

A Freedom of Choice- Sensory Profiling and Consumer Acceptability of Oil Blends

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ABSTRACT Taking into consideration the regional preferences of the local population to sesame oil, the study was planned to exploit its antioxidant properties and to reduce the high priced demand of the oil. Sesame oil was blended with soyabean oil, ricebran oil, cottonseed oil, palmolein, mustard oil and corn oil in the ratios of 80: 20 and 20:80 and *muruku* (deep fried Indian traditional snack) and *bobbatlu* (shallow fried traditional regional snack) were prepared with those blends. Consumers who were conversant with the factors governing quality of the products and raw oil blends were chosen as sensory panel. The present consumer acceptance trials indicated no strong rejection of an oil blend in comparison with control. In raw oils and in the products made with the blends sesame-rice bran blends of 80:20 and 20:80 and sesame-cottonseed blend of 80:20 and sesame-palmolein blend of 20:80 were significantly better than control.

INTRODUCTION

Sensory evaluation is considered to be an important analytical tool in the present day competitive corporate environment. Measuring the sensory properties, and determining the importance of these properties, as a basis for predicting acceptance by the consumer represent major accomplishments for sensory evaluation (Bodyfelt et al. 1988). The acceptability and perhaps keeping quality of non-conventional edible oils could be brought into line with familiar vegetable oils by suitable blending of the two.

The fact that differences exist among frying oils/fats on the sensory quality of fried foods is not disputed, but little information is available concerning how habits, custom, etc. affect consumer preference for the flavor of one oil compared with another. For consumers, the perceivable sensory attributes, color, flavor, texture, and taste are the deciding factors in food acceptance (Pal et al. 1995), though to say to a certain extent the food industry is moving away from using fats and oils only for their sensory characteristics, either as emulsifiers or

as flavor and vitamin carriers. Instead their roles in health and disease prevention are being explored by the development of new nutraceuticals or functional foods (Ong and Goh 2002). Products containing blends of oils may be considered functional foods, if they prove to fit the definition thereof and thus provide "health benefits beyond basic nutrition" (Clydesdale 1997).

The sensory properties of the oil are destroyed usually because of the deterioration caused by heat in red palm oil (Manorama and Rukmini 1992), but oil blends had different characteristics of stability and sensory factors as seen by Handoo et al. (1994) who reported that organoleptically 70:30 blends of both cottonseed-mustard and corn-mustard had greater acceptability than the other blends. Similar studies were done and reported by Handoo et al. (1992a) on groundnut-cottonseed and by Handoo et al. (1992b) on sunflower-mustard oil blends, and groundnut-cottonseed oil blends and by Waghray and Gulla (2010) in mustard-corn blends.

In this context, different product options were considered and it was decided to use a well-known and to Indian consumers, highly acceptable products of *muruku* (deep fried extruded snack), and *bobbatlu* (shallow fried pancake) which were used as a vehicle for the various oil blends in the intervention study. Incorporating the "voice of the consumer" in early stages of the new product development process has been identified as a critical success

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factor for the new product development (Kleef 2005). Since the products were made with the chosen oil blends, it was thus important to assess if these products were acceptable to the subjects of the intervention study and consumers, as market place success and continuous consumption of functional foods depends largely on consumer satisfaction (Wrick et al. 1993). Since the consumer flavor preferences for edible oils differ from region to region, oil blends containing various oils were prepared, and their acceptability was reported in the present work

MATERIALS AND METHODS

Sample Formulation

Sesame oil (*Sesamum Indicum L*) the most commonly consumed edible oil in the local area of Andhra Pradesh, India has been used as control and rice bran oil (*Oryza sativum*), cottonseed oil (*Gossypium hirsutum*), soybean oil (*Glycine max*), palmolein (*Elaeis guineensis*), mustard oil (*Brassica nigra*) and corn oil (*Zea mays*) were used as experimental oils. All the oils were purchased in bulk from the oil millers association, Andhra Pradesh, India. Sesame oil was blended with rice bran oil, cottonseed oil, soybean oil, palmolein, mustard oil and corn oil in the ratios of 80:20 and 20:80 in the laboratory using a blender cum mixer and stored in PET bottles. Twelve blends were prepared by this method.

Subjects

Subjects who were habitual consumers of both 'muruku' and 'bobbatlu' were recruited as subjects and as stated by Scholtz and Bosman (2005) the inclusion criteria for the recruitment of the target group for the consumer acceptability studies was defined as actual or potential consumption of the products prepared. The consumers were recruited by telephone calls on the basis that they conformed to the inclusion criterion and they were available and willing to participate. A total of 150 consumers aged 24 to 53 years, volunteered to take part in the study. No information regarding the various oils used for the study was given to the consumers, in order to avoid any bias regarding the different kinds of oils

used for the preparation of the products. The consumer tests was carried out in a central location and the prepared products were given as carry home packs as the incentive for their participation after the evaluation session.

Experimental Design

The subjects were presented with structured questionnaires for raw oil blends and control along with the coded samples of the raw oil blends and 26 coded packs of the two products prepared weighing 50 g each. One of the each product prepared were with control (sesame oil) and the rest 26 coded products were prepared with the blends of sesame, rice bran oil, cotton seed oil, soya bean oil, palmolein, corn oil and mustard in 80:20 and 20:80 ratio. After completing their demographic information, sensory evaluation followed and the subjects had to assess the acceptability of, preference for and intended consumption for each sample. For consumers, the perceivable sensory attributes, colour, flavour, texture, taste, viscosity (raw oils) and finally the overall acceptability, were the deciding factors in both the oil blends and its products. The twelve oil blends along with control and its products *muruku* and *bobbatlu* were evaluated using a five point hedonic rating scale. A prescreened and pretested sensory evaluation questionnaire, consisting of two sections was used. One section was used to record demographic information and the second section was a score sheet for assessing the acceptability and preference of the different samples using a five point hedonic scale for acceptance rating.

Preparation and Presentation

All preparation, handling and serving procedures were standardized and pretested in the laboratory. *Muruku* is a cereal (*Oryza sativum*)- pulse (*Cicer arietinum* and *Phaseolus mungo*) flour combination, prepared by mixing the ingredients into thick paste with the addition of an appropriate amount of water and extruded into noodle like structure and deep fried until they become golden brown. *Bobbatlu* is a wheat flour (*Triticum aestivum*), pulse (*Cicer arietinum*) and sweetener (sugar) based snack wherein the pulse was boiled, mashed and mixed with sugar. It was made into

balls and was imbibed with refined wheat flour dough and rolled into flat pancakes and shallow fried till golden brown. Deep fat frying of *muruku* was conducted in each oil blend in four batches consecutively while maintaining frying temperatures at $180\pm 5^{\circ}\text{C}$. After being fried the different samples were cooled and covered with transparent plastic cover and presented in identical containers. All samples were assigned a code and were presented to subjects in a balanced order as 0, blend 1, blend 2, blend 3, blend 4 and so on till blend 12, with no hint of what the blend's formulation was.

Consumer Sensory Tests

A five point hedonic scale for acceptance with tick boxes 1-poor, 2- average, 3- fair, 4-good, 5- very good was used for the independent hedonic rating of color, flavor, texture, taste and overall acceptability for each product. For raw oil blends, the hedonic rating of color, flavor, viscosity and overall acceptability was used. Consumers rinsed their palates with water before and between tasting and re-tasting of samples. The data was tabulated and subjected to tests of significance, means and standard deviation using the SPSS 15.0 windows version.

RESULTS AND DISCUSSION

The study of consumer perception of food quality and acceptability is complex and interdisciplinary, encompassing scientific disciplines including food science and technology, nutrition, psychology and physiology (Imram 1999). No matter how nutritious a food product may be, it can have no health benefits unless its sensory attributes are acceptable and the product is consumed repeatedly. For this reason, sensory valuation of food products especially by consumer panels, has re-emerged as a new science of inestimable importance in collaboration with nutritional research and functional food development (Scholtz and Bosman 2005).

In India, dietary habits, especially the fat consumption, vary according to geographical region and availability of fat. Mustard oil is used in the northern part of the country whereas sunflower oil, ground nut oil, and palm oil are used in most parts of the country. The new-

er sources of edible oil, like rice bran oil are currently in use in southern India (Malongil et al. 2007) along with a few other conventional edible oils like soya bean, and cottonseed oils. These were then blended with sesame oil as control that is very stable against lipid peroxidation (Bommi and Waghay 2007). Blended oils are thus a new series of vegetable oils suitable for edible purposes.

Raw Oil Blends

The mean values of consumer acceptability of raw oils blends studied is depicted in Table 1 and in control the scores were seen to be 3.0, 2.9, 3.0, 3.5 for color, flavor, oiliness and overall acceptability. These acceptability scores could indicate that since sesame oil was a predominantly common oil used in southern India (Malongil et al. 2007), the consumers were attuned to the oil and readily accepted it. Sesame-rice bran blends of 80:20 and 20:80 and sesame-cottonseed blend of 80:20 and sesame-palmolein blend of 20:80 were significantly different than control, which could mean that the consumers were aware of the tastes of rice bran oil, cottonseed oil and palmolein and blending the same with sesame enhanced the acceptability factors of their respective blends. Corn oil has a milder taste and can be blended with other oils in packages for home use in order to produce desirable flavor to other oils (Corn Refiners Association 2006). This particular property of corn was immediately seen in the blends that were prepared which gave a very good score though the blends were not significantly different from control.

Sesame- mustard blends and sesame-cottonseed (80:20) blends had relatively better scores than the control as seen in Table 1 but were seen to be not significantly different than control in the present study, however, Handoo et al. (1994) had reported that the taste panel scored flavor and odor of the oil blends sufficiently high on a scale of 0-10, where all were rated to as more than fair to show that oil blends were of good quality. The blends they studied were cottonseed-mustard and corn-mustard oil. It was seen by Murthi et al. (1996) who subjected the blended oils to consumer trials in selected parts of the country, that the oil blends containing cottonseed oil with sesame oil or gro-

Table 1: Mean averages of consumer acceptability of raw oil blends

Oil blends	Characteristics			
	Colour	Flavour	Oiliness	Overall acceptability
Control	3.0±0.79	2.9±1.18	3.0±0.86	3.5±0.97
Sesame: rice bran				
80:20 (1)	3.5±0.5*	2.7±0.82	2.7±0.67	3.1±0.71*
20:80 (2)	3.3±0.47*	2.3±1.08*	2.8±0.69	3.1±0.62*
Sesame : Cotton seed				
80:20 (3)	3.2±0.60	3.0±0.68	3.0±0.63	3.0±0.82*
20:80 (4)	3.7±0.46*	3.3±0.84	2.7±0.94	3.2±0.88
Sesame: Soybean				
80:20 (5)	3.1±0.68	2.7±1.06	2.6±0.68*	3.2±0.80
20:80 (6)	3.2±0.69	3.1±1.22	3.2±1.09	3.5±1.11
Sesame: Palmolein				
80:20 (7)	3.1±0.87	3.0±0.85	2.9±0.93	3.2±0.80
20:80 (8)	3.1±0.74	3.3±1.37	2.7±1.35	2.9±1.33*
Sesame: Mustard				
80:20 (9)	3.6±1.28	3.3±1.36	3.1±0.92	3.2±1.36
20:80 (10)	3.2±1.41	3.0±1.31	3.1±1.11	3.2±1.27
Sesame: Corn				
80:20 (11)	4.5±0.57	4.1±0.80	4.0±0.69	4.2±0.64
20:80 (12)	4.2±0.72	3.6±1.06	3.6±0.74	4.1±0.58

Mean±S.D *Significant at 5% level.

undnut nut oil, coconut oil with palmolein, and rapeseed oil with mustard oil were more preferred. Blends containing palm oil were less acceptable to the consumers as a waxy solid mass separates out in these oils, which were proven in the present trials as 20:80 blend of sesame-palmolein were significantly inferior than control.

Muruku (Extruded Deep Fried Snack)

The result of the sensory evaluation of *muruku* in control as seen in Table 2 was 2.2 (colour), 1.7 (flavour), 3.4 (texture), 2.3 (taste) and 2.6 (overall acceptability), which were seen to be of lesser scores than the blends. The color, taste and overall acceptability of the *muruku* was readily accepted by all the consumers for all the blends studied, and were significantly different than control. The flavor, however, showed variations, which were perceptible mainly in the sesame-soybean (20:80) which was significantly lower than control. The taste and characteristic fishy flavor, which developed on heating soybean oil might be the reason for the less acceptability of this particular blend and several studies proved that soybean had less flavor stability (White et al. 2000) and could also be stated that consumers

Table 2: Mean averages of consumer acceptability of muruku (extruded deep fried snack) prepared with oil blends

Oil blends	Characteristics				
	Colour	Flavour	Texture	Taste	Overall acceptability
Control	2.2±1.13	1.7±0.90	3.4±0.54	2.3±0.62	2.6±0.51
Sesame: rice bran					
80:20 (1)	2.7±0.75*	1.7±0.74	4.0±0.40*	4.1±0.47*	4.1±0.68*
20:80 (2)	3.4±0.67*	2.4±0.76*	3.5±0.54	3.6±0.53*	3.30.59*
Sesame :Cotton seed					
80:20 (3)	3.0±0.98*	2.1±1.03*	3.3±0.56	3.5±0.67*	3.70*
20:80 (4)	3.0±1.04*	2.1±1.01*	4.0±0.53*	3.8±0.47*	3.50.64*
Sesame :Soybean					
80:20 (5)	2.2±1.12	1.6±0.79	3.8±0.70*	3.3±0.56*	3.70.48*
20:80 (6)	3.3±0.98*	2.4±0.86*	3.6±0.53	4.3±0.54*	3.80.40*
Sesame: Palmolein					
80:20 (7)	2.8±1.3*	2.0±1.07*	4.1±0.59*	3.8±0.43*	4.10.52*
20:80 (8)	4.5±0.64*	3.5±0.76*	3.8±0.52*	3.9±0.44*	3.80.57*
Sesame:Mustard					
80:20 (9)	3.8±0.84	3.3±0.85	3.3±1.48	3.3±1.23	3.5±0.99
20:80 (10)	4.0±1.00	3.3±1.17	3.3±1.04	3.3±1.09	3.5±1.16
Sesame: Corn					
80:20 (11)	3.5±1.12	3.5±0.83	3.2±1.29	3.5±0.99	3.9±.90
20:80 (12)	3.8±0.83	3.7±1.14	3.0±1.31	3.8±0.88	3.8±1.00

Mean±S.D *Significant at 5% level

from the regions of south India were still not attuned to the smell and taste of soya bean oil.

Bourne (2002) stated that texture in the overall acceptability of food, varies widely depending upon type of food and may be affected by culture. Nishinari (2004) also stated that texture is classified into the physical factor of the palatability of food. The texture of *muruku* fried in sesame-palmolein (80:20) and (20:80) and sesame-rice bran (80:20) along with sesame-cottonseed (20:80) and sesame-soybean (80:20) were significantly superior than the control. Similar observations were echoed by Lakshmi and Sarojini (1998) when they studied the acceptability of products prepared in red palm oil blends with groundnut in different proportions for *muruku*. Bhatt and Kutty (1982) had done studies on cottonseed oil and groundnut oil mixtures as cooking media and stated that products like *bhajji* and *vadai*, and *murukku* prepared with pure cottonseed oil and their blends scored better than fried products made with groundnut oil and their blends.

For organoleptic evaluation of *muruku* taste, flavor, and texture would be the major contributing factors in the overall acceptability since they were cereal-pulse based fried snacks. These factors mainly depend on the dough composition, frying conditions and final

moisture in the finished products. For each recipe, the frying conditions were kept constant. When the product was introduced into hot oil at 180°C, the temperature came down to 175°C. the frying was continued in the temperature range of 175-185°C till the product attained light amber brown color in case of *muruku*.

Considering the overall acceptability of the product, '*muruku*' prepared in oil blends were observed to be better accepted than the control, and in general, sesame-ricebran and sesame-palmolein blends were ranked better than the other blends. In this study the high acceptance scores for the individual attributes of the product can be interpreted as a true reflection of actual liking by the consumers proving that this product is indeed very popular amongst the consumers.

***Bobbatlu* (A Shallow Fried Sweet Pancake)**

Sensory evaluation of *bobbatlu* (a shallow fried sweet pancake) in respect of its color, flavor, texture, taste and overall acceptability was given to the consumers who were conversant with the factors governing quality of the product. Each consumer independently examined the product and assigned scores for different characteristics of the product which were tabulated and presented in Table 3. The

Table 3: Mean averages of consumer acceptability of *bobbatlu* (shallow fried sweet pancake) prepared with oil blends

Oil blends	Characteristics				
	Colour	Flavour	Texture	Taste	Overall acceptability
Control	3.2±0.53	3.6±0.57	3.0±0.51	3.1±0.52	3.3±0.52
Sesame: rice bran					
80:20 (1)	3.6±0.49*	3.6±0.47	3.1±0.58	3.6±0.49*	3.7±0.46*
20:80 (2)	3.5±0.50*	3.8±0.56*	3.9±0.46*	3.5±0.50*	4±0.45*
Sesame :Cotton seed					
80:20 (3)	3.6±0.53*	2.8±0.53*	3.8±0.55*	2.9±0.96	3.2±0.61
20:80 (4)	2.9±0.97*	2.0±0.56*	3.2±0.59*	3±0.45	3.3±0.58
Sesame :Soybean					
80:20 (5)	3.0±0.71	2.0±0.71*	3.6±0.49*	3.1±0.71	3.2±0.60
20:80 (6)	3.5±0.54*	2.4±0.64*	3.2±0.57*	2.9±0.51	3.2±0.62
Sesame: Palmolein					
80:20 (7)	3.5±0.60*	2.4±0.54*	3.9±0.46*	3.8±0.60*	4±0.53*
20:80 (8)	3.9±0.53*	2.9±0.66*	3.9±0.57*	3.7±0.45*	3.9±0.57*
Sesame:Mustard					
80:20 (9)	4.2±0.69	3.5±0.99	2.9±1.20	3.5±1.12	3.8±0.90
20:80 (10)	4.1±0.83	3.8±0.94	2.9±1.16	3.7±1.01	3.8±0.89
Sesame: Corn					
80:20 (11)	3.9±0.86	3.5±0.99	2.6±1.178	3.6±0.96	3.8±0.87
20:80 (12)	4.0±0.80	3.5±1.07	2.8±0.1.27	3.8±1.17	3.9±0.98

Mean±S.D *Significant at 5% level

relative importance of each factor was then expressed numerically on a five point scale. The products receiving an overall acceptability of 3 and above were considered acceptable and those receiving below 3 were considered unacceptable, while determining the sensory qualities of the product. The product made from control had scores of 3.2, 3.6, 3.0, 3.1, and 3.3 for color, flavor, texture, taste and overall acceptability respectively. The blends of sesame-rice bran with overall acceptability values of 3.7 and 4 and sesame-palmolein with overall acceptability values of 4 and 3.9 of both 80:20 and 20:80 blends were seen to be significantly different from control. All the products made with other blends such as sesame-cottonseed, sesame-soybean, sesame-mustard, and sesame-corn had high scores of above 3, which were acceptable to the consumers without any complaints of aftertaste of the oil blend but were not seen to be significantly different from control.

CONCLUSION

It can be concluded that the present consumer acceptance trials indicated no strong rejection of an oil blend in comparison with control. The blends of sesame-rice bran and sesame-palmolein of both 80:20 and 20:80 were the best accepted among all the blends, and sesame-mustard and sesame-soybean (80:20) and (20:80) scored the least in consumer acceptability studies. The rest of the blends like sesame-cottonseed (80:20) and (20:80) and sesame-corn along with control were intermediary. It can be further concluded that the products can be analysed chemically for their physico-chemical parameters and correlate the same with the sensory evaluation of the product to ensure optimal compliance with and acceptance of the experimental products.

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