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Study on oxidative stability of deep fat fried food in Canola oil blended with medium chain triglyceride.

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In the present study potatoslices are deep fried in Canola oil blended with medium chain triglycerides. The oxidative stability of deep-fried Potato slices is evaluated during their storage in dark. The potato slices were deep fried for 5 min in hot oil blend of Canola Oil and MCT at the ratio of 90:10, 70:30, 50:50 and 40:60. The fried potato Slices were stored in a glass container at room temperature in a dark place. The deep-fried potato slices were stored for 20 days in dark. The oxidative stability was evaluated by estimation of peroxide value and formation of free fatty acid. The study revealed that the peroxide value was less for following two blends i.e., 50:50 and 40:60 of Canola oil and MCT and the peroxide value showed increased value for 90:10 and 70:30 blend of Canola oil: MCT. The left-over oil after frying was also evaluated for its quality by checking percentage of free fatty acids formed in it. The quality of oil containing less MCT degraded quickly as compared to blend containing high MCT.

Keywords: Canola Oil, Deep fat frying, Free fatty acid, Medium Chain triglycerides, Peroxide Value, Potato slices

Deep fat fried foods are consumed across the globe by all age group population due to its excellent sensory attributes. But at the same time these deep fat fried food contain high amount of absorbed fat and fat is usually associated with various cardiovascular diseases , increase in body weight[1,2]. Medium chain Triglycerides are edible oil having various health benefits[3-5]. Due to their shorter chain length they are metabolized in different way in body and these medium chain triglycerides are not stored in body as fat, rather they are immediately utilized as a energy source[6]. Medium chain triglyceride contains medium chain fatty acid namely Capric acid, Caproic acid, Caprylic acid, Lauric acid shown in Fig. 1. The natural source of medium chain triglyceride is coconut oil containing high percentage of lauric acid in it[7,8]. Medium chain triglycerides have high satiety value as compared to coconut oil. They are more beneficial than coconut oil[9]. When food is subjected to frying in deep fat at high temperature it causes heat damage to frying oil at high temperature due to thermal effect. Frying in presence of oxygen causes oxidative damage to fried foods and frying in presence of moisture results in hydrolytic deterioration of oil or fat. Oil or fat are triglycerides containing three fatty acids esterified to glycerol backbone by ester linkage. During frying water is released from food, which hydrolyses ester linkages and results in formation of free fatty acids, mono/Diglycerides[10]. Medium chain triglycerides contains saturated fatty acids, hence they do not develop rancidity and have better shelf-life and high keeping qualities[11]. Liberty *et al.*[12] reported reduction in oil absorption during frying by altering surface of product by use of hydrocolloids and also by alteration of frying medium and frying techniques. Many research is carried out and going to deliver a safe food to consumer having less risk of health diseases. Canola oil and MCT is a perfect blend as a frying medium since canola oil contains unsaturated fatty acid and MCT contains saturated fatty acids. In Industry and Restaurants Canola oil is used as a cooking medium or a medium for deep fat frying of foods[13]. The deep fat frying involves both heat transfer and mass transfer operation. When food is fried there is transfer of heat from hot oil to food. Due to transfer of heat from hot oil to food there is removal of moisture from food and this place is occupied by oil. Due to uniform heat treatment to food surfaces, there is development of good texture of fried food[14]. Zhang *et al.*[15] has reported various pre-processing and post processing technologies to reduce the absorption of oil in food. In the present research medium chain Triglyceride blended with

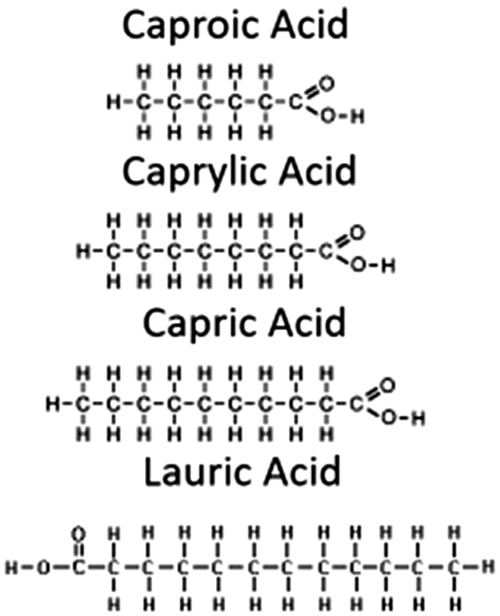

Fig. 1 — Structure of Medium Chain Fatty Acids

canola oil in different proportion and this oil is used for frying of potato slices. The oxidative stability of all the blends are studied for 20 days at room temperature and the leftover oil is checked for formation of free fatty acids in it. The blend containing more volume of medium chain triglyceride showed good results in terms of its peroxide value. Critical study of literature showed that there is no such study reported in the literature.

Experimental Section

Materials

Potato Slices, Canola oil, medium chain Triglyceride oil. The raw material was purchased from Local market except MCT. Medium chain triglycerides were received as a gift sample from AAK Kamani oils pvt.ltd, Mumbai.

Initially the potatoes procured from market were washed and cleaned with the water. The outer skin of potatoes was removed using peeler and the potatoes were sliced in thin slices if about 1 cm using knife. These sliced potatoes were deep fat fried in four different oil blends.

Method of Analysis

Acid Value

Acid value of the fried oil was estimated in order to evaluate free fatty acid formed in the oil after deep fat frying. Acid value was estimated as per standard AOAC Official methods Te 1a-64. 1 g of oil sample was taken in a conical flask to this oil sample 20 mL of neutral alcohol was added. Then it was titrated with 0.01 N KOH using phenolphthalein indicator. The acid value was determined using following formula:

Acid Value= 56 × 0.01 × Constant Burette reading / Weight of oil Sample.

The % free fatty acid are calculated [16] as

% FFA = acid value/ 2

Peroxide value

Peroxide value gives an indication of rancidity in sample of oil. Peroxide value was determined as per the AOCS standard procedure. 5 g of oil sample was taken in a conical flask, it was mixed with 3:2 acetic acid: Chloroform solution along with 0.5 mL saturated potassium iodide. This mixture was kept in dark for 1 min for liberation of iodine. After 1 min this solution was mixed with 30 mL distilled water and this mixture was then titrated with 0.01 N Sodium Thiosulphate with starch indicator. The following formula was used to calculate the peroxide value of the titrated sample of oil.

Peroxide value = (Sample – Blank) × 0.01 × 1000 / Weight of oil Sample.

Sensory Examination

Sensory evaluation was done by the team of 10 experts, for various quality attributes viz colour, mouth feel, texture, eye appealing, and overall acceptability. The sensory was done using hedonic scale technique.

Result and Discussion

Formation of Free fatty acids

When food is fried in oil, due to exposure of oil at high temperature there is thermal damage to oil. The ester bond breaks and the fatty acids are released. The oil from the fried food is extracted using soxhlet method and the extracted oil was checked for formation of free fatty acids in it. The formation of free fatty acids in fried food is illustrated in Table 1 and formation of free fatty acid in left over oil is shown in Table 2. The free fatty acid were checked after 20 days. The FFA is expressed as a % Oleic acid. The blend containing high Medium Chain Triglyceride showed less free fatty acid formation in it. Srivastava *et al.* [17] also reported virgin coconut oil as a good frying medium which can be exploited in commercial use. Since coconut oil is the only oil containing medium chain triglycerides in it.

Table 1 — Free Fatty acid in deep fat fried potato slices

Frying oil blend	% FFA formed
Canola oil : MCT 90:10	6.7
Canola oil : MCT 70:30	5.9
Canola oil : MCT 50:50	3.73
Canola oil : MCT 40:60	2.98

*FFA is expressed as %oleic acid

Table 2 — Free fatty acids in remained fried oil after frying in pan

Frying oil blend	% FFA formed
Canola oil : MCT 90:10	6.3
Canola oil : MCT 70:30	4.5
Canola oil : MCT 50:50	3.2
Canola oil : MCT 40:60	3.5

*FFA is expressed as %oleic acid

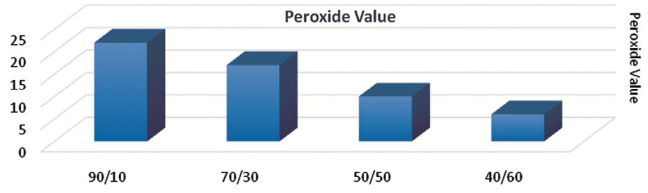

Fig. 2 — Peroxide value of various Oil from fried potato slices

Peroxide value

The peroxide value is calculated in order to check the oxidative stability of oil. The oil was extracted from the potato slices after 20 days using soxhlet extraction method. The oxidative stability of various blend of oil is shown in Fig. 2. From the figure it is observed that the oxidative stability of blend containing high volume of medium chain triglyceride is more. They have less peroxide value. Whereas the frying oil blend containing high volume of canola oil showed high peroxide value indicating that they became rancid due to oxidative damage to oil. This may be due to reason that Blend containing High canola oil contained more unsaturated fatty acid and unsaturated fatty acid can easily undergo oxidation process. Whereas Medium chain Triglyceride contains saturated fatty acids and these saturated fatty acids are less susceptible to oxidative damage. Hence, they showed more oxidative stability. The peroxide value of left-over oil was more in blend containing high volume of canola oil. It is shown in Fig. 3.

Sensory Evaluation

The sensory examination was done in terms of colour, texture, taste, mouth feel. Overall acceptability showed that the potato slices fried using blend of MCT have no effect on the sensory attribute of the food product. The use of medium chain

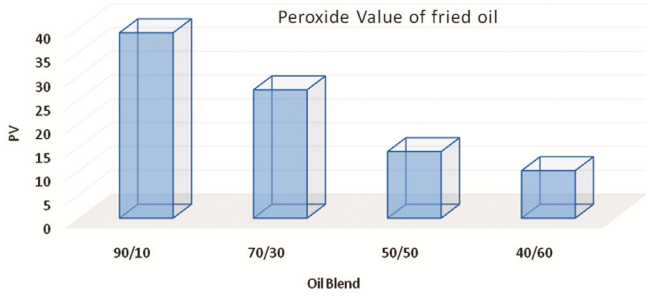

Fig. 3 — Peroxide value of fried oil

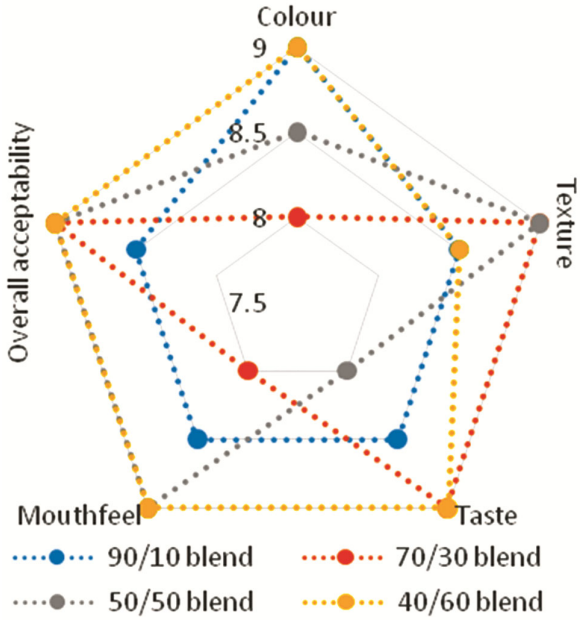

Fig. 4 — Sensory examination of Food fried in various oil blends

triglyceride in deep fat frying did not affect colour, texture and mouth feel of the deep-fried food. The result of sensory examination is shown in Fig. 4

Conclusion

The present study showed that use of medium chain triglyceride has many beneficial effects on the oxidative stability of deep fat fried food product. The food fried using high volumes of medium chain triglyceride were showed very less peroxide value indicating less oxidative damage and more oxidative stable because of presence of saturated fatty acid in it. The food fried with high volume of canola oil showed high peroxide value because of presence of unsaturated fatty acid. These unsaturated fatty acids are prone to oxidation process and hence it showed less oxidative stability, the analysis of left-over fried oil also showed less peroxide value for high MCT Volume blend. The amount of free fatty acids present

was more in high canola oil as compared with high MCT oil. The use of medium chain triglyceride in frying blend has no effect on the taste, texture, mouth feel of the food, whereas the overall acceptability was also good. This study showed that medium chain triglyceride can be a good healthy substitute for the traditional cooking oil.

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Conflict of Interest

The authors confirm that they have no conflicts of interest with respect to the work described in this manuscript.

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