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Frying Quality of Some Edible Oil Blends Based on Palm Olein

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Abstract

Palm olein was blended with three Sudanese edible oils namely cottonseed, groundnut, and sunflower oils, at two levels (3:1; 1:1, respectively), exposure to frying temperature at 180 ± 2^0C for 5, 10 and 15hrs and acceptability tests of potato chips fried in such blends were carried out.

In the acceptability tests, the sequence of preference of potato chips fried in palm olein blends showed that palm olein / sunflower oil (1:1; 3:1) blends, was similar to the pure palm olein in having first preference in color, flavor and taste, followed by chips fried in palm olein / cottonseed oil blends, whereas the chips fried in palm olein / groundnut oil blends received the least acceptability.

Introduction

The widespread use of palm olein as an excellent cooking oil and also as vegetable shortening is well known. Palm olein dominates the world's oils and fats production; it reached at the end of October, 2006 about 37.538 million metric tons, followed by soybean (33.87 million metric tons), and rapeseeds (16.59 million metric tons) (USDA, 2006).

Sudan imported about 260000 M.T. of edible oils during the last five years of different oils of which palm olein constituted the major part (about 74 %).

Palm oil is very rich in both forms of vitamin E, tocopherols and tocotrienols. It is the richest known source of tocotrienols (Wong, *et al.*, 1988). No other common edible oil (except rice bran oil) contains this form of vitamin E in significant amounts.

Tocotrienols of palm olein exhibit anti-cancer properties (Nesaretnam, 1992; and Goh *et al*., 1990). Tocotrienol have greater physiological efficiency in inhibiting the growth of human and mouse tumor cells than tocopherols (Kato *et al.*, 1985 and Komiyama *et al*., 1989).

Ng *et al.*, (1992) and Choudhury *et al.*, (1995) found that olive oil and palm olein have similar effects on plasma cholesterol in humans. They concluded that palm olein in showing nutritionally similar results as olive oil is better as it is much more economical.

Crude palm oil is one of the richest natural plant sources of carotenoids with concentration of 500 – 700ppm. It has 15 times more retinol-equivalent than carrots and 50 times more than tomatoes. No other vegetable oil contains carotenoids in significant quantities. (MPOPC, 2000).

In normal deep fat frying, linoleic(18:2) and linolenic (18:3) acids content are kept low to improve the oxidative stability of the oil. The n-3 essential fat alpha-linolenic acid (LNA) is damaged 5 times more quickly than the n-6. (USDA, 2006).

Yusoff *et al*. (2001) reported that the chemical changes in the frying fats result in changes in their physical characteristics. The aroma and flavor also change with increased frying time, as do the color and flavor of the food fried in oil.

Sensory evaluation of fried food characters, such as color, flavor, taste and texture have been studied by many research workers. Mostafa *et al.* (1996) evaluated the flavor of potato chips fried with different palm olein / cottonseed oil blends. Cowan *et al*. (1971) studied organoleptic and oxidative stability of blends of soybean and peanut oils. Also Schnept *et al.* (1991) studied the chemical and sensory characteristics of menhaden oil / soybean oil blends. It has been found by Elkabashi (2000) that, potato chips fried in groundnut oil were more acceptable than those fried in cottonseed oil for 5^{th} of the frying time. Omer (2002) also carried out sensory evaluation on potato chips fried in palm olein / groundnut oil blends. Shakak *et.al.* (2015)They also carried out a study about the stability of some Sudanese edible oils blended with palm olein oil.

The aim of this work is to study the acceptability of oil blends as frying oils based

on palm olein and the major conventional edible oils of Sudan, namely cottonseed oil, groundnut oil and sunflower oil.

Materials and Methods

Materials: Four different refined oils (cottonseed oil, sunflower oil, palm olein, and groundnut) were collected from Khartoum Industrial Area. Potato tubers used in frying experiments were purchased from the local market of Khartoum North.

Methods: A group of 16 panelists who were familiar with sensory analysis techniques were selected. Quality attributes of color, flavor, taste and texture (crispness) were examined for potato chips fried (exposure to frying temperature at 180 ± 2^0C for 5, 10 and 15hrs) in palm olein and its blends of sunflower, cottonseed, and groundnut oils mixed at two levels (1:1; 3:1 ratios) according to Elkabashi (2000) and Omer (2002). A scale of 5 points hedonic scale was used by the panel team.

Results and Discussion

Table 1 shows sensory evaluation of potato chips fried in palm olein containing, cottonseed, groundnut and sunflower oils at two mixing levels (1:1 ; 3:1), after exposure to frying temperature (180 C^0) for five hours. The color scores of all potato chips fried in different palm olein blends showed no significant ($P \leq 0.05$) changes, compared to those fried in the pure palm olein.

The flavor scores of potato chips fried in pure palm olein was significantly ($P \leq 0.05$) better (4.7) than that fried in all palm olein blends which ranged between 3.9 and 4.5) after the same hours of exposure to frying temperature. However, the flavor of potato chips fried in both blends ratio of palm olein / groundnut oil has the least quality ($P \leq 0.05$) compared to that fried in the pure palm olein and all the blends. On other hand Mostafa *et al.* (1996) found that the flavor of potato chips fried with different palm olein / cottonseed oil blends was improved.

The taste scores of potato chips fried in palm olein containing cottonseed and sunflower oils of (1:1; 3:1) blends, all blends showed similar results with no significant difference compared with pure palm olein oil except the two blends of the groundnut oil which showed the least taste score, after exposure to the same frying time.

The texture (crispness profile) of potato chips fried in all palm olein blends, remained significantly (P≤0.05) similar, compared to potato chips fried in the pure palm olein, after the same frying time.

Table 2 shows sensory quality of potato chips fried in palm olein containing, cottonseed, groundnut and sunflower oils of both blend ratios exposed to 10 hrs frying time. The color of potato chips fried in both blend ratios of palm olein / sunflower oil, showed no significant (P≤0.05) change, compared to that fried in the pure palm olein. However, the color of potato chips fried in palm olein / cottonseed oil and palm olein / groundnut oil at both mixing levels (1:1; 3:1), was significantly (P≤0.05) inferior (3.9, 3.0, 4.3 and 4.0 scores respectively), than potato chips fried in the pure palm olein (4.4)scores, after the same period of frying time.

The flavor scores of potato chips fried in palm olein /sunflower oil (3:1) remained significantly (P≤0.05) unchanged compared to that fried in the pure palm olein; while the flavor scores of potato chips fried in all other palm olein blends were significantly (P≤0.05) inferior, than that fried in the pure palm olein (4.6) scores, after the same frying time. This agrees with findings of Berger *et al.* (1998).

Table: 1 Sensory evaluation of potato chips fried in palm olein and its blends exposed to 5hrs frying time at 180 C^0.

Frying media of potato chips	Color	Flavor	Taste	Texture(crispness)
Palm olein	4.8^a	4.7^c	4.4^c	4.0^a
Palm olein / Sunflower oil(1:1)	4.7^a	4.4^b	4.6^c	4.1^a
Palm olein / Cottonseeds oil(1:1)	4.5^a	4.4^b	4.4^c	4.0^a
Palm olein / Groundnut oil(1:1)	4.4^a	4.0^a	3.7^a	3.9^a
Palm olein / Sunflower oil(3:1)	4.8^a	4.5^b	4.3^c	4.3^a
Palm olein / Cottonseeds oil (3:1)	4.6^a	4.1^a	4.3^c	3.9^a
Palm olein / Groundnut oil(3:1)	4.5^a	3.9^a	4.0^b	4.3^a
S. E.	0.I5	0.21	0.20	0.23

* Mean scores having different superscript letters in the same column differs significantly ($P \leq 0.05$).

**Values represent outcome of scoring tests of 5 points hedonic scale.

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The taste scores of potato chips fried in palm olein / sunflower oil and palm olein / groundnut oil (1:1; 3:1) blends, together with palm olein / cottonseed oil (1:1)blend were significantly (P≤0.05) inferior score (3.6, 3.4, 4.2, 3.9 and 3.9) scores respectively, than that fried in the pure palm olein scores (4.5). On the other hand the taste scores of potato chips fried in palm olein /cottonseed oil (3:1) blend remained significantly (P≤0.05) unchanged compared to that fried in the pure palm olein, after exposure to the same frying time.

The crispness degrees (texture) scored for potato chips fried in all palm olein blends, showed no significant (P≤0.05) change, compared to the crispness degree of potato chips fried in the palm olein blends, except potato chips fried in palm olein / groundnut oil (1:1) blend, which was significantly (P≤0.05) inferior (3.7), than that fried in the pure palm olein, after 10hrs frying time.

Table 3 shows sensory quality of potato chips fried in palm olein blend containing cottonseed, groundnut and sunflower oils blended at 1:1; 3:1 levels after 15hrs. frying time (180 C^0).The color of potato chips fried in palm olein /sunflower oil (1:1 ; 3:1) blends was significantly (P≤0.05) better (4.4and 4.6) than the color of that fried in the pure palm olein scores (3.9). On the other hand, the color of potato chips fried in palm olein / cottonseed oil (1:1) and palm olein / groundnut oil (1:1 ; 3:1) blends, (3.6, 2.8 and 3.4 scores respectively), was significantly (P≤0.05) inferior, to the color of potato chips fried in the pure palm olein.

The flavor of potato chips fried in palm olein / cottonseed oil and palm olein / groundnut oil (1:1; 3:1) blends was significantly (P≤0.05) inferior (3.3, 3.8, 3.1 and 3.6 scores respectively), compared to the flavor of potato chips fried in the pure palm olein (4.1). While the flavor of potato chips, fried in palm olein /sunflower oil of both blending ratios (1:1; 3:1), remained significantly (P≤0.05) unchanged, compared to the flavor of potato chips, that were fried in the pure palm olein for the same frying hours.

Table: 2 Sensory evaluation of potato chips fried in palm olein and its blends exposed to 10hrs frying time at 180C^0

Frying media of potato chips	Color	Flavor	Taste	Texture(crispness)
Palm olein	4.4^{d}	4.6^{d}	4.5^{d}	3.9^{a}
Palm olein / Sunflower oil(1:1)	4.5^{d}	3.7^{b}	3.6^{a}	4.1^{a}
Palm olein / Cottonseeds oil(1:1)	3.9^{b}	3.8^{b}	3.9^{b}	3.9^{a}
Palm olein / Groundnut oil(1:1)	3.0^{a}	3.4^{a}	3.4^{a}	3.7^{b}
Palm olein / Sunflower oil(3:1)	4.6^{d}	4.6^{d}	4.2^{c}	4.0^{a}
Palm olein / Cottonseeds oil (3:1)	4.3^{c}	4.1^{c}	4.4^{d}	4.1^{a}
Palm olein / Groundnut oil(3:1)	4.0^{b}	4.0^{c}	3.9^{b}	3.9^{a}
S. E.	0.23	0.24	0.21	0.26

* Mean scores having different superscript letters in the same column differs significantly (P≤0.05).

**Values represent outcome of scoring tests of 5 points hedonic scale.

The taste of potato chips fried in palm olein / cottonseed oil and palm olein / sunflower oil of (1:1; 3:1) blending ratios, showed no significant (P≤0.05) difference, compared to the taste of potato chips fried in the pure palm olein. However, the taste of potato chips fried in palm olein / groundnut oil, of both (1:1; 3:1) blends was significantly (P≤0.05) inferior in scores (3.1 and 3.3 respectively), than the taste of potato chips fried in the pure palm olein (3.8) scores, after 15hrs frying time.

It has been found by Elkabashi (2000) that, potato chips fried in groundnut oil were more acceptable than those fried in cottonseed oil for 5th time of frying.

Lastly, the texture of potato chips, fried in all palm olein blends was significantly (P≤0.05) inferior, compared to the texture of potato chips that fried in the pure palm olein for the same time and temperature.

Omer (2002) studied the sensory evaluation during the frying process of potato chips by blending palm oil with different ratios of groundnut oil. The palm /groundnut oil blends performed better than individual oils. Affandi and Sahri (1999) studied the blend of palm oil and groundnut oil and reached the same conclusions.

Table: 3 Sensory evaluation of potato chips fried in palm olein and its blends exposed to 15hrs frying time at 180C^0.

Frying media of potato chips	Color	Flavor	Taste	Texture(crispness)
Palm olein	3.9^{c}	4.1^{c}	3.8^{c}	4.1^{c}
Palm olein / Sunflower oil(1:1)	4.4^{f}	4.2^{c}	3.9^{c}	3.4^{a}
Palm olein / Cottonseeds oil(1:1)	3.6^{b}	3.3^{a}	3.8^{c}	3.4^{a}
Palm olein / Groundnut oil(1:1)	2.8^{a}	3.1^{a}	3.1^{a}	3.3^{a}
Palm olein / Sunflower oil(3:1)	4.6^{f}	4.3^{c}	3.8^{c}	3.5^{a}
Palm olein / Cottonseeds oil (3:1)	4.0^{c}	3.8^{b}	3.9^{c}	3.7^{b}
Palm olein / Groundnut oil(3:1)	3.4^{b}	3.6^{b}	3.3^{b}	3.9^{b}
S. E.	0.23	0.26	0.24	0.28

* Mean scores having different superscript letters in the same column differs significantly (P≤0.05).

**Values represent outcome of scoring tests of 5 points hedonic scale.

Conclusions

From the results outcome of blending palm olein with three Sudanese edible oils namely cottonseed, groundnut and sunflower oils, at two levels (3:1; 1:1, respectively), and studying their acceptability of fried potato chips, the following points may be concluded:

- Potato chips fried in the pure palm olein and in both blends of palm olein / sunflower oil were superior in color, flavor and taste compared to those fried in palm olein / cottonseed oil and palm olein / groundnut oil, respectively.

Recommendations

From these findings, the following points are recommended:

- Palm olein can be used as a base for blending with sunflower oil at 3:1 ratio of the former to the latter for all food uses particularly frying potato chips.
- More investigations are needed to apply palm olein blends on large scale production and their economy.
- Palm olien should be tested for other uses such as frying as frying other products using the same blends.

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