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IMPROVING OXIDATIVE STABILITY AND DEEP FRYING PERFORMANCE OF BLEND SUNFLOWER OIL WITH UNCONVENTIONAL JOJOBA OIL

El-Reffaei, W. H. M. and Sh. A. Nada
Regional Center for Food and Feed (RCFF), Agric. Res. Center, Giza, Egypt.

ABSTRACT

Improvement of oxidative stability and deep frying performance of sunflower oil (SO) by blending with highly stable unconventional edible jojoba oil (JO) was investigated. Jojoba oil is homogenized mixture of long chain esters and monounsaturated fatty acid. Blend (2:1 w/w) of sunflower oil with jojoba oil was studied with respect chemical , physical parameters and fatty acids as well as estimate oxidative stability by Oxidizability formula . Fresh oils and their blends after frying carried out at different times at potatoes finger. The frying process was carried out without replenishment of fresh oil for 30 intermittent frying of potato fingers at 180 ± 5 C° for consecutive 3 days in domestic open fryer. Rate of changes for PV, p-AV and TOTOX values as well as UV absorption at different wave length 234. 238, 268 and 420 nm were carried out as quality criteria to confirm the oxidative stability of sunflower was improved by blending with JO. Fatty acid composition by GC and oxidizability were determined to estimate the stability of fresh and used blend as well as unblended oils. Linoleic acid of sunflower decreased after blend with JO. Furthermore, the lower intensity of oxidation changes during heating as measured by selected indices of quality suggest wider used of jojoba in fat frying. Sensory evaluation was carried out on fried potato fingers at different frying numbers. The potato fingers with more susceptible sensory quality (color, appearance, odor, taste and texture) stability up to 10^{th} frying. Biodiesel from waste of frying oil, it's a new approach to eliminate and mange environmental pollution. Generally, the enhanced stability during deep fat frying of blend SO + JO could play a part in improving the shelf- life of fried foods. Concluded, that jojoba oil blending with sunflower was found to be a very well suit for deep frying.

Keywords: blending, biodiesel, deep frying, fatty acid composition, GC, jojoba oil, oxidizability, oxidative stability, sunflower oil, TOTOX.

INTRODUCTION

Increase of oil stability is the subject of intensive research. During frying process the oil was exposure to intensive heat, air, and moisture which are cable to produce hydroperoxides and subsequent degradation. Most of these thermal degradation products have a health lession effect or retardation nutritional status, moreover these activity decrease the overall acceptability of both used oil and the final fried products. The fatty acids composition of fatty material is the major factor influencing by these degradation conditions. Generally, the fatty acid composition of products derived from vegetable oils or animal fat corresponded to that of oil depend oil or fat. Furthermore, the rate of oil deterioration depends on fatty acid composition and number of double bonds.

Blending different types of oils is more reliable demand to improve the thermal stability of frying oils with more stable oil, and more demand to prevent the heath effects. By blending the most fatty acids composition were defiantly changed to elucidate oxidative stability of oils and increasing the final food quality. The nutritional consequences of ingesting deteriorated oils include a variety of symptoms ranging from allergy of the digestive tract, growth retardation, increase in liver and kidney weight, to other biochemical lesions (FAO/WHO, 1988).

Most of different research were designed to find a renewable oil sources to increase efficiency of heat stability and dedicated health and nutrition effects. The fried foods may absorbed the heated fat and attribute stability to the fat ingested by consumer. The lipid composition of deep-fat fried foods is of considerable interested to nutritionists' concencerned with nutrient intake of young people who tend to consume large quantities of convenience and snack foods, and to individuals who wish to alter their fat intake for medical reasons.

Jojoba (*Simmendsia Chinensis*) is a plant that a desert shrub. It is found through out the Sornoran desert area of Mexico, California and Arizona. Recently, jojoba was cultivated in Egypt at west desert land with a widely areas since 1991. The jojoba plant produces beans, which contain up to 50% their weight oil. The oil found in jojoba beans is a similar to that found in the sperm whale. It was liquid above 10 C°. Jojoba oil is not only similar to sperm whale oil, but superior. It is non greasy odorless oil which is actually a liquid wax. The oil is a great economical value with many applicants especially in the cosmetic industry and lubricant. The chemical composition of this oil is unique in that it contain little or no glycerin and that most of its components fall in the chain – length range of C40-C42, but is a mixture of long chain esters composition C18, C20, C22 and C24 and monounsaturated fatty acid. It has been recently found that wax esters whose acidic moiety enriched in ω-3 fatty acids are easily absorbed and metabolized by rats (Gorreta, 2002). Jojoba oil is liquid at room temperature because of its unsaturated fatty acids. It does not oxidize or become rancid and does not break down under high temperatures and pressures. Jojoba oil can be heated to 370°F (188°C) for 96 hours without exhibiting degradation in general composition and carbon chain length. The stability shown by jojoba oil makes it especially useful for cosmetic applications.

Jojoba oil is scarcely hydrolyzed by pancreatic lipases (Hamm, 1984). The jojoba oil have been reported as several application including coating of food stuffs (e.g. chocolate, dried fruits) which greatly improved stability and impassive moisture loss even in comparison with hydrogenated oil coating (Clarke and Yermanos ,1980). Native Americans were using the oil and the seeds for many different purposes: for treating sores, cuts, bruises, and burns; as a diet supplement and as an appetite suppressant when food was not available; as a skin conditioner, for soothing windburn and sunburn; as a cooking oil; as a hair or scalp treatment and hair restorative; and as a coffee-like beverage by roasting the seeds. Jojoba oil is a nontoxic, noncomedogenic (does not clog pores), and hypoallergenic substance. It has been widely used for decades in cosmetics, with no reported adverse effects. If jojoba oil is ingested, most of it is eliminated in the feces, with little getting distributed in the body (Alternative Medicine Encyclopedia, 2007).

In addition to jojoba wax can be used as food additive and replacing as edible fat and oil in margarine ad mayonnaise as well as deep -fat frying which stand up to high temperature (Tada *et al.*, 2005).

The main objectives of this study were to assess the increase frying performance of unstable oil such as sunflower by blending and uses in frying depending on chemical, physical parameters and fatty acid composition of fryer oil as well as their Oxidizability.

MATERIALS AND METHODS

Frying performance:

Refined sunflower oil, cold press jojoba oil and potatoes were purchased from a local market in Egypt. The oils were stored blew than 5 C° in the dark . The oils were blended (2:1w/w sunflower and jojoba oil) then kept up to use in refrigerator.

Uniform size of potatoes were washed, peeled by stainless steel knife, and then cut as finger shaped 0.5 cm diameter and length 5-8 cm , frying after stripping in 3 % sodium salt solution. Domestic deep-fat fryer with large jar 5 L aluminum vessel was used for frying. The properties of fried potatoes to frying oil in the repeated frying process was kept at 200g / 5 L without replenish the oil. The consecutive 10 frying cycle were carried out every day up to 3 days with intermittent time up to 24 hr.Total carried time was 2 hr per day. The fryer was filled with 5 liters blend oils (Sunflower + jojoba oil 2:1) and heated at 180 ± 5 C°. For the analytical determinations of oils and samples from nonfried blend oil (fresh) was also retained. All the oil samples were stored in freezer at -20 C° before analysis.

Sensory evaluation: organolyptic evaluation of potato fingers which produced from different frying times were conducted by presenting the potato finger sample to a taste panel comprise of nine members. The untrained members asked to record their degree of performance on an evaluation card using hedonic scale as given blew: Liked extremely 9, Liked very much 8, Liked moderately 7, Liked slightly 6, Neither liked nor dislike 5, Disliked slightly 4 , Disliked moderately 3 , Disliked very much 2 and Disliked extremely 1. The data thus obtained for sensory characteristics were subjected to statistical analysis by using a Duncan's Multiple Range test for determine variables as described by Snedecor and Cochran, (1967).

Chemical and physical properties of fresh and used oils:

Chemical properties:

Iodine, peroxide, p-Ansidine, TOTOX values and free fatty acid ratio were determined according to method described in AOAC, (2005). TOTOX value was calculated by using the following equation:

TOTOX value (p-Ansidine value) = 2PV + p-Ansidine value

Where:

PV= peroxide value   p-AV= p-Ansidine

Fatty acid profile analysis:

Fatty acid profile was determined by Gas Chromatography. BF_3 / methanol were used for the preparation of fatty acid methyl esters as described by AOAC, (2005). Automatic Shimadzu 2010 auto system model of gas chromatography fitted with an auto sampler, and DB-wax column 30mx0.25 mm (I.D) x 0.25 μ m film of fused silica, and fitted with FID detector. The temperature of injection port and FID was maintained at 250 C° , the oven was 200 C° and the carrier gas was helium 30 ml / min. The sample size was 1 μl. Peaks area was automatically integrated using heptadecanoic acid as internal standard.

Physical properties:

The color was measured in 10% oil in chloroform w/v at 400 and 450 nm according to Purdy (1985) by using spectrophotometer.

Absorbance at 232 and 268 nm :

This ultraviolet absorption evaluates the formation of conjugated compounds (diens and triens) due to shifting of the double bonds during thermal frying process. Absorbance at 232 and 268 nm was determined according to Huang *et al.*, (1988) using U.V. absorption in purified solvents 1 % oil at chloroform w/v using spectrophotometer (Unicam, Heλios α V2.03, England).

RESULTS AND DISCUSSION

Efforts to improve sunflower resistances for oxidation and thermal performance by blending with more stable oil such as jojoba (Monika *et al.*, 2002 and Moriod *et al.*, 2005). Modifying fatty acids composition of linolenate containing oil to improve frying stability has previously focused on blending or hydrogenating oils to decrease linolenic acid. Researchers have shown that decreasing linolenic and linoleic acids in oils, the stability of frying performance was increased. The direction towards lower linolenic acid , higher oleic acid and higher saturate seems appropriate because oils with these fatty acid profiles have greater frying stability as judged by less oxidation, polymerization and hydrolysis (Hamilton, 1994).

Potato chips and their French fried potato are the major concern in fast food restaurants , which consumed a lot of frying oils, from these view must be produced fried potatoes with cheapest oils and highly in heating stability, not only produce but also with high flavor quality. In addition, using hardened oils in frying process behave a health aspects that encourage the consumers search at another safely source of used frying oils.

Blending sunflower oil (SO) with jojoba oil (JO) (2:1 w/w) were debited to their chemical, physical quality parameters and their fatty acids profile for fresh and used blend oils in frying potato fingers.

Chemical parameters:

Effects of frying time and on blending SO with JO (2:1) on their chemical characteristics are listed in Table (1). The data show a clear distinction between fresh blend oils and their used blend oils at different times of frying in peroxide (PV), para ansidine (p-V), iodine, (IV) and TOTOX values. The level of oil primary oxidation is assessed by PV of used blend oil, which increases significantly from fresh blend oil up to FO30.

Peroxide value (PV) is often a criterion of peroxides generated during cooling and reheating process. The table shows a rapid increase from 0.7 ± 0.2 up to 4.31 ± 0.95 meq O_2/ Kg after successive FO30. Similar to Susheelamma *et al.*, (2002) who reported that a continuous increase of PV during three successive frying of model dough in all investigated samples of oils and blends. Dienoic acids such as linoleic acid are much more sensitive towards oxygen and rate of peroxide formation is faster accompanied with number of frying process. Similar finding was attained by Suguy *et al.*, (1996) whom summarized that jojoba oil is more stable in heat and time of frying process when compared to using corn oil in frying at less time and heating after along time of frying.

Table (1): Physical and chemical parameters for fresh and used blend oil (Sunflower: Jojoba oils 2:1 w/w) in deep-fat frying.

Type of oil	Chemical parameters					Physical parameters			
	Peroxide value (PV) $mEq.O_2$/Kg	Iodine value (IV) (mg I_2/100gm)	P-Ansidine value (p-AV)	FFA (%)	TOTOX value	oxidation index* mmol/L (abs at 234 nm)	Abs at 238 nm	Abs at 268 nm	Abs at 420 nm (color index)
Fresh blend oil	0.70±0.2	126.33±5.7	3.72±0.3	0.22±0.02	5.12	8.82	0.502	2.85	0.162
FO1	1.80±0.82	123.9±0.75	4.11±0.3	0.24±0.02	7.71	8.85	0.458	2.79	0.064
FO10	2.44±0.96	120.08±3.1	4.72±0.4	0.29±0.01	9.60	8.99	0.415	2.77	0.079
FO20	3.97±0.8	117.8±1.0	10.37±0.1	0.38±0.07	18.31	9.28	0.416	2.89	0.083
FO30	4.31±0.95	115.8±1.6	32.58±0.97	0.44±0.04	45.51	12.85	0.653	2.99	0.095

*** Oxidation index; this extinction coefficient of 29.000mol/L according to Privett O. S. and M. L. Blank (1962), JAOCS 39,465-469.**
Values are mean ± SD for 3 repetitions.
FO1: First fryer blend oil, FO10: Tenth fryer blend oil, FO20: Twentieth fryer blend oil, FO30: Thirty fryer blend oil

The most reliable measures p-ansidine and TOTOX values were elevated, a markedly increase in both is probably due to secondary oxidation typically resulting a conjugated dienoic , trienoic acids , epoxides , aldehydes, ketones. These compounds could undergo further and fission into smaller fragments and may remain in the triglyceride molecular and across linkage with each other, forming dienoic and higher molecular weight materials, remains in the oils and therefore contact with fried food products (Sebedio *et al.*, 1988 and Gertz, 2000).

The level of p-AV is regarding to secondary oxidation. It ranged from 3.72 ± 0.3 in fresh blend oil up to 32.58 ± 0.97 in used blend oil , with significantly increase not only in p-AV but also accompanied with PV and calculated TOTOX value (range from 5.12 up to 45.54 after thirty frying).

Iodine value is one measure a degree of unsaturation, tended to decline by frying process for fresh and used blend oil. IV was gradually declined from 126.33 to 115.8 for fresh and used blend oil of thirty frying. By reduction about 8 %. then gradually decrease in IV is assumed that IV expresses the stability of blend oil towards thermal oxidation (Carol Tompkins and Perkins Edward, 2000).

FFA % is one of the indicators utilized to assess of oil quality during the frying process. It could be used as an indicator to show whether the process is under control. The level of FFA is ranging 0.22 ± 0.02 up to 0.44 ± 0.04. Similar finding were reported by Che Man *et al.*, (1999) who found an increase in percentage of FFA for 5 days of potato chips frying and pointed out a promoting influence of water from the fried products on the process of lipid analysis. Also Mazza and Qi (1992) and Negishi *et al.,* (2003) agrees that continuous increase in acid value of rapeseed oil and palmolein during 72 of frying potato croquettes.

Physical parameters:

The data in Table (1) is clearly show difference between fresh and used blend oils in their physical parameters which included oxidation index (Abs at 234nm) conjugated dienoic, and trienoic level at 238 and 268 nm. The oxidation process is corresponding to formation conjugated dienoic and trienoic acid which absorbed at UV light region between 232 – 234 nm. Point of view agree with Alexander *et al.,* (1983) who stated that , the presence of degradation products including dimmers and polymers arising from chemical interactions continuously forms carbonyl and other compounds may account for the decrease absorption of heated or used oils. The oxidized oil was evaluated by using absorption at 234 nm as shown in Table (1) appeared more thermal stability to 9.0 along the frying numbers up to FO20. While the excessive abuse for blend oil up to 30 frying, the oxidation level rapid increase up to 12.85.

The absorbance between 238-263 nm is accomplished with increases conjugated dienoic and trienoic acid and fluctuated between fresh and used blend oil. These explained that long chain esters in jojoba oil exhibiting high stability at frying temperatures after manifested by UV absorbance; similar resultes were obtained by Suguy *et al.*, (1996).

The color of blend oil increase significantly from yellow color to darker color and impassive absorbance of optical region at 420 nm from 0.162 for fresh blend oil to 0.095 after used for thirty frying by invade the light wave.

Generally, regarding to these results, either chemical or physical characteristics is dedicated that blending jojoba oil with less heat stable such sunflower oil is the most popular choice, not only for increase heating stability, but also its excellent parameters such as p-AV and AV up to twenty frying without replenishment. Considerable to these previous chemical and physical results are supported that JO is the posses oil for frying process point of view.

Fatty acid composition:

Changes in the fatty acid composition of the thermal oxidized fats used in frying process relative to fresh fat were judged. Not only does the sensitivity and subsequent reacting increase within the degree of unsaturation fatty acids, but the distribution and geometry of double bonds also influence the extent of oxidation. Data in Table (2) and Fig. (1) illustrated that fatty acid composition of both fresh and used blend oils at different frying numbers.

Sunflower oil have the highest amount of unsaturated fatty acids (89.3 %), mainly linoleic acid (C18:2) 63% as shown in Fig. (1). Meanwhile jojoba oil contained more total unsaturated fatty acid (97.6 %) but linoleic acid was definitely lesser than sunflower oil (1%), this low level of linoleic acid is responsible to increase the jojoba oil stability. Furthermore, total monounsaturated fatty acids in jojoba was 96.4% thus total polyunsaturated 1.26 % this definitely responsible for stable of oil on the excessive heating abuse. C20:1 ω 9 is the major fatty acid (72.8%) in the JO followed by C22:1 ω 11 (14.0%) and oleic acid (9.2%). The nutritional sound of JO can be estimated by divided ω-6 / ω-3, it has 3.8 in the safety level to prevent coronary heart disease that ranged 1-5 (Kritchevsky *et al.,* 1982). Furthermore the ratio between ω-6 and ω-3, it behave takes as considered to estimate the effect of type oil against several of malignant tumors (Cave, 1991). The suitability of oil to frying stability depends on increase the level of oleic acid and depresses linolenic and linoleic acid to the lowest level (Firestone *et al.,* 1991).

Table (2) showed that linoleic acid (C18:2 ω 6) is the major compound of all fatty acid among different blend oils and used at 51.6%. Total unsaturated fatty acid was ranged from 90.9 to 92.4 % at different fryer oils. Meanwhile, total saturated FA was ranged from 7.8 to 8.5 % along different fresh and used blend oils.

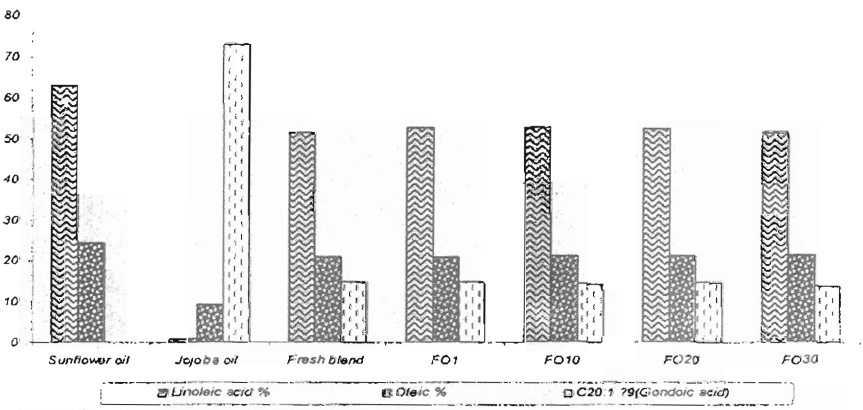

Fig (1): Most predominant fatty acids in fresh and used blend oils compared to their fresh unblended oils.

Partially decrease was found in C18:0 by about 2.7% was noticed compared to fresh blend oil in the Table (2), from these notices, it can be estimated that no alteration occurred in the oil stability along of frying process at different times. In addition to, JO in the blend oil can be maintained the heating stability of sunflower. Also, Table (2) showed that, major saturated fatty acid was varied between 5.1-5.4% at different fresh and used blend oils, monounsaturated oleic acid was 21- 21.4% and diunsaturated linoleic acid was 51.4-52.8 %. In general, blending JO and SO decreased linoleic acid and increase also oleic acid as well as palmitic acid decreased. These results agrees with Monika *et al.,* (2002) and Moriod *et al.,* (2005) whom stated that, blending SO kernel oil with melon bug oil increased oleic acid from 41.8 up to 43.9% and more pronounced decrease in linoleic acid from 42.5 to 31.0 %. In general the blends increased stability from 5 up to 68 %.These results agree with Allam, (2001) who studied that oxidation stability of sunflower oil blended with nine oils distinguished by their high oleic acid and the oxidative stability of oils. The stability of sunflower oil increased with increasing the amounts of oleic acid. Blend oil is rich in both oleic acid and linoleic acid, the major monounsaturated was gondoic acid (C20:1ω9) ranged from 13.9-14.8 with slightly decrease happened in fryer oil 30 by about 6.1% compared to fresh blend oil. Major depressed in arachidonic acid from 2.3 to 1.9 % for fresh and used up to 30[th] frying.

Table (2): Fatty acid composition percentage in fresh and used blend oil (sunflower and jojoba oils 2:1 w/w) at different numbers of frying potatoes fingers.

Fatty acids	Common name	Sunflower oil (SO)	Jojoba oil (JO)	Fresh blend oil	Frying treatment Used blend fried oil FO1	FO10	FO20	FO30
C14:0	Myristic acid	0.66	0.0	0.0	0.0	0.0	0.0	0.0
C16:0	Palmitic acid	6.04	1.3	5.1	5.2	5.2	5.2	5.4
C18:0	Stearic acid	3.2	0.0	3.2	2.6	2.6	2.6	2.6
C18:1ω9	Oleic acid	24.4	9.2	21.0	21.0	21.2	21.1	21.4
C18:1ω7	Vaccenic acid	1.3	0.36	1.0	0.9	0.9	1.0	1.2
C18:2 ω6	Linoleic acid	63.0	1.0	51.6	52.6	52.8	52.2	51.4
C18:3 ω4	Octadecatetrienoic acid	0.0	0.0	0.6	0.8	0.6	0.6	0.9
C18:3 ω3	Linolenic acid	0.3	0.26	0.2	0.2	0.25	0.2	0.2
C20:0	Arachidic acid	0.17	0.0	0.2	0.0	0.15	0.0	0.0
C20:1 ω9	Gondoic acid	0.0	72.8	14.8	14.6	14.3	14.4	13.9
C22:4 ω6	Arachidonic acid	0.0	0.0	2.3	2.3	2.0	2.2	1.9
C22:0	Behenic acid	0.3	0.2	0.0	0.0	0.0	0.0	0.0
C22:1 ω11	Docosenoic acid	0.0	14.0	0.0	0.0	0.0	0.0	0.0
Oxidizability (OX)**		**0.64**	**0.017**	**0.518**	**0.534**	**0.577**	**0.530**	**0.522**
Total saturated acids		10.3	1.5	8.5	7.8	7.9	7.8	8.0
Total unsaturated acids		89.3	97.6	91.5	92.4	92.1	91.7	90.9
Total ω-6		63.0	1.0	54.0	54.9	54.8	54.6	53.3
Total ω-3		0.3	0.26	3.1	1.0	0.3	0.2	0.21
Total mono unsaturated acids		25.7	96.4	36.8	36.5	36.4	36.5	36.5
Total polyunsaturated acids		63.3	1.26	54.7	55.9	69.4	55.2	54.4
Ratio of ω-6 / ω-3		210	3.8	270.0	274.5	219.2	273.0	266.5

*SO: Fresh sunflower oil, JO: Fresh jojoba oil, Fresh blend of Sunflower oil: Jojoba oil (2:1) FO1: First fryer blend oil, FO10: Tenth fryer blend oil, FO20: Twentieth fryer blend oil, FO30: Thirty fryer blend oil **Oxidizability (OX) : calculated according to Cosgrove J. P., D.F. Church and W. A. Pryor (1987) lipids 22:299, Using formula , OX={(0.02 (oleic%)+Linoleic %+2 (Linolenic %)}/100

Oil oxidizability performance:

Linoleic acid was decrease from 63 % in SO to 51.6 % in the 2:1 SO: JO. The fatty acid composition thus changed by blending. This decrease calculate oxidizability form, whereas Oxidizability = [(0.02 (oleic %) +Linoleic %+2 (Linolenic %)] /100. From this oxidizability it can be predicted the frying and thermal stability of used oil. From Table (2) the oxidizability of JO has a significant little oxidizability. The point of view, ensure that JO is more stable than SO which have oxidizability 0.017 (JO) and 0.64 (SO). Reduction in linoleic content responsible to release the oxidizability and modified the frying stability of used blend oil (Neff *et al.*, 1994). The calculated oxidized stability was decreased from 0.64 for SO to 0.518 after blending with JO.

Table (3): sensory evaluation of the different fried numbers potato fingers.

Sensory parameters	First Fried potato fingers	Tenth Fried potato fingers	Twentieth Fried potato fingers	Thirtieth Fried potato fingers
Appearance	8.71 A	8.49 A	8.28 A	5.83 B
Taste	8.58 A	8.55 A	8.10 A	5.36 B
Odor	8.75 A	8.35 A	7.88 B	5.00 C
Texture	8.41 A	8.27 A	6.55 B	5.23 C
Color	8.11 A	8.09 A	6.28 B	4.83 C

- **Analysis of variance procedure was carried out to evaluate sensory attributes and Duncan's Multiple Range test was used for determine variables.**
- **Means of results with the same letter in the same column were identified that non significant difference at level ($P<0.05$).**

Sensory evaluation:

The sensory evaluation data in Table (3) had shown the average sensory scores of the different fried potato fingers products which were produced from different frying numbers. Means with the same letters indicated that non significance between them. Regarding to increase number of frying in the frying oil leads to appreciable loss in the quality of the different fried products.

Potato fingers are still in a good quality appearance with average score about 8.0 up to consecutive 10^{th} , fryings meanwhile 30^{th} had a low score in appearance. It could be clearly noticed that even after 20^{th} fryings the fried potato fingers are still accepted at appearance , taste , and texture. Meanwhile, a significant difference was occurred in the appearance, taste, odor, color and texture after 30^{th} fryings of potato fingers. Generally, frying number 30 is the worst frying in all appropriate sensory evaluation.

How to mange the waste of exhausted frying oil?

An extensive working to eliminate and manage the waste exhausted frying oil for avoids environmental pollution. Modern concept to mange these waste by different ways such a newly duties, by easily converted into biodiesel for diesel engines, biodiesel is sold commercially in Europe, America and Aistralia, cheaply converted waste frying oil into biodiesel fuel that mix in any quantity with conventional diesel. The transestrification process involves mixing at room temperature with excess methanol and sodium hydroxide concentrate 100% , the mixing with waste frying oil and the supernatant is biodiesel in esters form clean up or purification process which consists of water , washing , vacuum , drying and filtration. This protocol was produced about 1.9 L of biodiesel from 10 L of waste used frying oil. Many researches evident were supporting this work such as Knothe *et al.*, (1997) and Haas, (2004). Biofuel Industries, Cogeneration Technology, Renewable Energy Tech., (2002) and Hajek *et al.*, (2006) summarized that, renewable energy of biodiesel from both jojoba oil and sunflower oil is pollution free power source and clean power.

Second approach depend on saponified this waste frying oil after filtration by alkali condition and breakage the soap with acidic condition to produce fatty acids after washed and salting out. The product fatty acids are received into feed animal and other industrial purposes. Finally , these new approach can be manipulate by community and decision makers to established these new trend to mange the waste of frying oil and find alternative clean power source.

CONCLUSTION

Oxidative stability and frying performance for SO can be improved by blending with JO. Blending lead to decrease linoleic acid level and increase level of oleic which may be partly responsible for better stability than each. JO is the better one of oil used to increase the other oil frying stability by blending and make as alternative oil in frying than hydrogenated blend oil, especially in fast frying food production.

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تحسين الثبات التأكسدي و معدل القلي العميق لزيت العباد بخلطة مع زيت الجوجوبا الغير تقليدي.

وائل حلمي موسي الرفاعي ، شيرين عباس صادق ندا.
المركز الاقليمي للأغذية والأعلاف – مركز البحوث الزراعية – الجيزه – مصر.

أجري هذا البحث لتحسين جهد الاكسدة ومعدلات القلي لزيت العباد بخلطة مع زيت غير تقليدي يتميز بالثبات الحراري العالي.يعتبر زيت الجوجوبا خليط متجانس من استرات لاحماض دهنية طويلة السلسلة وأحادية عدم التشبع وتم خلطة مع العباد بواقع ٢جزء من العباد مع ١ جزء من الجوجوبا المستخلص علي البارد ثم أجري التحاليل الكيماوية والطبيعية وتركيب الاحماض الدهنية المختلفة لكلا من الخليط في الصورة الظازجة وبعد عمليات القلي المختلفة عليها بأستخدام أصابع البطاطس وأجري عملية القلي في قلاية عادية الاستخدام ولمدة ٣ أيام لثلاثين قلية متتالية بدون اضافة زيت خليط جديد علي ١٨٠ ± ٥ °م بمعدل ١٠ قليات يوميا.وكان أقل معدل التغيير في قيم البيروكسيد و الانسيدين و التوتوكس والامتصاص علي اطوال موجية ٢٣٤ و ٢٣٨ و ٢٦٨ و ٤٢٠والتي اجريت لتحديد معايير الجودة المختلفة لتلك الخليط واتضح منها الثبات التأكسدي والقلي عند أستخدام زيت الجوجوبا في الخلطة.

كما أجري تقدير لتركيب الاحماض الدهنية بالكروماتوجرافي الغازي وحساب مدي القابلية للتأكسد من خلال ذلك التركيب ومنها تبين الثبات الحراري بعد الخلط مع حدوث معها أنخفاض لنسبة حمض اللينوليك المسؤل عن خفض الثبات واتضح من هذا مدي الثبات الحراري المرتفع للعباد وارتفاع مقاييس الجودة. كذلك ارتفعت مقاييس الجودة الحسية المختلفة للبطاطس الناتجة من حيث اللون والطعم والرائحة والقوام والمظهر حتي القلية العشرين. وقد أشار البحث الي أمكانية التعامل مع المتخلف من الزيت بعد القلي بأمكانية تحويلة الي وقود حيوي. وعموما تبين من البحث تحسن المواصفات الكلية لزيت العباد بالخلط مع زيت الجوجوبا مع رفع الجدوي الاقتصادية لاستخدام زيت الجوجوبا.