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Composition and Quality of Six Refined Edible Oils in Khartoum State, Sudan

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ABSTRACT

The composition and quality of six refined edible oils in Khartoum State, Sudan was evaluated. The oils analyzed were Sesame (*Sesamum indicum* L.); groundnut (*Arachis hypogea* L); cottonseed (*Gossypium barbadense* L.); sunflower, (*Helianthus annuus* L.); corn (*Zea mays* L.) and olive (*Olea europaea* L.). Both physical and chemical properties and acid profile of the six oils were determined. The results showed that all properties values vary among the six refined oils and are within the permissible limits for human consumption.

Keywords: *Refined, edible, Oil, Fatty acids*

1. INTRODUCTION

Vegetable fats and oils are substances derived from plants which are composed of triglycerides and represents a major component of edible fats and oils [**1**]. The minor components of edible fats and oils are formed of mono and diethyl-glycerol, free fatty acids, phosphatides, sterols, fat-soluble vitamins, tocopherol, pigments, waxes and fatty alcohol [**2**]. Normally, oils are liquid whereas fats are solid at room temperature. According to [**3**]**, a** dense brittle fat is called wax**.** Fatty acids play an important role in the life and death of cardiac cells because they are essential fuels for mechanical and electrical activities of the heart **[4].** The modern way of processing vegetable oils is done through chemical extraction and the use of solvent extracts, a process that produces higher yields of less expensive oils in a short time. The most common solvent is petroleum – derive hexane. Physical extraction, a method that does not use a solvent, is another way of processing vegetable oils through traditional mechanical extraction [**5**]**.** Oil seed presses are commonly used in developing countries, among people for whom other extraction methods would be prohibitively expensive [**6**]**.** The refinement of crude oils means the removal of natural colour, smell, odour and free fatty acids. The final product of refinement is transparent cooking oil. It involves chilling plant (to remove the wax content from the crude oil), neutralization (to remove soap); Bleaching (to remove colour), Filtration (use wax filter and use pressure leaf filter), and cooling. The stability or shelf-life of the edible oil is important globally, especially in developing countries where the storage condition for the edible oils is not ideal. A major influence on the stability of storage edible oils is the type of fatty acid practically the unsaturated. However, cultivars types, maturity and environmental condition are known to influence the composition of fatty acids e.g. groundnut oil is more stable than the safflower and sunflower, because both oils contain high amounts of polyunsaturated fatty acids [**7**]**.** The objectives of the present study are to evaluate the physical (relative viscosity, refractive index, and specific gravity) and chemical properties (iodine, saponification, acid and peroxide values) of the six refined edible oil of sesame, groundnut, cottonseed, sunflower, corn, olive.

2. MATERIALS AND METHODS

The six refined edible oils; Sesame (*Sesamum indicum* L.); groundnut (*Arachis hypogea* L); cottonseed (*Gossypium barbadense* L.); sunflower, (*Helianthus annuus* L.); corn (*Zea mays* L.) and olive (*Olea europaea* L.) were collected from a supermarket, Khartoum State, Sudan. Both physical and chemical characteristics of oils were determined. The relative viscosity and refractive index were measured according

ARPN Journal of Science and Technology

to [8] and specific gravity was measured using the method of [9]. Iodine, acid and peroxide values are determined according to method described by [10]. [11] method was used to determine saponification value. Fatty acid profile was prepared according to method described by [12]. Each experiment was repeated three times and the data obtained was statistically analyzed using analysis of variance (ANOVA) as described by [13].

3. RESULTS

a. Physical Characters:

The results (Fig. 1) indicate the relative viscosity of six refined edible oils is ranged between 0.9-1.3; the refractive indices between 1.47- 1.47 and the specific gravity between 1.02 -1.04.

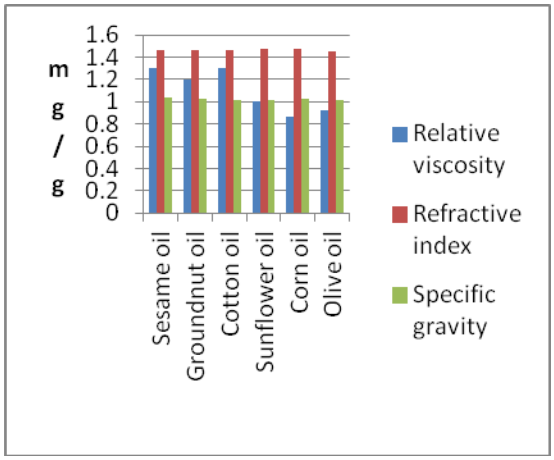

Fig. (1). Sppecific gravity, relative viscosity and refractive index of the six refined edible oils

Fig. (2) Indicated that corn oil scored highest iodine value and olive oil gave the lowest value. Maximum saponification value was given by cottonseed and minimum value was obtained by corn oil. The minimum acid value of six refine oil was 0.2 % that given by cottonseed oil and the maximum acid value was illustrated by sesame oil. The peroxide values ranged from (2 -10), groundnuts gave the highest value and cottonseed oil the lowest value.

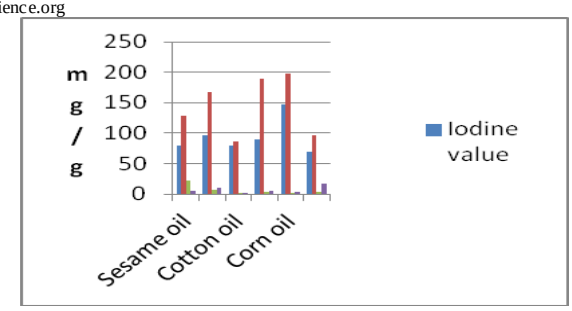

Fig. (2) Iodine value, saponification value, acid value and peroxide value of the six tested oils

Fig. (3) Indicates that the highest value of palmitic acid was given by cottonseed oil and lowest value was obtained by sunflower. The maximum value of stearic acid was illustrated by sunflower and the three remaining oil gave a similar lower value. Oleic acid value was estimated between 19 - 70%, linoleic acid between 10 – 68% and Linolenic acid value between 1-2%. The ratio of saturated to unsaturated fatty acid of the six edible oils ranges from 1:4 to 1:7.

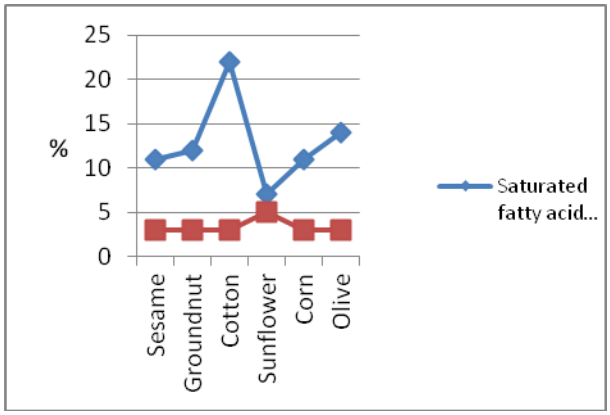

Fig. (3) Saturated fatty acids of six refine edible oil (palmitic and srearic acid)

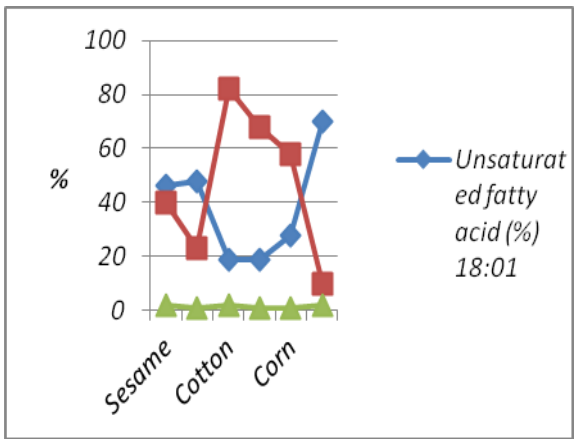

Fig. (4) Unsaturated fatty acid of six refined edible oil (oleic, linoleic and Linolenic acid)

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4. DISCUSSION

a. Physical Properties:

The relative viscosity for cooking oils is known to increase due to insoluble material, oxidation, overheating, air contamination, coolant contamination and water contamination and temperature [14]. The present results indicated that corn and olive oils are less contaminated i.e. contain less insoluble material because low viscosity means faster flow of the oil. These results were significantly different when compared with the other oils ($p \leq 0.05$). The refractive index of sesame is in agreement with [15], but lower than those results found by [16] but the refractive index of refined oil of sunflower is higher than those results obtained by [17]. The refractive index of refine oil of corn is in agreement with those findings by [17]. While refractive index of refine oil of olive is lower than those results of [18]. The specific gravity of the six refined oils is higher than those results of [19]. These findings indicated that there was no significant difference in refractive indices and specific gravity between different types of oils ($P \leq 0.05$).

b. Chemical Characters:

The iodine value of sesame is lower than those results of [20], but the iodine value of refined oil of groundnut lies within the range reported by [17]. Whereas, iodine value of refined oil of cottonseed oil is lower than those results of [19] and iodine value of refined oil of sunflower is in agreement with those results of [16]. Iodine value of refined oil of corn oil is higher than those results of [17] and iodine value of refined oil of olive is within the range given by [18 and 19] and higher than those results of [20]. These results were indicated that there is significantly difference between different types of edible oils in iodine value at ($p \leq 0.05$). The saponification of value of refined edible oil of sesame is 128 mg/g, which is lower than those results of [21] and saponification of value of refined edible oil of groundnut is168 mg/g, which is lower than those results of [17]. Saponification value of refine oil of cottonseed is 86 mg /Kg, which is lower than those results of [19]. Saponification of refined edible oil of sunflower ranged between 188 – 194 mg/g [15], which is higher than those results found. Saponification value of the refined edible oil of corn is 197 mg/g, which is in agreement with those results of [17], but saponification value of the refine oil of olive was 97.0±1.4 mg/g, which is in agreement with results reported by [19]. The results of the saponification values of different types of refined oils were significantly different at ($p \leq 0.05$). The acid value of refined edible oil of sesame is 22.0, which is higher than those results of [16].While acid value of refined edible oil of groundnut is 3 %, which is higher than those results obtained by [17]. The acid value of refine oil of cottonseed is 0.2 %, which is lower than those results of [19]. The acid value of refine oil of sunflower is 3.%, which is closed to those results reported by [17].Acid value of refine oil of corn is 1.%, which lower than those results given by [19], but acid value of refine oil of 0olive is higher than those results obtained by [21]. These results are indicated that there is not significantly different in acid value between six reined edible oil samples at ($p \leq 0.05$). The peroxide values of refine oil of sesame, cottonseed, sunflower and corn oil were lower than those results [22], whereas, peroxide value of refine oil of groundnut was agreement with [17]. These results are indicated that there was significantly different in peroxide value of different refine oil samples at ($p \leq 0.05$).

c. Fatty Acid Profile:

Fig. (3) show the palmitic acid of the refined oil of sesame was within the range obtained by [21]. While Palmitic acid of refined oil of sunflower was within the range those reported by [23]. Palmitic acid of refined oil of cottonseed was in agreement with the results obtained by [23]. These results indicated that the total amount of saturated fatty acids (Palmitic + Stearic acid) of the refined oil of cottonseed is high while of the refined oil of sunflower has low total amounts of saturated fatty acids. Fig.(4) indicates that Oleic, linoleic and Linolenic acid are unsaturated fatty acids which are found in various refined oils in different percentages. The higher oleic acid resulted from refined oil olive, which was within the range those reported by [24], whereas, the level of Linolenic acid in sesame, cottonseed and olive of refined oils was similar, but the level of Linolenic acid in groundnut, sunflower and corn of refined edible oil is similar. According to [24] both fatty acids (linoleic and Linolenic acids) are essential for good quality oils. The results obtained for linoleic and Linolenic acid of sunflower of refine oil were closed to results of [24]. In addition, the total amount of unsaturated fatty acids (Oleic + Linoleic + Linolenic) in groundnut is higher than the other types of refined oil samples. The results indicated that sunflower, sesame and corn refined oil contain high amount of unsaturated fatty acid. Therefore, from a nutrition point, sunflower, sesame and corn refined oil, sunflower, sesame and corn refine oil are more healthy oil for human diet.

Considering the physical and chemical characters measured in the present study to rank the six

edible oils, three categories are evident: corn and sesame; groundnut and sunflower and cotton and olive. Consumption of these oils by the Sudanese market does not follow the above criteria: groundnut is the highest oil consumed probably because of its low price. Sesame oil is used in certain Sudanese meals and sunflower is not known in Sudanese kitchen. Cotton oil is used only when other oils are not available and olive oil use is very limited. Olive oil is not grown in Sudan "exotic" and its use is not common in the Sudanese culture, sometimes it is used as a medicinal purpose.

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