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Studies on physicochemical properties of edible oils

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Abstract
Taking into consideration the regional preferences of the local population to Groundnut oil, Olive oil and rice bran oil, the present study of nutritional evaluation of three different oil blends was conducted using Groundnut oil, Olive oil, Palm oil as controls. The oil blends selected were Groundnut oil, Olive oil, Palm oil in the ratios of 50:50 with other oils. These oil blends were used for making a ready to eat (RTE) extruded snack. Shelf life studies during storage for two months were examined for changes in chemical and sensory characteristics. Near significant changes were observed in the oil extracted from the fried product in comparison to control. Sensory evaluation of the ready to eat (RTE) extruded snack indicated that it was chemically acceptable up to two months of storage.

Keywords: groundnut oil, oil blending, shelf life studies, sensory characteristics

Introduction
Deep-fat frying is one of the oldest and most popular food preparation methods [1]. Deep-fat frying is a process of immersing food in hot oil with a contact among oil, air and food at a high temperature of 150 to 190°C [2]. In the presence of oxygen, moisture, trace elements and free radicals, physiochemical reactions such as thermoxidation, hydrolysis, polymerization, isomerization or cyclization take place at high temperatures of the frying process, thus leading to the decomposition of frying oil and formation of monomeric, polymeric, primary and secondary oxidative compounds, thereby affecting the quality of oil and fried product [3].
These reactions in deep-fat frying process depend on factors such as replacement with fresh oil, frying conditions, original quality of frying oil, food materials, type of fryer, type and concentration of antioxidants and oxygen concentration [4]. Other factors such as frying temperature, quantity of frying, initial content of free fatty acids, polyvalent metals, type of food material, design and maintenance of fryer, light, use of filters and unsaturated fatty acid content of the oil also affect the oxidative stability and overall quality of oil during the frying process [5, 8]. Various method to improve oxidative stability of soybean oil has been developed and studied, for example, partial hydrogenation, fatty acid modification and blending with more saturated or monosaturated oils to reduce the amount of polyunsaturated fatty acids [9, 11]. Partial hydrogenation decreases polyunsaturated fatty acid but increases saturated fatty acid and trans-fatty acid to produce more stable frying oil. However, trans fatty acid may have adverse effects on cardiac health [12]. Blending has long been used to modify oils and fats to improve the fat functionalities and thus optimize their application in food products. It modifies the physicochemical properties of oils without changing their chemical composition [13]. The oils can be blended even to derive the protective advantage due to the presence of specific ingredients that offer protection against oxidation to improve frying recyclability [14]. Sunflower oil (SFO) and soybean oil (SBO) have a good nutritional profile, with poor oxidative stability and is, accordingly, prone to flavor deterioration because of their high proportion of unsaturated fatty acids, especially, linolenic acid in SBO [15]. Oxidation of unsaturated fatty acids is one of the major causes in the development of off-flavor compounds and in the reduction of nutritional value of food products [16].
Tiger nut (*Cyperus esculentus* L.) is an underutilized crop which belongs to the division-Magnoliophyta, class-Liliopsida, order-Cyperales and family-Cyperaceae and was found to be a cosmopolitan perennial crop of the same genus as the papyrus plant. Tiger nut is not really a nut but a small tuber, first discovered some 4000 years ago in ancient Egypt and is cultivated today in China, Spain and West Africa for its small tuberous rhizomes which are eaten raw or roasted, used as hog feed or pressed for its juice to make a beverage. Non-drying oil (usually called chufa) is equally obtained from the rhizome [17]. The tubers contain 20-36% oil. C. esculentus has been suggested as potential oil crop for the production of biodiesel [18]. The nut was found to be rich in myristic acid, oleic acid, linoleic acid [18, 19]. Although quality of pure vegetable oils before and after frying has been evaluated by many researchers but the physicochemical properties for binary oil blends have not been studied extensively. Actually, stability of unsaturated vegetable oils can be increased by blending with stable oil that has high saturation [20]. Therefore, the main objective of the present study was to evaluate the effects of fatty acid compositions of sunflower oil and binary mixtures of them on the changes in physicochemical parameters of during deep frying process by assessing Free Fatty Acid (FFA), Peroxide Value (PV), thiobarbituric acid value (TBA value), iodine value, Total Polar Compounds (TPC), color and viscosity of the oils.

Materials and Methods
Study design
All oils were available locally and have been purchased in bulk

from the Oil Millers Association of Tirupathi, Andhra Pradesh, India. Groundnut oil, Olive oil, Palm oil have been used as control and also were used as experimental oils. These were blended in the ratios of 50:50 in the laboratory using a blender cum mixer and 12 blends were prepared and stored in PET bottles.

Deep fat frying of the RTE extruded snack was conducted in each oil blend while maintaining frying temperatures at 180°C±5ºC. Identical frying experiments were also conducted with control oils. The RTE extruded snack was stored at room temperature in polythene bags in the same way as they are stored under normal marketing conditions. These were stored for 60 days and were opened periodically (0, 30, and 60 days) for sensory evaluation followed by chemical analysis to conduct a comparison of oil quality, and taste of the product prepared in different blends of oil.

Sensory evaluation

The samples stored in polythene bags were evaluated by panel members for their perceivable sensory attributes, like colour, flavour, texture, taste, and finally the overall acceptability initially at 0 day, after 30 days, and after 60 days using 5 point hedonic scale. A schedule was developed for sensory evaluation i.e. for assessment of colour, flavour, texture, taste and overall acceptability of the product. In order to eliminate bias, the products were undisclosed as to the fact to the type of oil that was used, and were assigned codes as blend 1, blend 2 and so on till blend 12. The intent of the study was to determine how well the oil blends performed nutritionally, in sensory evaluation and oil stability and usage though a controlled 60 day storage.

Chemical analysis

The RTE extruded snack was stored for a period of 60 days and the oil was extracted from the product using soxhlet apparatus at 0, 30, 60 days. The extracted oil samples were analysed for various rancidity parameters such as acid value, peroxide value, free fatty acids (% oleic acid), para anisidine value, totox value, thio-barbituric acid value and kreis test by standardized methods. The data was tabulated and subjected to analysis of variance, tests of significance, means and standard deviation. The package used for the analysis was SPSS 15.0, Windows version.

3. Results and Discussion

In India, oils and fats are extensively used for the preparation of deep fat fried products. Substantial part of dietary fat is derived from such products. Assessment of quality of frying oil used for considerable period is necessity to provide a limit for judging its suitability from stand point of health and nutrition.

The present investigation on "Deep fat frying factors of selected oils and oil blends'' is carried out to find out different techniques to reduce fat absorption during deep fat frying. The results of the analysis are

Fatty acid Composition

Oils and fats form an integral part of the dietaries all over the world. Chemically they are complex mixtures of esters of fatty acids and glycerol. Fat in the liquid state is known as oil. There are various types of fatty acids present, which may be saturated and unsaturated in nature. Hence, the composition of the different fats/oils depend upon the types of fatty acids present namely stearic, oleic, palmitic, recinolic etc. Fatty acid composition of some edible fats and oils are tabulated in table 1.

Table 1: Fatty acid composition of different oils

Oils/ fats	Un saturated / saturated ratio	Saturate					Mono unsaturated	Poly unsaturated	
		Capric acid	Lauric acid	Myristic acid	Palmitic acid	Steric acid	Oleic acid	Linoleic acid	Alpha linoleic acid
Olive oil	4.5	-	-	-	12	8	22	54	5
Groundnut oil	6.6	-	-	-	7	6	14	68	3
Ricebran oil	5.8	-	-	-	5	7	18	58	6

Quality characteristics of individual oils

The quality characteristics of individual oil selected in the experiment is discussed under the following two sub-heads to study physic-chemical characteristics of the oils.

Physical characteristics

In this section, the most important parameters of colour and spreadability of individual oils are

a) Colour

Colour observed in each selected oil is presented in the below table

Table 2: Colour observed in each selected oil samples

S. No	Name of the oil	Colour
1	Groundnut oil	yellow colour
2	Palm oil	Pale Yellow
4	Olive oil	yellow colour

The Groundnut oil is of light amber in colour when it is crude on refining the oils the colour changes to pale yellow in colour. Palm oil changes to dark yellow to yellow in colour it is taken from the brown rice or rice bran. Palm oil is red in colour or orange red in colour when it is crude because of the carotenoids present when it is refined it undergoes golden yellow in colour. Olive oil is dark brown colour when it is refined it is changed to clear light yellow in colour.

b) Spreadability

The main purpose of testing spread ability of oil is mainly to predict the different oil. The spread ability test is carried out using line spread chart. Spread ability of individual oil Groundnut oil is very high (12cm), Palm oil is (13 cm), Olive oil (8 cm) has very low spread ability.

Table 3: Spreadability of different oils

S. No	Name of the oil	Spreadability
1	Groundnut oil	12
2	Palm oil	13
4	Olive oil	8

Chemical parameters

The important chemical parameters to assess the quality and shelf life stability of any oil are free fatty acid value, Peroxide value, Iodine number and saponification number. Hence in the present study these quality parameters are tested at the laboratory using standard procedures and presented in the table for convenience, each parameter is depicted graphically and discussed separately in the section.

Table 4: Chemical quality analytical tests of different oils

S. No	Individual oils	FFA value (Mg KOH/g oil)	Peroxide value (Meq)	Iodine number (Mg12/g oil)	SPN number (Mg KOH/g oil)
1	Olive oil	0.4	0.26	0.8	0.6
2	Groundnut oil	0.5	0.3	0.5	0.15
3	Palm bran oil	0.3	0.3	0.5	0.18

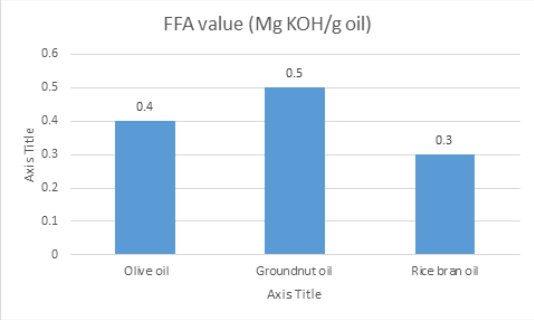

Fig 1: Free fatty acid values for individual oils

The free fatty acid values of different individual oils are plotted in figure1. Free fatty acid values helps to estimate the quantity of palmitic, leuric and oleic acid content in different oils. Palm oil contains 0.3 mg of free fatty acids when compared with Olive oil (0.4mg), Groundnut oil (0.5mg).The values of the remaining oils are same.

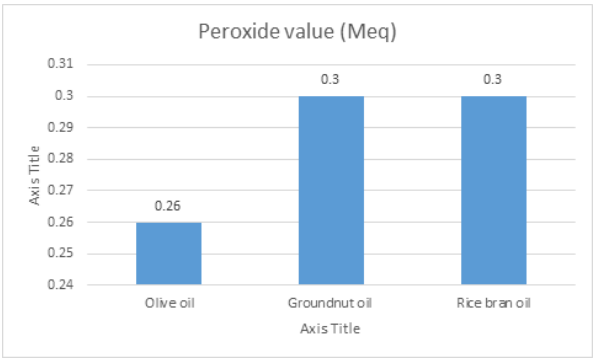

Fig 2: Peroxide values for individual oils

Detection of peroxide value gives the initial evidence of rancidity in unsaturated fats and oils. Other methods are available, but peroxide value is most widely used. It gives measure of the extent that which oil sample has undergone primary oxidation, extent of secondary oxidation and further rancid values. The peroxide values for olive oil is (0.26meq), Groundnut oil and Palm oil contain same amounts (0.3meq) of peroxide value.

The sensory parameters such as colour, flavor, texture, taste and overall acceptability of any food product depends on the extent of oxidation of fats and oils in the food due to the formation of peroxides, aldehydes and ketones (Gupta, 2005).

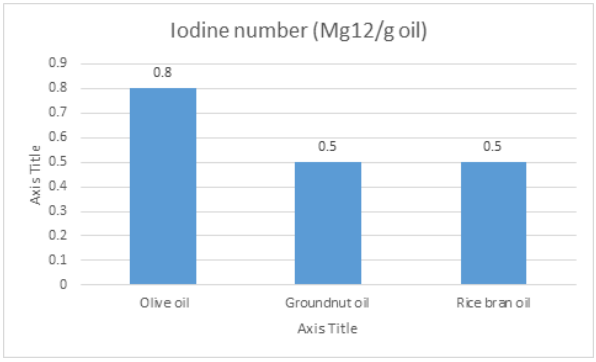

Fig 3: Iodine number for individual oils

Iodine number in chemistry is the mass of iodine in grams that is consumed by 10 grams of a chemical substance. Iodine numbers are often used to determine the amount of unsaturation in fatty acids. This unsaturation is in the form of double bonds, which react with iodine compounds. Higher the iodine number, more C=C bonds are present in the fat. On the other hand Palm oil and Groundnut oil s are highly unsaturated which makes it a drying oil, well suited for making an oil plant. Iodine number for palm oil contains amount (0.5 mg) of iodine number and next to Olive oil (0.8mg) when compared with Groundnut oil (0.5 mg).

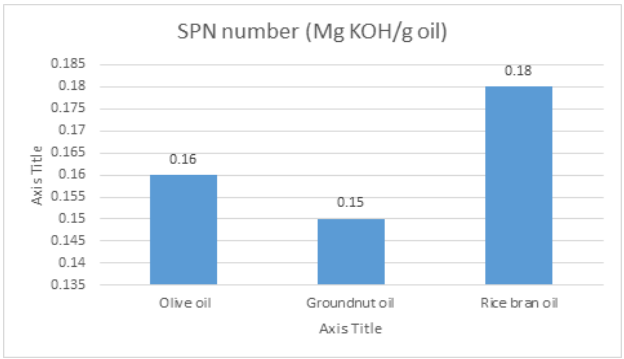

Fig 4: Saponification number for individual oils

It is a measure of the average molecular weight of all the fatty acids present. As most of the mass of a fat/tri ester is in the 3 fatty acids, it allows for comparison of the average fatty acid chain length. Long chain fatty acids found in the fats have a low saponification values because they have a relatively fewer number of carboxylic functional groups per unit mass of the fat as compared to short chain fatty acids. Figure 4 denotes that maximum of saponification number is observed in Groundnut oil, palm oil and olive oil (0.15 mg, 0.18 mg and 0.16 mg) respectively.

Quality characteristics of blended oils

i) Physical characteristics

a) Colour

Table 5: The colour of the blended oils is different from the individual oils. It shows slight variance.

S. No	Name of the blended oil	Colour
1	GN+PO	yellow colour
2	GN+OO	Pale Yellow colour
3	PO+OO	yellow colour

In the blended oils, when the Olive oil blended with Groundnut oil it shows pale yellow colour, Olive oil with Palm oil shows yellow colour, Olive oil with palm oil gives golden yellow colour. Groundnut oil with Palm oil gives light yellow colour, Groundnut oil with palm oil gives golden yellow colour and the palm oil combines with the Palm oil shows yellow colour. These are the different variations of colour in the blended oils.

b) Spreadability

Table 6: The spreadability of the blended oils are Spreadability of blended oils

S. No	Name of the blended oil	Spreadability
1	GN+PO	13
2	GN+OO	8
3	PO+OO	9

The main purpose of testing spreadability of oils is mainly to know the viscosity of different oils. Spreadability is the test which is also used mainly for the baking and gel formation of oils in commercial purpose. It is mainly used for the post-baking spreading in industries. Spreadability is tested by using the line spread test. The spreadability of the blended oil combination of soy bean oil and the sunflower is very high (12 cm). Spreadability of the combination of soy bean oil and Palm oil contains (9 cm). Spreadability of the combination of Groundnut oil with Palm oil (8cm) and the Groundnut oil with palm oil (7 cm). The blended oils with Olive oil and palm oil are very low (5 cm). Because of thickness the spreadability time is more for these oils. So, the spreadability is very poor in the oil of palm mixed with other individual oils.

Miller *et al.*, (2000) studied on viscosity and heat transfer coefficients for canola, corn, palm and Olive oil and concluded that the frying time and oil temperature significantly affected viscosity and also showed greatest increase in corn oil viscosity over 36 hr.

ii) Chemical characteristics

The chemical parameters of the blended oils are very important to assess their shelf life, quality of the combination of oils.

Table 7

S. No	Mixed oils	FFA value (Mg KOH/g oil	Peroxide value (Meq)	Iodine number (Mg 12/ g oil)	SPN value (Mg KOH/ g oil)
1	GN+PO	0.6	0.5	0.5	0.15
2	GN+OO	0.6	0.3	0.6	0.28
3	PO+OO	0.6	0.2	0.4	0.3

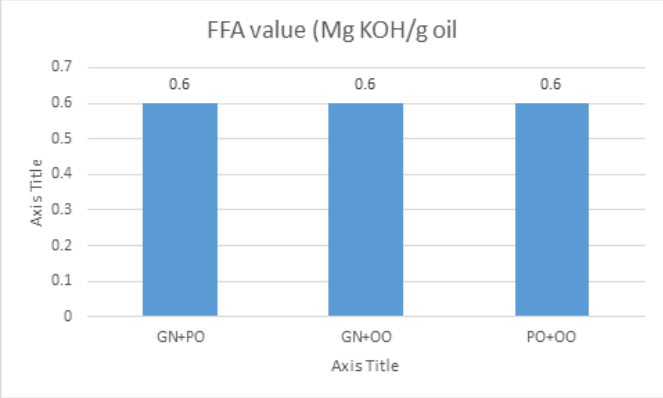

Fig 5

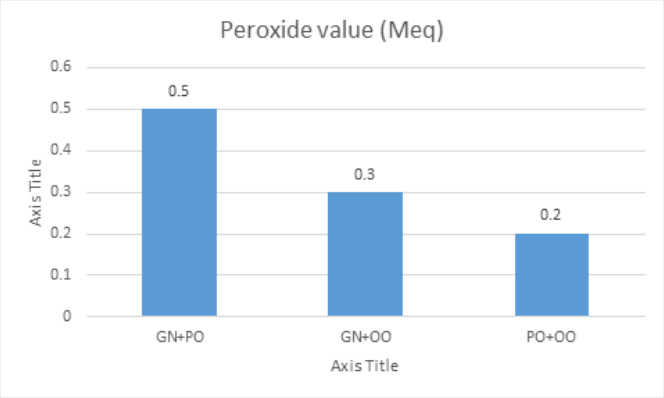

Fig 6: Peroxide vale for different combinations of oils

According to the figure the free fatty acid values are very high (0.3 mg) in combination of palm oil mixed with Groundnut oil (0.6 mg), Olive oil mixed with Palm oil (0.6 mg), Groundnut oil mixed with Oliveoil (0.6 mg). It reflects the freshness and the deterioration of the materials and also the quantity of glycerol to be released as a result of neutralization of oils. High acidity oils or fats produce excess smoke during heating.

If the fat frying oil is over used in frying process, the triglycerides may produce thermal oxidative materials. The differences in stability of various oils are due to the other natural antioxidants quoted bt Stephen *et al.*, (1978).

According to the graph the saturated fat palm oil shows high rancidity. When palm oil mixed with Olive oil, Groundnut oil and Palm oil these combinations show high points peak points of (0.5 meq) in peroxide estimation. It is less in combinations of Palm oil mixes with Olive oil and Groundnut oil which is only 0.2meqand 0.3meq in the blending sample.

From the above quoted data, it can be discussed that palm oil as it exhibits high oleic acid performs much greater stability against oxidative deterioration than the normal seed oil supported by Sharon *et al.*, (1969). Due to this lesser increase in the free fatty acid and peroxide value is observed in palm oil.

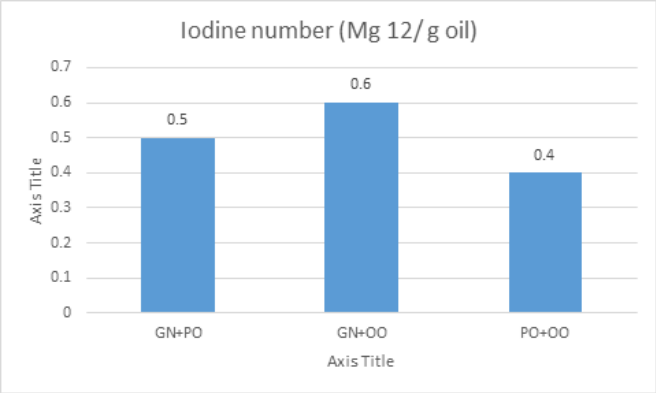

Fig 7: Iodine number for combination of oils

Palm oil and Groundnut oil s are good cooking oils because of the drying. According to the graph, when Olive oil mixes with Groundnut oil and Olive oil mixes with palm oil it contains (0.6 mg & 0.4 mg) high iodine number. When palm oil mixed with Groundnut oil (0.5 mg) iodine number. These combinations are good for cooking.

Saponification number for combination of different oils

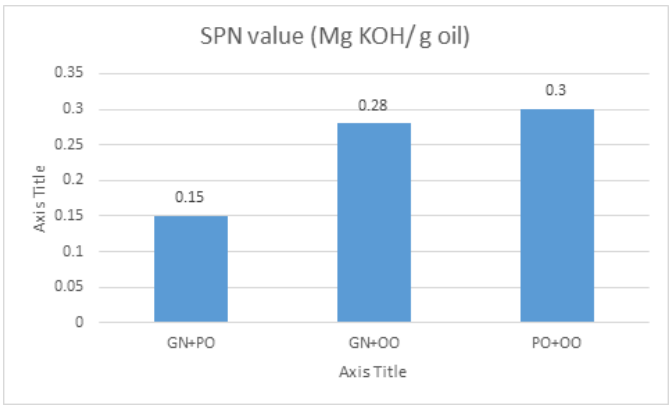

Fig 8

According to the plotted graph Olive oil when mixed with Palm oil and Groundnut oil mixes with palm oil shows high saponification number of 20 mg & 18 mg respectively. At the same time Groundnut oil mixes with Palm oil shows medium range (0.15 mg) of saponification. Only Groundnut oil combination shows low 0.28& 0.3 respectively or no saponification number.

Cooking quality characteristics of individual oils

i) Smoking temperatures for individual oils

Smoking point for different individual oils records different ranges of temperature. The smoking point for Palm oil and Groundnut oil s are very high i.e., 185 and 180^{o}C respectively. The temperature for palm oil is 135^{o}C very low when compared to other individual oils. The temperature for Olive oil is 150^{o}C.

ii) Frying time for individual oils

The frying time for individual oils also varies. The time was taken in seconds. Among all the individual oils the product prepared with palm oil and Palm oil takes more time to deep fry the product poori 48 and 43 seconds respectively. Olive oil takes a moderate temperature of 40 seconds to deep fry the poori. Groundnut oil takes a lowest temperature of about 30 sec to cook the poori among all the individual oils.

iii) Sensory evaluation of individual oils

Sensory evaluation assesses the acceptability of the selected individual oils. For sensory evaluation poori was prepared with different individual oils. In sensory evaluation the quality parameters of appearance, colour, texture and taste was recorded.

a) Appearance of the product with individual oils

Appearance influences the acceptability of the product. If the appearance was good the acceptability rate also in good proportions. The below graph indicates the comparison of the sample prepared with the individual oils and the appearance of the product with different individual oils.

Comparison between individual oils with appearance

According to the figure the mean sensory score reveals that the appearance of the product prepared with Palm oil appears good (6.30 %). The appearance of the product of remaining oils, Groundnut oil shows (5.45%), Olive oil (5.86%) respectively shows average range of appearance. There is no significant variation observed between the individual oils and appearance.

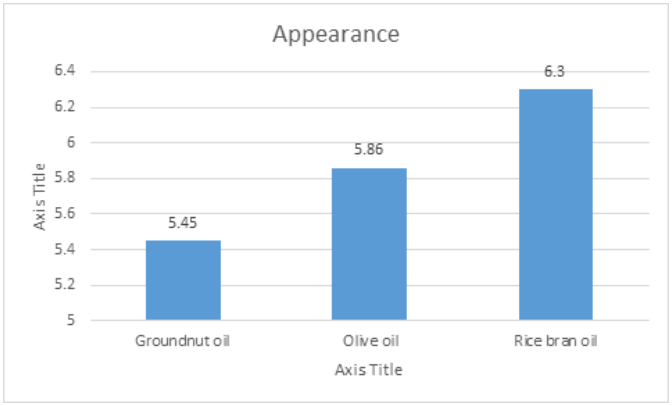

Fig 9

b) Colour of the product with individual oils

Comparison of different individual oils with colour

According to the figure there is no significant variance between the different individual oils and their colour during preparation. All the oils show similar variance (5.46, 5.30, 5.25%) between the products prepared with different oils. the product prepared with the Groundnut oil show less variance.

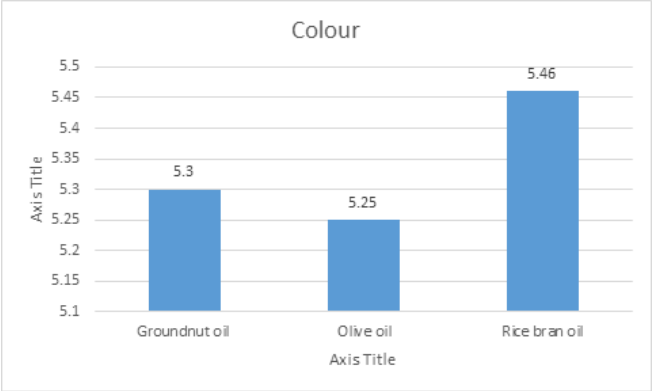

Fig 10

c) Flavor of the product with individual oils

The storage time of the oils and the type of the oil shows a variation in the flavor of the product.

Comparison of different individual oils with flavor

The product prepared with Olive oil shows a great variance in flavor i.e., 5.73%. The product prepared with palm oil shows a different range of acceptability because of the flavor range respectively. Palm oil and Groundnut oil products gave a medium range of flavor 5.92 and 5.85.

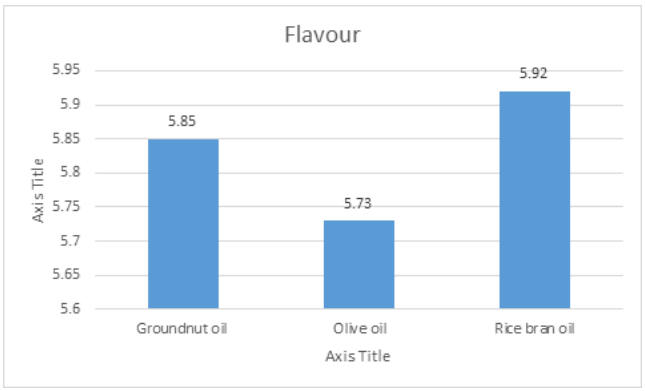

Fig 11

d) Texture of the product with individual oils

Comparison of different individual oils with texture

According to the data available from the sensory panel the mean score texture shows that the product prepared with Groundnut oil 6.35%, Olive oil 6.28% and Palm oil 6.16% are almost same.

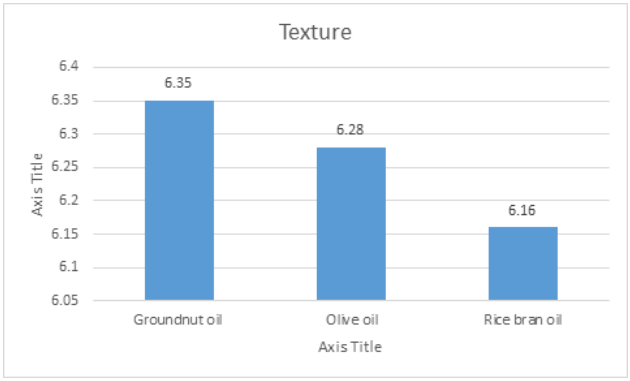

Fig 12

e) Taste of the product with individual oils

Comparison of different individual oils with taste

According to the data, the product prepared with Olive oil, Palm oil and groundnut oil shows a fair taste range 6.06%, 5.43% and 5.142% respectively.

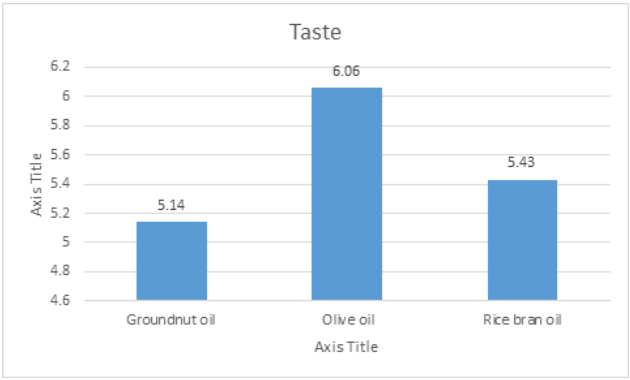

Fig 13

f) Overall acceptability of the product with the individual oils

Comparison of different individual oils and overall acceptability

According to the data, among all the individual oils the preparation of the products with palm oil 5.43% and Olive oil 6.95% shows a range of acceptability to the consumers. The product prepared with Groundnut oil 5.25 gives a preference range of acceptability. Among all the oils compared Olive oil gives fair result in all the assessments. The flavor, texture, appearance, taste and overall acceptability of the products prepared with Olive oil and palm oil gives good range of result.

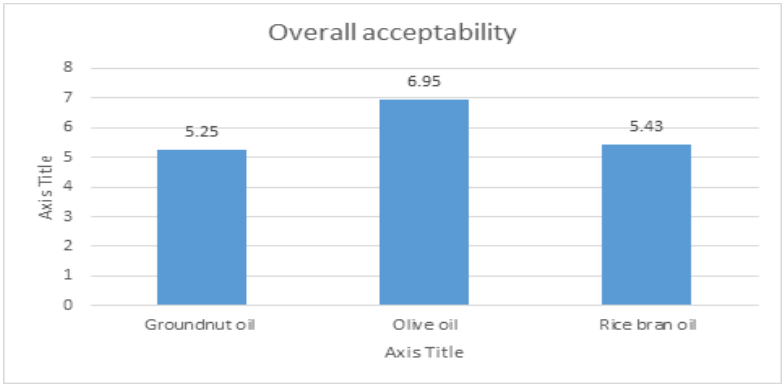

Fig 14

Table 8: Summary of One-way ANOVA on sensory evaluation of four products

	Product	N	Mean	Std. Deviation	F-value	P-value
Appearance	Groundnut oil	50	5.45	1.364	1.023	0.154
	Olive oil	50	5.86	1.338		
	Rice bran oil	50	6.30	1.358		
	Total	150	5.83	1.363		
Colour	Groundnut oil	50	5.30	1.426	1.153	0.215
	Olive oil	50	5.25	1.365		
	Rice bran oil	50	5.46	1.365		
	Total	150	5.35	1.285		
Flavor	Groundnut oil	50	5.85	1.364	1.256	0.326
	Olive oil	50	5.73	1.545		
	Rice bran oil	50	5.92	1.442		
	Total	150	5.75	1.345		
Texture	Groundnut oil	50	6.35	1.432	2.638	0.434
	Olive oil	50	6.28	1.635		
	Rice bran oil	50	6.16	1.467		
	Total	150	6.22	1.363		
Taste	Groundnut oil	50	5.14	1.643	2.264	0.534
	Olive oil	50	6.06	1.468		
	Rice bran oil	50	5.43	1.536		
	Total	150	5.22	1.352		
Overall acceptability	Groundnut oil	50	5.25	1.289	2.628	0.326
	Olive oil	50	6.95	1.435		
	Rice bran oil	50	5.43	1.386		
	Total	150	5.15	1.383		

The cooking quality of any oil is evaluated by preparing suitable oil based product and testing organoleptic ally. The five essential sensory parameters appearance, colour, flavor, texture, taste and overall acceptability are assessed by the select panel member and the results are presented in the table. The level of significant difference for each parameter is tested by one-way ANNOVA and the corresponding interpreted values are denoted in the same table. The significant difference was recorded in the appearance and taste of the product.

Cooking quality characteristics of blended oils

i) Temperature

The temperature was recorded in seconds. The two combinations of Olive oil shows high temperature they are Olive oil with palm oil and Olive oil with Groundnut oil they records high temperature of 172ºC. The combination of palm oil mixed with Groundnut oil, Olive oil with Palm oil and Groundnut oil with Palm oil shows the temperatures of 158, 145 and 142ºC respectively. The smoking point for the palm oil mixes with Palm oil is very low.

ii) Cooking time

The products prepared with the combinations of Olive oil with Groundnut oil and palm oil is very low. The cooking time is 28 and 38 seconds respectively. This oil is a fastest cooking oil combination. The moderate cooking temperature is 40 and 43 sec with the combinations of palm oil mixes with Groundnut oil, Groundnut oil combines with Palm oil and Olive oil with Palm oil respectively. The cooking time is highest for the combinations of palm oil with rice bran oil. It takes 57 seconds of time to cook the poori. It is slow cooking oil.

iii) Sensory evaluation

Comparison of blended oil products with appearance

According to the rating given by the consumers the figure was plotted. The product prepared with palm oil mixed with Groundnut oil shows good appearance (6.66%), Olive oil mixes with Palm oil (7.44%), Groundnut oil mixes with Olive oil (6.35%). It contains low range palm oil mixed with Olive oil (6.10%) and palm oil mixed with Palm oil (5.98%) shows consumer acceptability rate. It shows a 5% significant difference.

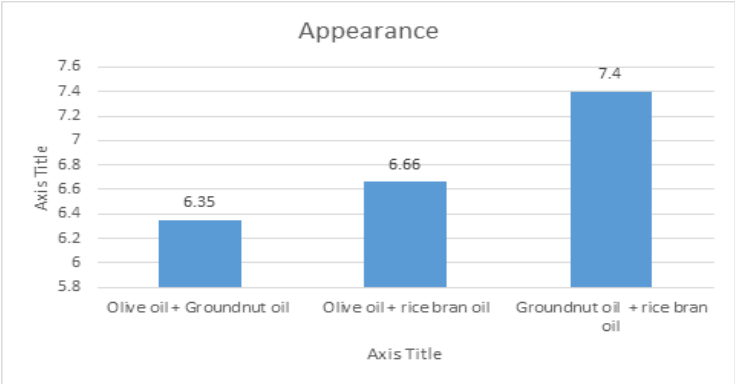

Fig 15: Comparison of blended oil products with colour

Colour is the main aspect that directly impacts the acceptability of any food. According to the figure Palm oil combined with Olive oil (6.45%), Groundnut oil mixed with Palm oil (6.36%), Groundnut oil mixes with Olive oil (5.92%). It shows a significant variance of one percent. Other mixed oils show moderate colour acceptance.

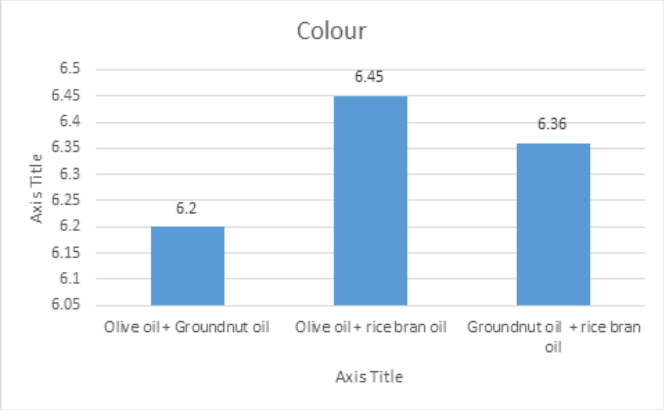

Fig 16: Comparison of blended oil products with flavor

Flavor increases the acceptability of food. The figure shows that the flavor of the product prepared with the combinations of Olive oil gives high acceptability. The product prepared with Groundnut oil gives moderate flavor acceptability. The product prepared with palm oil mixed with Olive oil (6.63%), Olive oil mixed with Groundnut oil (6.75%), Groundnut oil mixed with Palm oil (6.32%) are similar flavor.

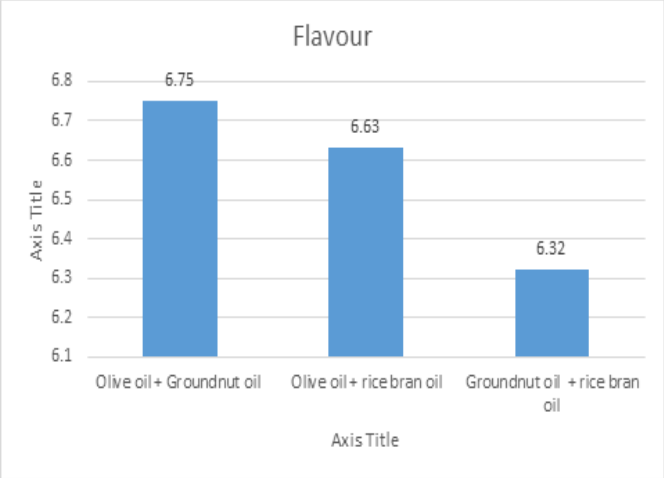

Fig 17: Comparison of blended oil products with texture

Soft, hard and crisp texture of the product shows a great impact on consumption rate of the product. Texture doesn't give any significant variance with the blended oils. All the combinations Olive oil mixed with Groundnut oil (7.25%), Olive oil mixed with palm oil (7.28%), palm oil mixed with Groundnut oil (7.36%) shows almost similar texture of the product.

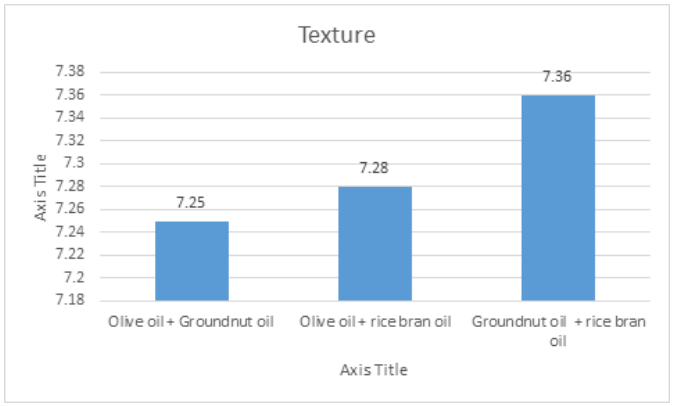

Fig 18: Comparison of blended oil products with taste

According to the figure Olive oil mixed with Palm oil gives (6.25%) acceptability in taste. Palm oil mixes with Groundnut oil mixes (6.28%) gives moderate rate. Remaining combinations Olive oil mixed with Groundnut oil (6.34%), gives relatively high score and found to be within acceptable limits of the preference.

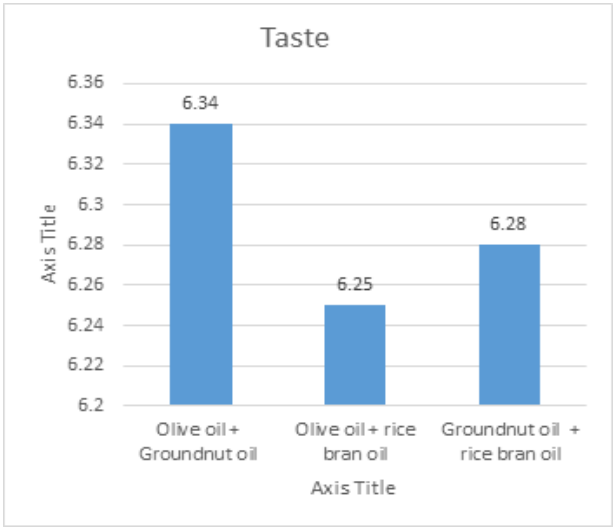

Fig 19: Comparison of blended oil products with overall acceptability

Overall acceptability shows which combination of oil is acceptable for consumption. Among all the blended oils that are available Olive oil when mixed with Groundnut oil (6.74 ranges), palm oil with Groundnut oil (6.55 ranges) give higher percentages of acceptability. Olive oil with rice bran oil, Groundnut oil with Palm oil and palm oil with Olive oil, palm oil with Palm oil shows second level (6.68, 6.26, range) of acceptability. When compared with all the combinations of oils only the palm oil combined with soybean and rice bran oils gives within consumer acceptable range of the blended oil product.

The acceptability of the product attains maximum score if it attains good colour, flavor, texture and overall taste etc. A study carried out by Bhatt and Indira Kutty; (1982).

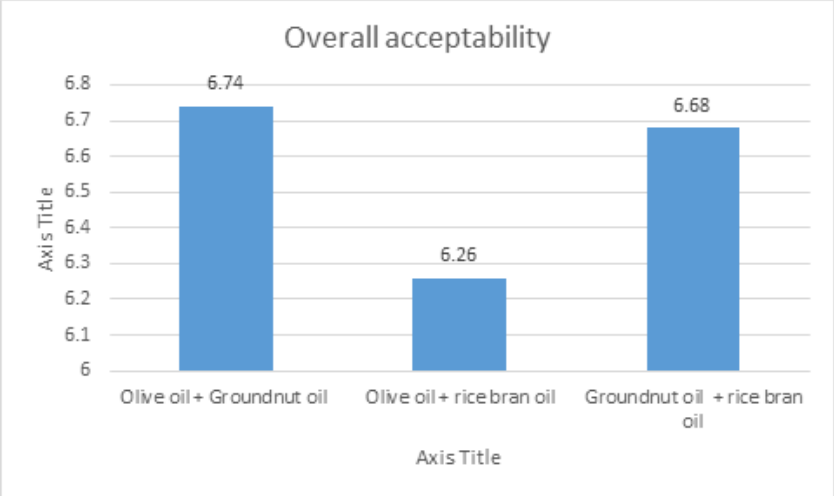

Fig 20

Table 9: Summary of One-way ANOVA on sensory evaluation of three products

	Product	N	Mean	Std. Deviation	F-value	P-value
Appearance	Olive oil + Groundnut oil	50	6.35	1.269	1.267	0.447
	Olive oil + Palm oil	50	6.66	1.585		
	Groundnut oil + Palm oil	50	7.40	1.326		
	Total	150	6.63	1.473		
Colour	Olive oil + Groundnut oil	50	6.20	1.434	2.463	0.216
	Olive oil + Palm oil	50	6.45	1.265		
	Groundnut oil + Palm oil	50	6.36	1.422		
	Total	150	6.45	1.565		
Flavor	Olive oil + Groundnut oil	50	6.75	1.374	2.268	0.426
	Olive oil + Palm oil	50	6.63	1.285		
	Groundnut oil + Palm oil	50	6.32	1.322		
	Total	150	6.55	1.285		
Texture	Olive oil + Groundnut oil	50	7.25	1.326	3.3364	0.365
	Olive oil + Palm oil	50	7.28	1.565		
	Groundnut oil + Palm oil	50	7.36	1.465		
	Total	150	7.22	1.485		
Taste	Olive oil + Groundnut oil	50	6.34	1.364	1.454	0.558
	Olive oil + Palm oil	50	6.25	1.438		
	Groundnut oil + Palm oil	50	6.28	1.558		
	Total	150	6.18	1.443		
Overall acceptability	Olive oil + Groundnut oil	50	6.74	1.363	1.216	0.253
	Olive oil + Palm oil	50	6.26	1.645		
	Groundnut oil + Palm oil	50	6.68	1.341		
	Total	150	6.74	1.345		

According to the data available from the table, when blended oils are compared with each other in their appearance, texture, taste, colour, flavor and overall acceptability there is a 5 percent significant difference between appearance and one percent significant difference (P<1%) in colour are observed. Texture, taste, flavor and overall acceptability didn't show any significant difference.

The cooking quality characteristics of all blended oils clearly demonstrated well acceptance score of all the five sensory characteristics and thus including good overall acceptability. The present experimental research is much interesting and helpful to promote blending of different oils for the better wellbeing instead of adhering to the common usage of any single oil individually. Texture and flavor shows the significant difference of five percent (p>5%). The combination of Groundnut oil, Olive oil and the Palm oil gives good texture and appearance because of their dry nature.

Summary and Conclusion

In India, deep-fat-fried products from the major root through which oils and fats are consumed. Various vegetable oils are used for deep fat frying of food products. During deep fat frying, the oil is continuously or repeatedly used at elevated temperatures in the presence of oxygen which might cause hazard to human health. Frying is a system that combines in the presence of oxygen which might cause hazard to human health. Frying is a system that combines food, oil, processing equipment and processing conditions together. Hydrogenation of vegetable oils imparts desired stability, freedom from greasiness and a satisfactory palate sensation. Factors that influence the proportion of breakdown components in vegetable oils are temperature, presence and extent of oxygen, eating time, frying capacity, turnover, method of heat transfer, metals in contact with oils etc.

The present study "deep fat frying factors of selected oils and oil blends'' is carried out to find out the "quality parameters of blended oils''. In the deep fat fried products by taking into consideration the factors like temperature and acceptability studies etc. The oils selected for this present study are Groundnut oil (GN), Olive oil (OO), Palm oil (PO) and the selected blends are GN+OO, GN+PO, PO+OO, to observe their effect on acceptability in the selected product "poori". The effect of temperature on the acceptability of oil by the product is observed. The acceptability studies of the product fried in selected oils and oil blends and the variations in poori has been conducted.

The proportions selected for the blended oils are 50:50 percent because of their higher acceptability. This was because of the toxics present in the some oils like ground nut oil and Olive oil etc.

From the above results, it can be discussed that the poori fried in Olive oil gained maximum acceptability of oil in almost all the variations. Acceptability scores attained "maximum" by the product fried in the soybean medium as well as prepared with other variations. But other oils did not reach the score equivalent to Olive oil. The "excellent'' scores are attained to product fried in soybean and olive oil + Groundnut oil s blend. Among the high linoleic acid oils, Olive oil is considered best and among the blends, soybean Groundnut oil is found to give beneficial results next to palm oil with minimum increases in the peroxide values free fatty acid, iodine and saponification values. It is statically proved that the effect of type of the oil with appearance of the product is highly significant at 1 percent level. The colour of the product also found to be highly significant at five percent level.

The above data can be collected that on the whole, Olive oil and among blends soybean sunflower is found to exhibit positive results. Thus it can be suggested that Olive oil should be used as a good frying media oil by the product from the health point of view and the blending of oils should be done attain better results as revealed from this study. These practices can be applied in the households levels easily but commercially also, it should be checked that such practices are followed well by fast food outlets, hotels, industries etc. for better and beneficial results. Thus products as such prepared attain good flavor, aroma and crisp appearance which will have immense popularity among all classes of people.

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