, such as myocardial infarction [23] [24].

It should also be noted that in the process of cooking with edible oils, high temperature will change the structure of the oil and produce harmful *trans* fatty acids and other products, which are harmful to human health [1] [25]. In Kenya, as the case is in many other similar economies, and in a bid to maximize profits, local vendors recycle the cooking fats/oils used in the deep frying process over and over [8] [26]. The repeated high temperature heating of such fats/oils lead to the generation of toxic or carcinogenic substances whose accumulation in the oil is likely to increase with every re-use [8]. This thermal oxidation of edible oils has since attracted great attention of nutritionist and researchers given the deteriorative effect such as generation of very cytotoxic compounds, loss of carotenoids, phenolics and vitamins thus reducing the overall antioxidant properties of the oils and impacting negative health effects following their consumption [26] [27]. In Kenya, the situation may be worsened by transformer oil, a mineral oil, reportedly added to the deep frying oils since it is not easily oxidized and is heat stable and so can be used repeatedly for a longer time [28]. As a consequence, some commercial frying vendors opt to blend cooking edible oils with the transformer oil despite potential toxicological and carcinogenic effects of the transformer oil [28].

## 5. Conclusion

In conclusion, it is inarguable that the increasing availability of vegetable edible oils mainly dominated by palm oil in Kenya is driving their higher consumption, along with deep-fried foods that are rich in *trans* fats. It is therefore an opportune time for a more holistic approach to dietary recommendations and safety considerations of vegetable edible oils in the country. Additionally, plausible movement from the current palm oil-dominated market towards the incorporation of a greater variety of vegetable edible oils and/or as palm oil blends with pure vegetable edibles oils such as corn, rapeseed (canola), sunflower and soybean oils might be necessary as the importance of fatty acid intake is associated with a number of non-communicable diseases particularly cardiovascular diseases, type 2 diabetes mellitus and cancer which are increasingly becoming a threat in the midst of undernutrition in Kenya.

## Data Availability

All data generated or analyzed during this study are included in this published article.

## Conflicts of Interest

The author declares no conflicts of interests.

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