

Comparative Study of Phytosterols and Vitamins A and E Composition of Vegetable Oil Brands Consumed in Nigeria

ABSTRACT

Since the techniques employed in refining can alter the chemical composition of edible oils, the phytosterol and vitamins A and E composition of branded vegetable oils sold in Nigeria were determined. The result showed that sitosterol, campesterol, stigmasterol and 5-Avenasterol were the major phytosterol present; with much lesser amounts of cholestanol and ergosterol. The cholesterol concentration was less than 10mg/100g in all the samples and was thus labeled “no cholesterol” by the manufacturers. Vitamin A supplementation for all the oil brands was about 7.5mg/100g for all the samples. A considerably high amount of vitamin E was retained in all the oil brands, Executive Chef Soya bean oil showing the highest concentration of vitamin E. It was thus concluded that the techniques employed in refining the oils retained an acceptable amount of phytosterol and vitamin E in the products.

Keywords: *Phytosterol; Vitamin A; Vitamin E; Oil brand; Nigeria; cardiovascular disease.*

INTRODUCTION

Edible oils are essential nutrient and an important source of energy comprising up to 25% of calorie intake. Edible oils are biological mixtures, usually of plant origin, consisting majorly of esters derived from glycerol with chain of fatty acids [1]. The minor unsaponifiable constituents of edible oils are generally made up of tocopherols, tocotrienols, sterols, ubiquinones and pigments [2]. Tocopherols and tocotrienols are the two forms in which vitamin E exists [3] and are hereinafter referred to as vitamin E. Sterols from plant origin are termed to phytosterols and are predominantly sitosterol, campesterol, stigmasterol and 5-Avenasterol with very little amount of ergosterol and cholestanol [4]. Cholesterol exists in plants but in a relatively small concentration compared to animals [5].

Phytosterols have been extolled for their numerous beneficial health effects. Of these, circulatory cholesterol and triglyceride lowering are the most significant [6,7]. This is because cardiovascular disease, associated with raised levels of circulatory cholesterol and triglyceride [8], is the leading cause of global death [9,10]. Other health benefits of dietary phytosterols include inhibition of lung, stomach, ovarian and breast cancers [11]. While vitamin E supplementations have no positive effect on health [12-17], the supplementation of vitamin A has been shown to reduce mortality by up to 24% [18]. The supplementation of branded oils with vitamin A is therefore increasing among the manufacturers.

Cooking in Nigeria is characterized by the use of the traditionally extracted, unrefined palm oil; called red oil among Nigerians [19]. This is because of the accustomed flavor and the general notion that it is safer for cardiovascular health than the branded vegetable oils which are termed “white oil” in Nigeria [19]. However, the use of refined and branded vegetable oils is increasing among Nigerian urban elites [20]. As a result, Nigerian markets are becoming “flooded” with assorted refined vegetable oils brands from different parts of the world [21]. The Food and Agriculture Organization warned that techniques employed in refining can cause chemical changes to composition of edible oils and thus decreases its

nutritional value [22]. This study therefore comparatively examines the contents of phytosterol and vitamins A and E in Nigerian branded oils.

MATERIALS AND METHOD

All the oil brands were bought from Ado-Ekiti urban market. The manufacturers of the oil brands are presented in Table 1. All reagents used in this work were of analytical grade.

Table 1. Manufacturer of the oil brands analyzed

Oil brands	Manufacturers
Executive chef soya bean oil	JOF Industries Limited
Mamador vegetable oil	PZ Wilmar Limited
Oki vegetable oil	Oki Food Industries
Laser (Virgin) olive oil	Sun Mark Limited
Power vegetable oil	Dufil Prima Foods Plc

Total lipid extracts were subjected to acid hydrolysis and then alkaline saponification, and free sterols were analyzed as trimethylsilyl derivatives by capillary GC-FID and GC-MS. Vitamin A was determined by HPLC with spectrofluorimetric detection (λ_{ex} 340 nm; λ_{cm} 460 nm). Determination of vitamin was by reversed-phase high-performance liquid chromatography.

The results are presented in means of three replicates.

RESULT AND DISCUSSION

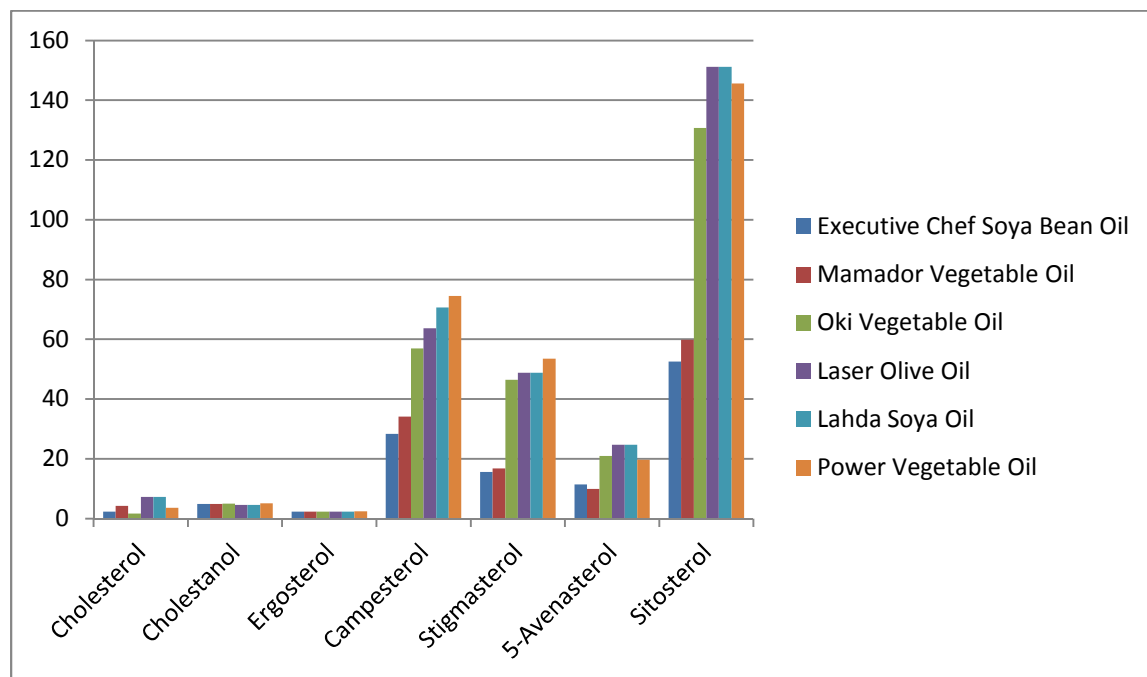


Figure 1: Phytosterol Concentration of Vegetable Oil Brands Consumed in Nigeria (mg/100g)

As shown in Figure 1, cholesterol was present in all the oil brand samples; despite the “no cholesterol” tag on the brands’ labels. Cholesterol, despite the fact that it is generally termed an animal sterol, is also found in plants [23]. Although there have been some wrong [24,25] and misleading [26-28] conclusions about the presence of cholesterol in plants, cholesterol occurs as a component of plant membranes and as part of the surface lipids of leaves where it is sometimes the major sterol [23]. Cholesterol therefore exists in plants oils; although in a very small quantities, usually less than 60mg/kg [5,29]. However, the “no cholesterol” tag can be justified because the cholesterol concentration in all the oil brands is less than 10mg/100g and legalities of food labeling allow such small quantities of cholesterol in foods to be labeled zero [30,31].

While the dynamics of cholesterol homeostasis and development of cardiovascular disease is extremely complex and multifactorial [32], researchers maintain that cholesterol intake increases the risks of cardiovascular diseases [33,34]. However, it is now acknowledged that the original studies purporting to show a linear relation between cholesterol intake and cardiovascular disease (CHD) may have contained fundamental study design flaws, including conflated cholesterol and saturated fat consumption rates and inaccurately assessed actual dietary intake of fats by study subjects [32]. It is now known that the degree to which serum cholesterol is increased by dietary cholesterol depends upon whether the individual's cholesterol synthesis is stimulated or down-regulated by such increased intake, and the extent to which each of these phenomena occurs varies from person to person [32].

As presented in Figure 1, all the vegetable oil brands are rich in phytosterols. As expected of plant oils [4], sitosterol, campesterol, and stigmasterol are the most abundant phytosterols in the oil brand samples. Phytosterols have been applauded for reducing circulatory cholesterol levels [35,36] by competing with cholesterol absorption in the gut via one or several possible mechanisms [37-39]. Vegetable oils are the richest sources of phytosterols. However, the methods employed in refining can significantly reduce the amount of phytosterol in oils [40,41]. As evident in Figure 1, the refining methods employed in the oil brands retained satisfactory amounts of phytosterols in the oils.

Table 2: Total Sterol, Vitamin A and Vitamin E Concentrations of Vegetable Oil Brands Consumed in Nigeria

	Vitamin A (mg/100g)	Vitamin E (mg/100g)	Total Sterol (mg/100g)
Executive Chef Soybean Oil	7.36	49.43	117.38
Mammador Vegetable Oil	8.62	25.89	132.18
Oki Vegetable Oil	8.32	18.28	264.13
Laser Olive Oil	8.24	18.00	302.5
Lahda Soya Oil	8.32	11.05	309.47
Power Vegetable Oil	7.36	19.00	304.4

As presented in Table 2, all the oil brand samples contain vitamin A and E in amounts much higher than the recommended daily allowances for the vitamins [42-44]. Executive Chef Soya bean oil showed a strikingly high concentration of vitamin E. This can be linked to reduced auto-oxidation of the oil since vitamin E is consumed by auto-oxidation of oils [45]. Vitamin A plays a role in a variety of functions throughout the body. These includes: Vision, gene transcription, Immune function, embryonic

development and reproduction, Bone metabolism, Hematopoiesis, Skin and cellular health as well as Antioxidant activity [46-48]. Vitamin E is a renowned lipophilic anti-oxidant [49]. Other known functions of vitamin E include enzymatic activities, gene expression, and neurological function. The most important function of vitamin E has been suggested to be in cell signaling [50,51].

CONCLUSION

It can be concluded from the result that the techniques employed in refining the oils retained a substantial amount of phytosterol and vitamin E in the products. The oils are also well supplemented with vitamin A.

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