EFFECT OF BLENDING OF CRUDE PALM OIL WITH SUNFLOWER AND GROUNDNUT OIL ON PROXIMATE COMPOSITION, B-CAROTENE AND TOTAL CAROTENOIDS CONTENTS OF SAMOSA AND CUTLET

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Abstract
Crude palm oil (CPO) is an excellent source of β-carotene and mono-unsaturated fatty acid mainly palmitic acid (16:0).CPO can be blended with other cooking oils namely sunflower oil (SFO) and groundnut oil (GNO). The purpose of blending was to improve the fatty acid ratio and β-carotene content of oil blends. These oil blends can be used to control VAD (Vitamin A deficiency). The oils were analyzed for fatty acid composition and β-carotene . Based on their fatty acid composition, four oil blends were prepared viz. CPO: SFO (70:30 and 65:35), CPO: GNO (55:45 and 65:35). These oil blends were used for the preparation of samosa and cutlet which were evaluated organoleptically and analyzed for proximate composition, β-carotene and to tal carotenoid content. Polyunsaturated fatty acid composition of SFO and GNO improved significantly when blended with CPO. The snacks were organoleptically acceptable. No significant differences were observed in the proximate composition of developed snacks, however, a significant improvement in β-carotene and total carotenoid content was found in snacks prepared using blends of palm oil and other cooking oils. Since deficiency of vitamin A is quite prevalent in India; this study will be useful for further research in feeding trial among vitamin A deficit children. CPO is a good source of provitamin A, so there is an urgent need to develop more commercial products from oil blends containing CPO.

Key words: VAD (Vitamin A deficiency) Palm oil, sunflower oil, groundnut oil, oil blends, samosa, cutlet

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1. INTRODUCTION

Among various nutritional problems prevalent in India, deficiency of vitamin A is quite severe and is affecting mainly malnourished children and women. Efforts have been made from time to time to combat vitamin A deficiency (VAD) using various food stuff. Vegetable oils are an essential ingredient in cooking and are the chief source of dietary fat, which is one the essential nutrient required by human beings. A wide variety of edible oils are available in the market viz. groundnut oil, soybean oil, mustard oil, safflower oil, sunflower oil etc. under various brand names. However, these oils are devoid of β-carotene and can contribute a little to alleviate VAD. Crude palm oil, which is an excellent source of β-carotene, can be used for blending with commonly used cooking oils and can help to overcome the deficiency of Vitamin A (Rukimini,1994).

Palm oil is extracted from the mesocarp of the fruit of oil palm (*Elaeis guineensis*) and the oil is derived from the kernel seed of the palm (POKU, 2002). Palm oil has a characteristic dark red color because of a high amount of beta-carotene (Lai *et al*., 2015; Ng and Choo,2016).Palm oil is commonly used as cooking medium in Africa, Southeast Asia and parts of Brazil due to its lower cost (Behrman *et al.*, 2005) and its nutritional and health attributes have been well documented (Chandrasekharan *et al*., 2000). In another study, Yap *et al*., (1991) reported 500 to 700 ppm carotenoids in Malaysian crude palm oil, of which 37% is α- and 50% is β-carotene. Of these, β-carotene has the higher vitamin A activity, expressed in retinol equivalents. Although beta- carotene is the most abundant form of provitamin A in fruits and vegetables (Hathcock, 2004), however, there are various practical difficulties in incorporating these into the diets of young weaning children. Many

different approaches, including supplementation with mega doses of Vitamin A have been attempted to overcome this problem. Various dietary supplements in which β-Carotene is incorporated have been prepared commercially (Schierle *et al*., 2004). But still, VAD is one of the major nutritional problems in India. The production of palm oil is quite good (4-5 tones/ha/yr) in Indian context and it can help to overcome the shortage of edible oil to some extent (Mielke,1984) as well as can help to increase the level of β-carotene content of cooking oils. Palm oil is mainly cultivated in Andhra and in Andaman and Nicobar Islands. However due to contribution of some private and Government agencies its production is now promoted in various parts of India (Indian Council of Agricultural Research, 1988).

Keeping this in view, crude palm oil was used in the present study to blend with other cooking oils namely sunflower oil (SFO) and groundnut oil (GNO) which are commonly used as a cooking medium in various parts of India. An attempt was made to develop fried snack foods viz. samosa and cutlet using CPO and four types of oil blends. The fried products are quite frequently used snacks both at domestic and commercial level. The developed products were evaluated organoleptically and nutritionally. The products prepared in oil blends were compared with those prepared in palm oil alone to evaluate their organoleptic and nutritional profile.

2. MATERIAL AND METHODS

Procurement of oil

Crude palm oil was obtained from National Research Centre for Oil Palm, Kerala, India. Sunflower and groundnut oils were procured in a single lot from the local market of Hisar, India.

Blending of oils

Crude palm oil (CPO) was blended with sunflower oil (SFO) and groundnut oil (GNO) in the ratio as mentioned below:

Type Ia	CPO: SFO	70:30
Type Ib	CPO: SFO	65:35
Type IIa	CPO: GNO	50:50
Type Iib	CPO: GNO	45:55

The blending of CPO with other cooking oils was done to attain an ideal fatty acid ratio of 1:2:1 of PUFA, MUFA and SFA (Panghal *et.al*., 2010).

Nutritional evaluation of oil blends

Fatty acid composition of oil blends

Fatty acid composition of oils was determined by gas liquid chromatography method (Metcalfe and co-workers, 1966). The peaks were identified by retention time or position on the recorder chart using a standard reference mixture. The fatty acid methyl esters eluted in the order – palmitic (16:0), stearic (18:0), oleic (18:1), linoleic (19:2), arachidic (20:0), eicosenoic (20:1), behenic (22:0) and linoleic (24:0) acids. Percentage of each component was calculated from the ratio of each peak area (integrator count) to column to sum of areas (integrator count) under all peaks and reported as percentage by weight.

β-carotene

β-carotene in the sample was separated by column chromatography and estimated calorimetrically (AOAC, 1995)

Preparation of Snacks

Samosa

It was prepared using the following ingredients: Wheat flour refined 100g,potato (boiled) 100g, peas shelled 50g, chopped green chillies 10g, salt to taste, garam masala ¼ tsp, mango powder ½ tsp, baking powder a pinch and fat for frying.

Method of preparation

Refined flour was sieved and a stiff dough was prepared using water. Boiled potatoes, peas shelled, green chilies salt, and all spices were mixed well. Rolled the dough into sheet. Fill the required amount of mixture in it and deep fried till golden brown.

Cutlet

It was prepared using following ingredients: potato 500g; peanuts 200g; refined wheat flour 100g; green chillies, salt, mango powder and red chillies to taste and fat for frying.

Method of preparation

Boiled potatoes were mashed with roasted and ground peanuts. Mixed all spices and make the

shape of cutlets and dip in a thin paste of refined wheat flour. Deep fry till golden brown.

Sensory evaluation of products

Snacks were prepared using standard recipe and their organoleptic characteristics were determined by a panel of 10 judges for colour, appearance, lavor, texture, taste and overall acceptability using a nine point Hedonic Rating Scale ranging from like extremely (9) to dislike extremely (1) for each organoleptic characteristics as suggested by Austin and Ram (1971). The judges were asked to record the quality characteristics i.e. colour, appearance, aroma, texture and taste by employing a 9-point Hedonic rating Scale. Average of scores for all these characteristics were expressed as overall acceptability. Judges were asked to rinse their mouth before and after testing each product. Most acceptable snacks were selected for nutritional evaluation.

Nutritional evaluation of crude palm oil based food products

The developed snacks were dried in an oven at 60°C ± 2°C till constant weight was achieved. After drying, the samples were ground to fine powder and analyzed for following parameters:

Proximate nutrients

Moisture, ash, protein, fat and crude fibre content of the control and developed snacks were analyzed according to the method of AOAC (1995).

β-carotene

β-carotene in the sample was separated by column chromatography and estimated colorimetrically (AOAC, 1995)

Total carotenoids

Total carotenoids were determined by the method of Wellburn (1994).Weighed 5 g sample and extracted with 10 ml petroleum ether. Added 10 ml 50% acetone and shook vigorously. Added 5 ml sodium sulfate. Took the reading at 550 nm on Spectrophotometer.

Statistical Analysis

The data were statistically analyzed in completely randomized design (CRD) for mean, standard deviation and percent using standard method (Panse and Sukhatme, 1969). On the basis of CRD, critical difference (CD) has been calculated. Whenever the differences between two treatments were more than CD value, the differences were significant at the 5% level ($P<0.05$).

3. RESULTS AND DISCUSSION

Fatty acid composition of cooking oils and their blends

Results in the Table1 present the fatty acid composition of individual oils i.e. crude palm, sunflower and groundnut oil. The dominated fatty acid in crude palm oil was palmitic acid i.e. 43.45% followed by oleic acid (40.98%) and linoleic acid (14.67% of total fatty acids). Stearic acid was 0.88 per cent of total fatty acids. Similar fatty acid composition of palm oil reported was by various workers (Armugan, *et.al.* 1989; Manorama, 1994 and www.sunflowernsa.com, 2004).

Sunflower oil contained 67.76 per cent polyunsaturated fats, 22.72 per cent monounsaturated and 9.54 per cent saturated fats. On the other hand in groundnut oil, oleic acid was the prominent fatty acid which was 48.90 per cent of total fatty acid; linoleic acid was 48.9 per cent; 7.76 per cent palmitic acid and 2.31 per cent stearic acid of total fatty acid detected.

The blend of CPO and sunflower oil (70:30) had 30.85 per cent palmitic, 2.54 per cent stearic, 33.97 per cent oleic and 32.10 per cent linoleic acid (Table 1). Almost similar fatty acid profile was observed in case of 65:35 blends of crude palm and sunflower oil. Blend of crude palm and groundnut oil in a 55:45 and 65:35 proportions has 24.18 and 23.12 per cent saturated fats; 48.22 and 46.98 per cent monounsaturated fats and 27.60 and 29.07 percent polyunsaturated fatty acid of total fatty acids respectively. Bhatnagar *et. al.*(2009) conducted a study on development of blends of coconut oil with other vegetable oils i.e. palm, rice bran, sesame, mustard, sunflower, groundnut, safflower, and soybean and concluded that blending coconut oil with other vegetable oils provides medium chain fatty acids and oxidative stability to the blends.

TABLE 1. Fatty acid composition (%) and β-carotene of different cooking oils and their blends

Type of oil	SFA		MUFA	PUFA		β-carotene (mg/100g)
	Palmitic acid	Stearic acid	Oleic acid	Linoleic acid	Linolenic acid	
Crude palm oil	43.45	0.8865	40.98	14.67	-	36.62 ± 14.0
Sunflower oil	6.87	2.67	22.72	67.76	-	-
CPO : SFO oil blend						
70 : 30 (Type Ia)	30.85	2.54	33.97	32.10	-	24.18 ± 8.0
65 : 35 (Type Ib)	29.59	2.19	33.04	35.18	-	22.30 ± 5.0
Groundnut oil	7.76	2.31	48.90	40.81	-	-
CPO: GNO oil blend						
55: 45 (Type IIa)	24.18	-	48.22	27.60	-	18.93 ± 35.0
65:35 (Type IIb)	23.12	-	46.98	29.07	-	15.68 ± 23.0
CD($p<0.05$)	-	-	-	-		24.48

Key: SFA = Saturated fatty acid, MUFA = Monounsaturated fatty acid, PUFA = Polyunsaturated fatty acid
CPO=crude palm oil, SFO=Sunflower oil, GNO=Groundnut oil

Fatty acid ratio of blends

Crude palm oil was blended with sunflower oil in 65:35 and 70:30 proportion whose SFA: MUFA: PUFA ratios were 1:1.09:1.03 and 1:1.09:1.12, respectively. Crude palm oil was blended with groundnut oil in a 55:45 and 65:35 proportion and the SFA: MUFA: PUFA ratios were 1:2:1.16 and 1:2.04:1.30, respectively (Table 2).

TABLE 2. Fatty acid ratio of blends of different cooking oils with crude palm oil

Blends	Fatty Acid Ratio		
	SFA	MUFA	PUFA
CPO:SFO blend			
70 : 30 (Type Ia)	1.00	1.03	1.09
65 : 35 (Type Ib)	1.00	1.12	1.09
CPO : GNO blend			
55 : 45 (Type IIa)	1.00	1.16	2.00
65:35 (Type IIb)	1.00	1.30	2.04

Key: SFA = Saturated fatty acid,
MUFA = Monounsaturated fatty acid,
PUFA = Polyunsaturated fatty acid,
CPO = Crude palm oil

Similar observations have been made by Grundy (1998) who reported that an ideal saturated monounsaturated and polyunsaturated acid ratio was 1:2:1 and it is in close agreement with the present investigation.

The World Health Organization (WHO) recommends polyunsaturated(PUFA)/saturated fatty acid (SFA) ratio of 0.8 -1.0 in the diet(WHO/FAO, 2003).

β-carotene content of CPO and its blends

Maximum β-carotene content was observed in crude palm oil (36.62 mg/100 g) followed by Type Ia (70:30) blend of CPO and SFO (24.18 mg/100 g) and Type Ib (65:35) blend (22.30 mg/100 g). No β-carotene was observed in SFO and GNO. The Type IIa oil blend of CPO and GNO had 18.93mg/100 g β-carotene while Type IIb had 15.68mg β-carotene per 100 g. A significant ($P<0.05$) difference in β-carotene content was observed when all seven types of oils and their blends were compared together. More the amount of crude palm oil in the blend more was the β-carotene in the oil (Table 1)

Organoleptic evaluation of value added products

Samosa and *cutlet* prepared using crude palm oil, sunflower oil, groundnut oil and their blends were evaluated for their organoleptic acceptability in respect of colour, appearance, aroma, texture, taste and overall acceptability by a panel of judges using 9-point Hedonic Rating Scale. The results revealed that all the products were acceptable.(Table 3)

Nutritional evaluation of products

Proximate composition of Samosa and Cutlet

The moisture content of samosa and cutlet incorporating crude palm oil and sunflower oil and their blends (Type Ia and Ib) ranged from 45.11 to 49.04 per cent (Table 4 and 5). All the four types of samosa *and cutlets* incorporating CPO, SFO and GNO as well as their blends had almost similar moisture contents and did not vary significantly among themselves. The blending of crude palm with sunflower oil did not have any significant effect on protein, fat and ash content of different samosa. Overall, variation in type and amount of oil did not contribute towards change in the protein, fat and ash content of different types of samosa and cutlet.

The highest crude fibre content was observed in samosa *and cutlets* incorporating sunflower oil (0.62%) while the lowest in crude palm oil incorporated samosa *and cutlet* (0.54%) when all the four types of samosa *and cutlet* incorporating crude palm, sunflower oil and these were compared. However, the differences were non-significant. Crude fibre content ranged from 0.51 to 0.58 per cent with no significant variations in samosa *and cutlets* incorporating crude palm oil, groundnut oil and their blends. All types of oils i.e. crude palm oil, sunflower oil and groundnut oil had no crude fibre content, hence, the variation in type and amount of oil did not contribute towards the crude fibre content of samosa *and cutlets.*

β-carotene and total carotenoid of Samosa and Cutlet

β-carotene and total carotenoid content were highest in samosa and cutlet prepared using CPO.As results in Table 1 indicates that SFO and GNO were devoid of β-carotene, the level of β-carotene and total carotenoids increased significantly in both the products when they were cooked in oil blends containing 65:35 and 70:30 ratio of CPO with both SFO and GNO. Products prepared in oil blends containing higher amount of crude palm oil had higher β

TABLE 3. Mean scores of various sensory characteristics of Samosa prepared using crude palm oil, sunflower oil, groundnut oil and their blends

Type of oil	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
CPO (control)	8.00 ± 0.00	8.00 ± 0.00	7.60 ± 0.16	7.80 ± 0.13	7.70 ± 0.15	7.80 ± 0.08
SFO (control)	8.20 ± 0.13	8.10 ± 0.18	8.10 ± 0.10	8.20 ± 0.13	8.20 ± 0.13	8.10 ± 0.10
CPO : SFO oil blend						
65 : 35 (Type Ia)	7.20 ± 0.39	7.00 ± 0.37	7.40 ± 0.27	7.40 ± 0.27	7.50 ± 0.34	7.48 ± 0.25
70 : 30 (Type IIa)	7.20 ± 0.39	7.20 ± 0.39	7.60 ± 0.27	7.70 ± 0.21	7.50 ± 0.34	7.54 ± 0.27
GNO (control)	8.20 ± 0.13	8.20 ± 0.13	8.10 ± 0.10	8.20 ± 0.13	8.20 ± 0.13	8.20 ± 0.13
CPO : GNO oil blend						
55 : 45 (Type IIa)	8.00 ± 0.00	8.00 ± 0.00	7.90 ± 0.10	7.70 ± 0.15	7.50 ± 0.22	7.82 ± 0.07
65:35 (Type IIb)	8.70 ± 0.15	8.20 ± 0.25	8.00 ± 0.00	7.80 ± 0.13	8.20 ± 0.13	8.20 ± 0.09
Overall CD (P<0.05)	0.64	0.67	0.48	0.49	0.64	0.46

Values are mean ± SE of ten observations

Key: CPO = Crude palm oil, SFO=Sunflower oil, GNO= groundnut oil

TABLE 4. Mean scores of various sensory characteristics of Cutlet prepared using crude palm oil, sunflower oil, groundnut and their blends

Type of oil	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
Crude palm oil (control)	7.80 ± 0.13	7.80 ± 0.13	7.20 ± 0.33	7.60 ± 0.16	7.10 ± 0.31	7.32 ± 0.21
Sunflower oil (control)	7.60 ± 0.22	7.00 ± 0.26	7.50 ± 0.17	7.50 ± 0.17	7.40 ± 0.16	7.36 ± 0.10
CPO : SFO oil blend						
65 : 35 (Type Ia)	7.30 ± 0.30	6.70 ± 0.21	7.20 ± 0.20	7.40 ± 0.16	7.40 ± 0.22	7.22 ± 0.14
70 : 30 (Type Ib)	7.50 ± 0.22	6.90 ± 0.28	7.10 ± 0.16	7.40 ± 0.22	7.30 ± 0.26	7.36 ± 0.11
Groundnut oil (control)	7.70 ± 0.15	7.50 ± 0.22	7.50 ± 0.22	7.50 ± 0.17	7.40 ± 0.16	7.52 ± 0.10
CPO : GNO oil blend						
55 : 45 (Type IIa)	7.50 ± 0.17	6.70 ± 0.26	7.00 ± 0.26	6.80 ± 0.25	6.80 ± 0.25	6.98 ± 0.10
65 : 35 (Type IIb)	7.20 ± 0.25	7.50 ± 0.27	7.20 ± 0.29	7.20 ± 0.25	7.40 ± 0.22	7.18 ± 0.20
Overall CD (P,0.05)	NS	0.67	NS	NS	NS	NS

Values are mean ± SE of ten observations
Key: NS = Non-significant , CPO = Crude palm oil, SFO=Sunflower oil, GNO= groundnut oil

TABLE 5: Effect of blending of crude palm oil with sunflower and groundnut oil on proximate composition of samosa

Type of oil	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Crude fibre (%)
CPO (control)	49.04 ± 0.09	5.25 ± 0.01	26.28 ± 0.08	0.65 ± 0.02	0.92 ± 0.02
SFO (control)	48.11± 0.52	5.26 ± 0.04	26.27 ± 0.08	0.65 ± 0.04	0.98 ± 0.04
CPO:SFO oil blend					
65 : 35 (Type Ia)	47.01± 0.12	5.23 ± 0.10	26.13 ± 0.07	0.63 ± 0.03	0.94 ± 0.03
70 : 30 (Type Ib)	46.76 ± 0.25	5.26 ± 0.09	26.41± 0.06	0.66 ± 0.02	0.96 ± 0.02
GNO (control)	47.11± 0.24	5.24 ± 0.07	26.26 ± 0.11	0.65 ± 0.05	0.94 ± 0.02
CPO:GNO oil blend					
55 : 45 (Type IIa)	48.21 ± 0.11	5.21 ± 0.08	26.18 ± 0.05	0.64 ± 0.03	0.97 ± 0.02
65 : 35 (Type IIb)	47.74 ± 0.28	5.23 ± 0.05	26.21± 0.07	0.67 ± 0.04	0.93 ± 0.02
Overall CD (P<0.05)	NS	NS	NS	NS	NS

Values are mean ± SE of ten observations
Key: NS = Non-significant , CPO = Crude palm oil, SFO=Sunflower oil, GNO= groundnut oil

TABLE 6: Effect of blending of crude palm oil with sunflower and groundnut oil on proximate composition of cutlet

Type of oil	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Crude fibre (%)
CPO (control)	45.13 ± 0.22	9.30 ± 0.05	23.11± 0.06	1.22 ± 0.02	1.12 ± 0.03
SFO (control)	45.11 ± 0.26	9.28 ± 0.07	23.00 ± 0.08	1.27 ± 0.06	1.50 ± 0.05
CPO:SFO oil blend					
65 : 35 (Type Ia)	45.73±0.24	9.31 ± 0.18	23.11± 0.13	1.28 ± 0.02	1.14 ± 0.05
70 : 30 (Type Ib)	45.13 ± 0.15	9.33 ± 0.11	23.01 ± 0.03	1.23 ± 0.08	1.13 ± 0.07
GNO (control)	45.89 ± 0.37	9.27 ± 0.07	22.98 ± 0.25	1.23 ± 0.05	1.12 ± 0.02

CPO:GNO oil blend					
55 : 45 (Type IIa)	46.57 ± 0.14	9.29 ± 0.02	23.04 ± 0.04	1.21 ± 0.06	1.13 ± 0.02
65 : 35 (Type IIb)	46.12 ± 0.14	9.26 ± 0.10	23.11± 0.12	1.25 ± 0.07	1.15 ± 0.02
Overall CD (P<0.05)	NS	NS	NS	NS	NS

Values are mean ± SE of ten observations
Key: NS = Non-significant , CPO = Crude palm oil, SFO=Sunflower oil, GNO= groundnut oil

TABLE 7: Effect of blending of crude palm oil with sunflower and groundnut oil on β-carotene and total carotenoid content of Samosa and cutlet

Type of oil	Samosa		Cutlet	
	β-carotene (µg/100 g)	Total carotenoids (µg/100 g)	β-carotene (µg/100 g)	Total carotenoids (µg/100 g)
CPO (control)	65.16 ± 0.09	98.51± 0.73	46.08 ± 0.29	69.13 ± 0.33
SFO (control)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
CPO: SFO oil blend				
65 : 35 (Type Ia)	42.11± 0.27	63.64 ± 0.18	30.11 ± 0.24	45.61 ± 0.96
70 : 30 (Type Ib)	44.14 ± 0.23	67.51 ± 0.63	32.41± 0.36	48.75 ± 0.42
Groundnut oil (control)	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
CPO:GNO oil blend				
55 : 45 (Type IIa)	30.31± 0.31	44.10 ± 0.80	20.56 ± 0.10	32.08 ± 0.60
65 : 35 (Type IIb)	32.68 ± 0.10	49.15 ± 0.25	23.14 ± 0.28	35.56 ± 0.66
Overall CD (P<0.05)	0.56	1.49	0.69	1.64

Values are mean ± SE of three independent determinations;
Key: CPO= Crude palm oil, SFO=Sunflower oil, GNO= Groundnut oil

carotene and total carotenoid contents (Table 7). Manorama and Rukimini, (1991) observed that CPO was well accepted in various food preparations and 1:1 blend of CPO and GNO was better accepted.

4. CONCLUSION

It may be concluded form the study that the crude palm oil is an excellent source of polyunsaturated fatty acids and β-carotene. It can be blended with sunflower and groundnut oils to improve their fatty acids composition and β-carotene content. Blending of CPO with other cooking oils can be done even at household level. The products developed using various oils and their blends were found organoleptically acceptable, cheap, easily affordable and nutritious in terms of their higher β-carotene and total carotenoids content. This will positively help to enhance the vitamin A content in the diet, especially for malnourished preschoolers and women who are either suffering from the deficiency of vitamin A or are at risk of vitamin A deficiency. Fried products are acceptable and relished by all age groups and will help to overcome the problem of malnutrition as well as deficiency of vitamin A. Moreover, the developed products could serve as a good supplement for improving the nutritional status of young children. Thus, attempts are required to be made with the help of various community programme and welfare agencies to popularize such oils and products among community people and to make people aware of their nutritional importance.

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