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DEVELOPMENT AND ORGANOLEPTIC ANALYSIS OF FOOD PREPARATIONS USING BETA CAROTENE RICH COOKING OILAditi Upadhyay^{1*} and Renu Mogra²

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Vitamin A Deficiency (VAD) results in an increased risk of severe mortality and morbidity due to anemia and depressed resistance to infectious diseases and responsible for more than a million child deaths annually. Beta carotene being a provitamin A in daily diet, can be one of the strategy for improving the nutritional status and reducing vitamin A deficiency. Keeping in view the insolubility of beta carotene in oil, it was added in refined as well as in unrefined groundnut oil and the present study was undertaken with the objective to analyze the acceptability of beta carotene rich cooking oils by sensory evaluation of commonly consumed food preparations viz., Rice, Dal, Chawmein, Potato Vegetable, Sandwich, Paneer Cutlet, Poha, Aloo Parantha, prepared by using the developed oils. Organoleptic evaluation of all food preparations was conducted by a panel of ten judges using 9 point hedonic scale. All the recipes were highly acceptable by the panel members as they were found to fall under the category of 'liked very much' on the hedonic and achieved scores within the range of 8-9. Among all the recipes, Aloo parantha scored highest (8.9 ± 0.01) organoleptic mean score while dal achieved comparatively least (8.3 ± 0.21) organoleptic mean score. No significant difference was found between the food preparations prepared by using both refined and unrefined developed beta carotene rich cooking oils.

Keywords: Highly acceptable, Overall acceptability scores, Organoleptic evaluation, Liked very much, Beta carotene

INTRODUCTION

Sub clinical data indicates 250,000 to 500,000 vitamin A deficient children become blind every year; half of them die within 12 months of losing their sight (WHO, 2008). The prevalence of vitamin A deficiency in India is one of the highest in the world (NNMB, 2006), especially among preschoolers. UNICEF and WHO consider that mortality may reduce by 23% on average by improving the vitamin A status of young children with marginal deficiency. Dietary approaches are needed to replace supplementation programs, ensuring sustainability and adequate coverage.

Therefore it is essential that locally available materials which are inexpensive but highly nutritious be used as a vehicle to improve the nutritional status (Negi and Roy, 2004).

Beta carotene is practically the only natural source of vitamin A. Leafy vegetables are excellent source of carotenoids, especially beta carotene and lutein, which represent about 80% of the total carotenoids, with very low content of alpha carotene. But the carotenoids from carrots and green leafy vegetables are poorly absorbed, presumably because they are united to proteins. This union is not only physical (effect of the matrix) but also chemical, which

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reduces carotenoids bioavailability. Homogenization and thermal processing of tomatoes significantly increased the bioavailability of beta carotene and lycopene because it breaks food cells and protein-carotenoid complexes (Van het Hof *et al.*, 2000). Also the food matrix plays an essential role in the bioavailability of beta carotene. Recent studies have proved that absorption of carotenoids increases when they are ingested with dietary lipids (Brown *et al.*, 2004; and Unlu *et al.*, 2007). Some studies have suggested that at least 5 g/day of dietary fat are required for suitable beta-carotene absorption (West and Castenmiller, 2002).

Recognizing the need for the identification of such unconventional sources which are nutritious, inexpensive, locally available and may be helpful in achieving nutritional security, the present study was undertaken with the objective to analyze the acceptability of developed beta carotene rich cooking oil by sensory evaluation of commonly consumed food preparations prepared in the developed cooking oils.

MATERIALS AND METHODS

Refined and unrefined groundnut oil was procured from the local market of Udaipur on the basis of preliminary survey of general store and retail shops while, spinach (Jobner Green variety) was procured purposively, from the hi-tech nursery of SKRAU, Bikaner, Rajasthan. Beta carotene rich cooking oil was developed by using a homestead technology. 50 gm of spinach leaves (chopped) were fried in 100 ml oil, at medium flame, for 3 minutes and filtered after 2 hours. The technique was standardized in the laboratory.

For assessing the acceptability of the developed beta carotene rich cooking oil, Eight commonly consumed recipes were prepared viz., Rice, Dal, Chawmein, Paneer Cutlet, Poha, Sandwich, Potato Vegetable and Aloo Parantha. All the prepared recipes were evaluated for the sensory qualities such as color, flavor, taste, appearance and overall acceptability by a panel of judges (10) for assessing the acceptability of the product (Ranganna, 1986), using 9 point hedonic scale where, 1 point showed 'disliked extremely' while 9 point showed 'liked extremely'.

Statistical Analysis

The data obtained was analyzed statistically (Gupta and Saini, 1987). Mean, standard deviation and standard error of mean were calculated for each studied variable. The interpretation of the data so obtained was done by using t-test for difference between two means. Level of

significance was accepted at 5% level of significance for 18 degrees of freedom.

RESULT AND DISCUSSION

Sensory Evaluation

Developed refined beta carotene rich oil was found to have total beta carotene as $1115.66 \pm 3.29 \mu\text{g}/100 \text{ ml}$ with 'light green' color and peculiar smell of fried spinach. Whereas developed beta carotene was found containing $1016.00 \pm 2.35 \mu\text{g}$ beta carotene/100 ml with 'brownish yellow' color and same peculiar smell of fried spinach. Cost of developed refined beta carotene rich cooking oil was calculated as ₹120 per kg while that of unrefined beta carotene rich cooking oil it was ₹100 per kg.

The sensory evaluation of the food preparations made by using developed beta carotene rich cooking oils revealed that all the food products developed were organoleptically acceptable. However, the amount of oil varied from 5-15 ml, in different food preparations. But it has not been noticed that the amount of oil had a significant effect on the mean scores for the organoleptic evaluation for appearance, color, texture, taste, flavor and overall acceptability of the food preparations.

The data presented in Table 1 revealed that recipes prepared by using developed refined beta carotene rich cooking oil, even though differ with respect to color, flavor, taste, appearance and overall acceptability, were all acceptable. With respect of color, flavor and taste, also parantha and chawmein achieved highest (9.0 ± 0.00) organoleptic scores while dal scored lowest (8.3 ± 0.46) comparable scores. Highest mean value (8.9 ± 0.30) for texture was found in paneer cutlet and also parantha while least (8.4 ± 0.49) was found in dal. From appearance point of view chawmein and aloo parantha were most acceptable with highest (9.0 ± 0.00) score whereas rice scored least (8.3 ± 0.48) score. Similarly for overall acceptability aloo parantha was most acceptable with highest (9.0 ± 0.00) mean score while dal achieved least (7.9 ± 0.30) acceptable scores in comparison to other recipes on 9 point hedonic scale.

The perusal of data presented in Table 2 revealed that all the recipes prepared by using unrefined developed beta carotene rich cooking oil were most acceptable as the scores achieved by the recipes were found to fall under the category of liked very much on the 9 point hedonic scale. Among all the recipes, chawmein and aloo parantha were most acceptable for color, flavor and texture with mean scores as

Table 1: Sensory Evaluation Scores of Food Preparations Developed by Using Refined Beta Carotene Rich Oil

Recipes	Color	Flavor	Taste	Texture	Appearance	Overall Acceptability	Mean
Rice	8.6 ± 0.49	8.6 ± 0.49	8.5 ± 0.49	8.4 ± 0.16	8.3 ± 0.48	8.6 ± 0.49	8.5 ± 0.11
	(0.15)	(0.15)	(0.15)	(0.15)	(0.14)	(0.15)	(0.03)
Dal	8.3 ± 0.46	8.4 ± 0.49	8.4 ± 0.49	8.2 ± 0.40	8.6 ± 0.49	7.9 ± 0.30	8.3 ± 0.21
	(0.14)	(0.15)	(0.15)	(0.12)	(0.15)	(0.09)	(0.06)
Chawmein	9.0 ± 0.00	9.0 ± 0.00	9.0 ± 0.00	8.5 ± 0.49	9.0 ± 0.00	8.8 ± 0.40	8.8 ± 0.20
	0.00	0.00	0.00	(0.15)	0.00	(0.12)	(0.05)
Potato Vegetable	8.6 ± 0.49	8.8 ± 0.40	8.6 ± 0.49	8.8 ± 0.40	8.3 ± 0.46	8.3 ± 0.46	8.6 ± 0.20
	(0.15)	(0.12)	(0.15)	(0.12)	(0.14)	(0.14)	(0.06)
Sandwich	8.8 ± 0.40	8.8 ± 0.40	8.8 ± 0.40	8.6 ± 0.49	8.6 ± 0.49	8.6 ± 0.49	8.7 ± 0.10
	(0.12)	(0.12)	(0.12)	(0.15)	(0.15)	(0.15)	(0.03)
Paneer Cutlet	8.7 ± 0.46	8.7 ± 0.46	8.4 ± 0.49	8.9 ± 0.30	8.7 ± 0.46	8.6 ± 0.49	8.7 ± 0.14
	(0.14)	(0.14)	(0.14)	(0.09)	(0.14)	(0.15)	(0.04)
Poha	8.8 ± 0.40	8.5 ± 0.50	8.3 ± 0.45	8.8 ± 0.40	8.6 ± 0.49	8.6 ± 0.49	8.7 ± 0.17
	(0.12)	(0.16)	(0.14)	(0.12)	(0.15)	(0.15)	(0.05)
Aloo Parantha	9.0 ± 0.00	8.7 ± 0.46	9.0 ± 0.00	8.9 ± 0.30	9.0 ± 0.00	9.0 ± 0.00	8.9 ± 0.11
	0.00	(0.14)	0.00	(0.09)	0.00	0.00	(0.03)

Note: Values in parenthesis is standard error.

Table 2: Sensory Evaluation Scores of Food Preparations Developed By Using Unrefined Beta Carotene Rich Oil

Recipes	Color	Flavor	Taste	Texture	Appearance	Overall Acceptability	Mean
Rice	8.6 ± 0.49	8.2 ± 0.40	8.5 ± 0.50	8.3 ± 0.49	8.2 ± 0.40	8.5 ± 0.50	8.4 ± 0.16
	(0.15)	(0.12)	(0.16)	(0.09)	(0.12)	(0.16)	(0.04)
Dal	8.3 ± 0.49	8.5 ± 0.50	8.4 ± 0.49	8.2 ± 0.40	8.4 ± 0.49	7.9 ± 0.30	8.3 ± 0.20
	(0.09)	(0.16)	(0.15)	(0.12)	(0.15)	(0.09)	(0.06)
Chawmein	9.0 ± 0.00	8.8 ± 0.40	9.0 ± 0.00	8.5 ± 0.50	8.9 ± 0.30	8.8 ± 0.40	8.8 ± 0.16
	0.00	(0.12)	0.00	(0.16)	(0.09)	(0.12)	(0.05)
Potato Vegetable	8.7 ± 0.46	8.7 ± 0.46	8.3 ± 0.49	8.9 ± 0.30	8.6 ± 0.49	8.6 ± 0.49	8.6 ± 0.18
	(0.14)	(0.14)	(0.09)	(0.09)	(0.15)	(0.15)	(0.05)
Sandwich	8.8 ± 0.40	8.7 ± 0.46	8.8 ± 0.40	8.7 ± 0.46	8.7 ± 0.46	8.7 ± 0.46	8.7 ± 0.04
	(0.12)	(0.14)	(0.12)	(0.14)	(0.14)	(0.14)	(0.01)

Table 2 (Cont.)

Paneer Cutlet	8.7 ± 0.46	8.7 ± 0.46	8.6 ± 0.49	8.7 ± 0.46	8.3 ± 0.49	8.2 ± 0.40	8.5 ± 0.20
	(0.14)	(0.14)	(0.15)	(0.14)	(0.09)	(0.12)	(0.06)
Poha	8.8 ± 0.40	8.5 ± 0.50	8.3 ± 0.45	8.9 ± 0.30	8.7 ± 0.46	8.6 ± 0.49	8.6 ± 0.20
	(0.12)	(0.16)	(0.14)	(0.09)	(0.14)	(0.15)	(0.06)
Aloo Parantha	9.0 ± 0.00	8.8 ± 0.40	9.0 ± 0.00	8.9 ± 0.30	9.0 ± 0.00	9.0 ± 0.00	8.9 ± 0.07
	0.00	(0.12)	0.00	(0.09)	0.00	0.00	(0.02)

Table 3: Level of Significance between Refined and Unrefined Beta Carotene Rich Oil

S. No.	Recipes	Level of Significance Between Refined and Unrefined Developed Oil
1	Rice	NS (7.69)
2	Dal	NS (0.00)
3	Chawmein	NS (0.00)
4	Potato Vegetable	NS (0.00)
5	Sandwich	NS (0.00)
6	Paneer Cutlet	NS (9.70)
7	Poha	NS (4.20)
8	Aloo Parantha	NS (0.00)

Note: Values in parentheses are t-values.

9.0 ± 0.00, 8.8 ± 0.40 and 9.0 ± 0.00 respectively while least acceptable score were achieved by dal as 8.3 ± 0.49, rice as 8.2 ± 0.40, potato vegetable and poha as 8.3 ± 0.49 for color, flavor and taste respectively. With respect of texture poha, potato vegetable, aloo parantha was most acceptable with 8.9 ± 0.30 mean scores while dal achieved lowest score of 8.2 ± 0.40. Highest value for appearance was found in aloo parantha (9.0 ± 0.00) while lowest value was found in rice (8.2 ± 0.40). For overall acceptability aloo parantha scored highest (9.0 ± 0.00) scores while dal scored lowest (7.9 ± 0.30) organoleptic mean scores.

Hence from Tables 1 and 2 it was concluded that aloo parantha was the most acceptable recipe with highest (8.9 ± 0.11) mean acceptability scores while dal achieved lowest (8.3 ± 0.21) comparable mean acceptability scores among all the recipes prepared by using developed refined beta carotene rich cooking oil. Similar findings were reported by Kolanowaki and Gandhi, who had carried out researches on influence of oil fortification (fish oil, and seasm oil) as the sensory quality of food

products (dairy products and biscuits) respectively (2007 and 2009). These findings were also supported by the research studies such as, nutritional and sensory evaluation of biscuits, cakes and fried products using red palm oil and maize germ oil by But *et al.*, and Nasir *et al.*, respectively (2004 and 2009).

Data shown in Table 3 revealed that there was no significant difference found between the overall acceptability score achieved by the food preparations, at 5% level of significance for 18 degrees of freedom. Hence it was concluded that all the recipes prepared by using both the developed oils were equally accepted by the panel members.

CONCLUSION

All the food preparations prepared by using both refined and unrefined beta carotene rich cooking oil were organoleptically acceptable. This concludes that the developed oil has no considerable effect on the sensory qualities of the food preparations.

RECOMMENDATIONS

It is strongly recommended that almost all the commonly consumed food preparations in daily routine by all the family members, can be successfully prepared by using any refined or unrefined beta carotene rich cooking oil and these preparations if consumed on a daily basis can take care of the micronutrient deficiencies of the population.

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