

Research Article

Acceptability assessment of yellow colour obtained from turmeric in food products and at consumer level

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Abstract

Water soluble liquid formulation (WSLF) and fat soluble crystallized powder (FSCP) prepared from yellow pigment i.e. curcumin extracted from turmeric (*Curcuma longa*) was evaluated for their acceptability in food products and at consumer level. WSLF was used to colour various sweet and savoury products in the range of 0.01-0.5 ml/100g of product, whereas FSCP was added 5-10 mg/100 g in only two products. Acceptability scores were graded between 8.0-8.7 and indicated that colour of the products was highly acceptable by the panel members. A survey was also conducted to assess the consumer acceptability and market potential of developed colour. The result indicated that the majority of consumers use yellow colour in food products, 34% of consumers had knowledge about food colouring obtained from natural sources and all preferred to use natural colouring. Both liquid and crystal formulation can easily be used in food products at home and had good market potential.

Keywords: food colouring, *Curcuma longa*, curcumin, additives, India.

Introduction

Colour is one of the most important sensory qualities as it helps us to accept or reject particular food items. Colour is important in consumer perception of food and it is often associated with a specific flavour and intensity of flavour. Colour is used to add or restore colour of a food in order to enhance its visual appeal and to match consumer expectations [1]. Presently, there is an increased global trend towards usage of natural colours in food, pharmaceutical and personal care industries. Much awareness is created amongst consumers regarding natural products and adopting a more natural way of life. Currently, people prefer natural food, herbal medicines, natural curing practices and even organic farming i.e. without using chemical fertilizers and pesticides. This is mostly due to the rampant use of synthetic chemicals, colours, and derived

products that has lead to various human health hazards. Due to the adverse effect of synthetic dyes, all countries have made strict regulations about the permitted colours to be used as food additives [2].

The advantages of using natural colourants are many as they are eco-friendly, safe for body contact, unsophisticated and harmonized with nature, obtained from renewable sources and also their preparation involves a minimum possibility of chemical reactions. Generally natural dyes do not cause health hazards; on the contrary, they sometimes act as a health cures like *rathanjot*, turmeric and annatto etc. Furthermore, the use of natural dyes offers no disposal problems [3].

India produces about 135 tonnes of synthetic food colours and this is just about 1.5% of the world production. The Indian population consumes 220 mg of food colours per year [4]. Food products such as sweets, beverages, confectioneries, bakery products, desserts, etc are routinely brushed with bright colours. Tartrazine, a synthetic dye, is the most commonly used yellow colouring agent commercially available in the market. Turmeric (*Curcuma longa*) is a spice commonly used to impart yellow colour at household level, mostly for spicy preparation, however its direct use for sweet products is mostly limited due to its typical flavour and taste. Curcumin, the major colouring principal present in turmeric, can be extracted and used as a natural food colour. These pigments can be used as food colouring and flavouring agents in the food industry as substitutes for synthetic dyes like tartrazin [5].

The Draft Codex General Standard for Food Additives provides an extensive list of food items in which curcumin is used as a colouring agent, i.e. dairy products, fats, oils and fat emulsions, edible ices, fruit and vegetable products, confectionery, cereal products, bakery wares, meat and meat products, fish and fish products, eggs and eggs products, spices, soups, sauces and protein products, foodstuffs intended for particular nutritional uses, beverages, ready-to-eat savouries and composite foods [6]. However, these natural colours are yet to find a place in the Indian market for domestic use. Normally *kesar* is added to give yellow colour to many sweets. This is a very expensive commodity hence curcumin formulation can serve a cheaper substitute.

In previous work, ready to use water soluble liquid formulation and fat soluble crystallized powder from curcumin oleoresin were prepared [7]. Hence in the present investigation acceptability of these formulations was assessed in food products, at consumer level and the market potential of developed colour was also evaluated.

Materials and Methods

Development of liquid and crystal colour

Water soluble liquid formulations (WSLF) were developed from turmeric oleoresin by adding polysorbate (Tween 80) followed by mixing in cyclomixer, whereas fat soluble crystallized powder (FSCP) was prepared by crystallization of concentrated oleoresin using petroleum ether. The detailed methods for preparing liquid and crystallized formulation are as described in the previous study [7], and these developed colours were incorporated in selected food products.

Product development

Ten selected food products such as sweet and *namkeen boondi*, *besan burfi*, *jalebi*, *khaja papadi*, *besan sev*, *paneer peetha laddoo*, *shrikhand*, *kulfi*, pineapple squash and *mysore pak* were prepared as per standard recipes. After cleaning and removing the inedible portion, ingredients required for each recipe were accurately weighed on an electronic balance. These products were standardized in the laboratory for their quantity of colour and time of addition of colour. The

quantity of colour and time of addition of colour is given in Table 1. A group of 10 panel members were selected by threshold test as suggested by Swaminathan [8]. Acceptability test was conducted using 9 point hedonic scale.

Table 1. Food Products Prepared with Water Soluble Liquid Formulation.

Name	Quantity of colour (ml/100g)	Addition time
<i>Sweet boondi</i>	0.4	Sugar Syrup
<i>Namkeen boondi</i>	0.4	Batter
<i>Besan burfi</i>	0.4	Sugar Syrup
<i>Jalebi</i>	0.5	Fermented batter
<i>Besan Sev</i>	0.4	Batter
<i>Khaja papadi</i>	0.04	Milk
<i>Paneer peetha laddoo</i>	0.01	Grated <i>paneer</i> and <i>peetha</i>
<i>Shrikhand</i>	0.01	Curd
<i>Kulfi</i>	0.02/1litre	Milk (just before freezing)
Pineapple squash	0.02	Sugar syrup

Consumer acceptability assessment

After the lab trials for acceptability of product, fill testing was conducted to assess the market potential of the colour. This was done in two parts; one at consumer level and other at shopkeeper selling such items. An interview schedule was developed to collect the information regarding food colours from consumers.

Selection of families for product development

Fifty families were selected by personal contacts for the collection of information presented in first part of interview schedule. On the basis of their willingness and availability, 25 families were selected for distribution of colour for the preparation of food products with developed colour.

Distribution of colour

About 2ml of WSLF was packed in glass vials (tubes) and distributed to the selected 25 families by the investigator. The families were asked to use the colour in various food products from the list supplied with the interview schedule and were permitted to prepare any other products to evaluate their innovativeness. The products prepared by each family was then evaluated by them using the 9 point hedonic scale.

Feedback

Feedback from families regarding the acceptability of developed colour in food products was taken.

Assessment of market potential

Market potential of any product is necessary to know the status of that particular product in the market or its need in the market. Survey of 15 shops (7 general stores and 8 sweet homes) of different areas of Udaipur City was conducted for the collection of information regarding the food colours.

Results and Discussion

Unquestionably, the colour is a vital constituent of food. It is one of the rapid and indispensable factors deciding the quality and acceptability by the consumer. Generally artificial colours are added to improve the appearance of processed and preserved food products. Normally it has been appreciated that where natural colour of food is unattractive, colouring matter may be added. Of the colouring agents available some of them are soluble in water, some in oil, while others in acid and alkalies. In the present study acceptability of water soluble liquid formulations and fat soluble crystallized powder was assessed in food products and at the consumer level. Liquid colour being soluble in aqueous medium was ready for use in food products, whereas crystallized colour had poor solubility in aqueous solution, hence was not found suitable for adding as such. Crystallized colour was first solublized in hot fat and then used in the food products. Delgado-Vargas and Paredes-Lopez [9] also reported that curcumin or curcuminoid concentrate is insoluble in water and is not suitable for use as food colour in products, whereas oleoresin is cheaper as compared to crystals and is satisfactory for most of the uses in food products. Nielsen and Holst [10] found that typical products for use in the food industry have a curcumin (yellow pigment of turmeric) content of 4-10% which is achieved by dispersing pure curcumin in a mixture of food-grade solvent and emulsifier, by dissolving in vegetable oil, or by spraying onto starch.

Products prepared with WSLF

Sweet boondi

Boondi is a popular Indian snack. It is consumed in both sweet and salted variety. It gets its name from the Hindi word for drops or droplets - *Boond*. To prepare *sweet boondi*, gram flour batter is made into small balls using a ladle with holes. These balls are deep fried in oil/ghee and then immersed in sugar syrup. Ingredients for *sweet boondi* include 100g gram flour, 400mg baking soda, 400g sugar for syrup preparation and ghee for frying.

The colour was added to the sugar syrup and this imparted the colour and taste to the *sweet boondi*. The final products were subjected to evaluation by a group of panel members. Mean score for colour of *sweet boondi* was 8.1, indicating that it was liked very much by the panel. Overall acceptability was graded at 8 indicating very high acceptability of *sweet boondi*. Hendry and Houghton [11] also specified the limits or standards for curcumin in various food items such as 300 mg/kg in confectionary, 200mg/kg in fine bakery wares (viennoiseric, biscuits, cake and wafers), 500 mg/kg in decoration and coatings, 200 mg/kg in candied fruits, vegetables and preserves of red fruit, 500 mg/kg sauce and seasonings (for e.g., curry powder, tandoori pickles, relishes, chutney and piccalilli).

Khara boondi

In preparing *Khara* (salted) *boondi*, the batter is mixed with spices and salt before frying. *Khara boondi* is eaten as such or is added to *namkeen*-mixture or curd to give *rayta*. *Namkeen boondi* ingredients are similar to sweet *boondi* except sugar, red chili and salt are sprinkled after frying *boondi*.

In *Khara boondi*, colour was incorporated in the preparation of batter in different quantities and then visual acceptance of colour was assessed. *Boondi* prepared by addition of 0.4 ml/ raw besan gave acceptable colour. The mean acceptability of *namkeen boondi* was 8.65 indicating that it was extremely liked by the members. The colour, flavour and taste of *namkeen boondi* recorded at 9 point scale were 8.7, meaning it was extremely liked by members.

Besan burfi

Besan burfi is a traditional *mithai* (sweet) made with gram flour and sugar. *Besan burfi* ingredients included 100g gram flour, 25g ghee, 10 ml milk and 50g sugar.

Besan burfi was prepared with the addition of sugar syrup with different quantities of colour added to *burfi* prepared from 100g raw *besan*. Acceptance of colour was judged visually by the investigators and members working in the laboratory. *Besan burfi* prepared with 0.4ml/100g raw *besan* colour was found acceptable so the final product was prepared with 0.4 ml of colour and presented to panel members for organoleptic evaluation. The mean score for overall acceptability was 8.1, thereby suggesting that the *burfi* was liked very much by the members Mean score for characteristics viz. colour, taste, flavour, appearance were 8.2, 8.2, 8.1 and 8.3 respectively.

Namkeen besan sev

Besan sev, is a variety of *farsan* or crunchy fried snacks made from Bengal gram flour. It is commonly used as a snack and found in most households. Ingredients include 100g gram flour, 30ml oil, 4g salt and oil for frying.

In *besan sev*, the colour was added in the preparation of batter in different amounts and 0.4ml/100g raw *besan* gave the best appearance. The acceptability scores of *sev* for various characteristics ranged between 8.4 to 8.7 out of 9 points revealing that it was liked extremely by panel members.

Jalebi

Jalebi is a sweet commonly sold in India, Pakistan and Bangladesh. It is made from deep-fried, syrup-soaked batter and shaped into a large, chaotic pretzel shape, rather like the American funnel cake. *Jalebis* are mostly bright orange in colour. The sugars get partly fermented which is thought to add flavour to the dish. Ingredients for *Jalebi* include 100g refined wheat flour, 25g curd, 100g sugar for syrup and 100g ghee for frying.

The 0.5ml liquid colour/100g wheat flour gave acceptable colour. Overall acceptability scores considering various characteristics was 7.9 at nine point scale indicating that the product with addition of colour was highly acceptable. The water soluble form of curcumin has been applied onto extruded food products, made from corn and defatted soybean flour, as reported by Sowbhagya *et al.* [12].

Khaja papadi

Khaja papadi is a sweet snack of Rajasthan state of India. It is prepared in almost every household at the time of festivals like holi, shitla-satam, Gangoar etc. Refined wheat flour, sugar

and edible oils are the chief ingredients of *khaja*. First, dough is made out of wheat flour, oil, milk and sugar. Then it is deep fried until crisp. Ingredients include 100g refined wheat flour, 40g ghee, 40ml milk and 20g sugar.

For the preparation of *khaja*, colour 0.04ml/100g was mixed well in milk and dough was then prepared with this milk. Mean scores show that it has good acceptability after addition of developed colour. The mean score for various characteristics were appearance 8.2, flavour 8.3, colour and taste 8.4 and overall acceptability 8.3. The application of annatto dye formulation in bakery and extruded food products such as rice and wheat noodles, rice and sago fryums, as well as baked food such as sugar cones and wafer biscuits has been studied. Desired shades of yellow-orange to bright orange colour were obtained by using a dye formulation in a range of 15–50 mg norbixin/kg of the product.

Paneer peethe laddoo

Laddoo is an Indian and Pakistani sweet that is often prepared to celebrate festivals or household events such as weddings. *Paneer peethe laddoo* is a one of the varieties of traditional *laddoo*. It is prepared with *paneer*, wax gourd (*Agra ke peethe*) and cardamom and colour. The colour is added to make them attractive. The preparation of *paneer peethe laddoo* is very quick and easy. It is a very nutritious and also liked by children, as well as adults. Ingredients for *paneer peetha laddoo* were 50g *paneer*, 50g *peetha* and 1 cardamom.

The colour was added in grated *paneer* and *peetha*, mixed and bound to make *laddoo*. Initially 0.02ml of colour was incorporated. The colour appeared bright, so the final product was made with 0.01ml of colour. Mean score of *paneer peetha laddoo* given by the panel members for colour and taste were 8.3 revealing very high acceptability. Hendry and Houghton [11] also determined levels of curcumin in flavoured processed cheese and desserts including flavoured milk products i.e., 100 and 150 mg/kg.

Shrikhand

Shrikhand is an Indian dessert made of strained yogurt. It is one of the main desserts in Gujarati cuisine and a common side dish in Maharashtrian cuisine. The yogurt is tied and hung until all the water has drained off, the result being a thick and creamy yogurt. Ingredients for *shrikhand* include 400g curd and 50g sugar.

0.01 ml of colour was added in 5ml milk which was then mixed in whey drained curds. The mean score for *shrikhand* indicated that this product was acceptable by the panel members. The overall acceptability score was 8.2, whereas for colour, taste, flavour and appearance the scores were 8.5, 8.2, 7.9 and 8.3 respectively. Similarly, Peter [13] describes 5 ppm curcumin as giving an acceptable colour in yoghurt. The colouring agent from red beet is suitable for use in dairy products (kefir, yoghurt) and other food having a pH 7.0.

Kulfi

Kulfi is a popular South Asian dessert made with pure milk. *Kulfi* is prepared by boiling milk until it is reduced by half. Then sugar is added and the mixture is boiled for another ten minutes. Then flavourings, dried fruit, cardamom, etc. are added. The mixture is then cooled, put in moulds and frozen. It comes in many flavours, including pistachio, *malai*, mango, cardamom (*elaichi*), saffron (*kesar*). *Kulfi* ingredients include 1kg milk, 50g sugar, 2 drops vanilla essence and 2 cardamoms.

0.02ml of colour was added to milk when the half the volume was left, along with sugar and cardamom and boiled for a minute. Peter [13] also reported that vanilla ice cream can be coloured with a combination of curcumin (200 ppm) and norbixin (12 ppm). Table 2 shows the mean \pm SD scores for the *Kulfi* given by 10 panel members. For the colour of *kulfi*, the mean score was 8.4 which showed that it was liked very much by the panel of members.

Table 2: Scores of organoleptic characteristics of developed food products using/added WSLF and FSCP.

Characteristics	Colour	Taste	Flavour	Appearance	Overall acceptability	Mean acceptability (N=50)
Sweet Boondi	8.1 \pm 0.568 (0.179)	8.1 \pm 0.568 (0.179)	7.9 \pm 0.316 (0.099)	8.0 \pm 0.816 (0.258)	8.0 \pm 0.095 (0.030)	8.0 \pm 0.082 (0.026)
Khara Boondi	8.7 \pm 0.483 (0.153)	8.7 \pm 0.483 (0.153)	8.7 \pm 0.483 (0.153)	8.6 \pm 0.699 (0.221)	8.7 \pm 0.05 (0.016)	8.7 \pm 0.043 (0.014)
Besan Burfi (Liquid colour)	8.2 \pm 0.422 (0.133)	8.2 \pm 0.788 (0.244)	7.9 \pm 0.567 (0.179)	8.3 \pm 0.483 (0.153)	8.1 \pm 0.173 (0.055)	8.1 \pm 0.15 (0.047)
Jalebi	8.1 \pm 0.738 (0.233)	8.0 \pm 0.666 (0.211)	7.9 \pm 0.632 (0.199)	7.8 \pm 0.789 (0.249)	7.9 \pm 0.125 (0.039)	7.9 \pm 0.108 (0.034)
Namkeen besan Sev	8.5 \pm 0.707 (0.223)	8.7 \pm 0.483 (0.153)	8.4 \pm 0.516 (0.163)	8.5 \pm 0.527 (0.166)	8.5 \pm 0.126 (0.039)	8.0 \pm 0.108 (0.034)
Sweet Maida Papadi	8.4 \pm 0.699 (0.221)	8.4 \pm 0.516 (0.163)	8.3 \pm 0.483 (0.153)	8.2 \pm 0.632 (0.199)	8.3 \pm 0.096 (0.030)	8.3 \pm 0.083 (0.026)
Paneer Pethee Laddoo	8.3 \pm 0.483 (0.153)	8.3 \pm 0.483 (0.153)	7.9 \pm 0.738 (0.233)	8.3 \pm 0.483 (0.153)	8.2 \pm 0.2 (0.063)	8.2 \pm 0.173 (0.055)
Shrikhand	8.5 \pm 0.527 (0.166)	8.3 \pm 0.948 (0.299)	8.2 \pm 0.918 (0.290)	7.9 \pm 0.568 (0.179)	8.2 \pm 0.25 (0.079)	8.2 \pm 0.216 (0.068)
Kulfi	8.4 \pm 0.516 (0.163)	8.3 \pm 0.483 (0.153)	8.2 \pm 0.632 (0.199)	7.9 \pm 0.316 (0.099)	8.2 \pm 0.216 (0.068)	8.2 \pm 0.187 (0.059)
Pineapple squash	8.6 \pm 0.516 (0.164)	8.2 \pm 0.788 (0.244)	7.9 \pm 0.567 (0.179)	8.3 \pm 0.483 (0.153)	8.1 \pm 0.173 (0.055)	8.1 \pm 0.15 (0.047)
Besan Burfi (Crystallized colour)	8.5 \pm 0.5 (0.158)	8.3 \pm 0.64 (0.203)	8.2 \pm 0.87 (0.276)	8.2 \pm 0.60 (0.189)	8.3 \pm 0.444 (0.141)	8.3 \pm 0.638 (0.09)
Mysore Pak	8.0 \pm 0.774 (0.295)	8.0 \pm 0.632 (0.2)	8.3 \pm 0.640 (0.202)	8.3 \pm 0.640 (0.202)	8.1 \pm 0.614 (0.194)	8.1 \pm 0.676 (0.096)

* All values are Mean \pm SD (SE)

* Ten panel members for each product

Pineapple squash

Squash is a common beverage being consumed since a long time. It consists essentially of strained juice containing a moderate amount of fruit pulp to which sugar is added for sweetening. Fruit squash are valuable from the nutritional point of view as they are rich in vitamins, minerals and other nutritive components [14]. Ingredients for pineapple squash are 100ml pineapple juice, 100g sugar and 2g citric acid.

In the pineapple squash the colour was incorporated in the preparation of sugar syrup in various quantities. The mean score for all the characteristics showed that the pineapple squash was liked very much to extremely liked by the panel members (Table 2). Hendry and Houghton [11] described the limits of curcumin in non-alcoholic flavoured beverages were 100mg/litre. Kirca, *et.al.* [15] also added black carrot juice concentrate to enhance the colour of strawberry jams prepared from two locally grown cultivars, Osmanli and Kara.

Products prepared using FSCP

Two products i.e. *besan burfi* and *mysore pak* were prepared with FSCP. Crystallized colour has poor solubility in water so that it was dissolved in hot oil/ghee. Oil/Ghee was heated to a temperature that is equal to melting temperature. This coloured oil/ghee was used in food products. Commission Directives [16] describe use levels of yellow pigment of turmeric (curcumin) and these are in the range from 5 to 500 mg/kg depending on the food category.

Besan burfi

Various ingredients and the steps involved in preparation of the *besan burfi* was similar to the steps involved in preparation *besan burfi* with liquid colour except colour (20mg/100g *besan*) was added in heated ghee used as shortening in preparation of hard dough. The mean score for all the characteristics were appearance and flavour, 8.2, colour, 8.5, taste and overall acceptability 8.3 (Table 2). The result showed that the *besan burfi* prepared with crystallized colour was liked very much by the panel members. Annatto, paprika, turmeric and carmine are encapsulated to provide natural colours with high colouring power combined with increased stability. The powders have good solubility and increased bulk stability and are low dusting and free flowing. They can be used in a wide number of applications including beverages (fruit juice and cloudy soft drinks) in which all colour shades from light yellow to deep rhubarb red can be achieved.

Mysore pak

Mysore pak is a sweet dish of Karnataka, usually served as a dessert. It is made of generous amounts of ghee, sugar and bengal gram (*besan*) flour. Ingredients include 100g gram flour, 250g ghee and 100g sugar.

In the formulation of *Mysore pak*, 10mg/100g colour was added in ghee. The mean \pm SD score given in Table 2 reveals that *Mysore pak* showed good acceptability for all the organoleptic characteristics. The mean score for various characteristics were appearance and flavour 8.3, colour and taste, 8.0 and overall acceptability 8.15 (Table 2).

Consumer acceptability

Quality is an essential feature that will lead the consumer to select or not any food product. With numerous food scares that have hit the food market, consumers have become much more aware and therefore selective in their choice of food. Quality includes many aspects from safety to nutrition, sensory characteristics to service qualities. Consumers integrate these concepts to decide which product to buy according to their own criteria. A safe product is an essential requirement but will never suffice to sell a product. Consumers want an attractive product in terms of organoleptic properties at a price they consider appropriate. It should satisfy their needs in terms of service provided (e.g. convenience, ease of opening) and more and more related to specific nutritional needs (vitamins, functional ingredients, low calories, low salt). In summary, quality is the combination of features in a product which ensure customer satisfaction [17]. The consumer acceptability of developed colour was assessed by interviewing 50 families and information was collected regarding their knowledge about food colour i.e. types and forms available in the market, usage in food products, preferences and avoidance of natural and synthetic colours and their willingness to use developed colour in food products.

Information regarding the knowledge of food colours by consumers

Table 3 depicts knowledge of food colours among the consumers. It appeared that all the families had knowledge about the use of food colours in food products. About 98% of women knew of a powder form of colour while 86% knew of a liquid form. The majority of women (86%) used colouring agents in food products at the home level and amongst this group, 78% were using yellow colour. About 34% of consumers had knowledge that food colours can be obtained from natural sources. All the consumers showed preference for food colours from natural sources. Reasons to prefer natural colour as given by consumers were due to ill effects of synthetic colour (82%) and colour quality and medicinal value of natural colour (20%). Only 4% considered cost also while preferring colour from natural sources. Nayak and Nath [18] carried out a survey to study dietary intake of synthetic colour by school children. They found that mean

intake of various (permitted and non-permitted) colours was found to be in the range of 0.38-45.42 ppm. The intake of non-permitted colours was high in savouries in the range of 24.92-39.90 ppm. Similarly, the intake of permitted colours was high in beverages which were in the range of 0.83-45.42 ppm.

Table 3. Information Regarding Knowledge of Food Colours among Consumers.

S.no.	Details	Number (%)
1.	Knowledge about food colours and their forms a. Powder b. Liquid	50 (100%) 49 (98%) 43 (86%)
2.	Uses of food colours I. Users a. Yellow b. Green c. Red II. Nonusers Reasons for not using food colour a. Do not know about the colour b. Colour available in the market are harmful c. Do not like to use colour d. Any other	43 (86%) 39 (78%) 8 (16%) 18 (36%) 7 (14%) 0 6 (12%) 2 common 4 (8%) 2 1(2%)
3.	Knowledge about food colour obtained from natural sources	17 (34%)
4.	Preference of using food colour* a. Synthetic b. Natural c. Both	0 48 (96%) 2 (4%)
5.	Reasons for preference of using natural food colour a. Colour quality b. Ill effects of synthetic colour c. Medicinal value d. Cost factor	10 (20%) 41 (82%) 10 (20%) 1 (2%)
6.	Interested to use food colour from natural sources provided by the investigator	49 (98%)

* n = 50

* Even the non- users were asked about their preferences in case they were to use food colours.

Assessment of turmeric colour in food products prepared by the consumers

The WSLF was given to twenty-five selected families on the basis of their willingness and cooperation for the preparation of food products. In all thirty-one products were prepared by the families with the turmeric colour. A comprehensive list of products in which yellow colour is added, was provided to consumers for the development of products. Seventeen consumers added the developed colour given to them in *kheer* (rice and vermicilli), sweet rice, *halwa* (wheat and gram flour), *besan burfi*, mango shake, *jalebi*, ice cream and *shrikhand* etc. Some products other than list were also prepared by consumers includes *kheer (sabu danna and samma)*, *halwa*

(semolina and bottle gourd), *tender maize jajria*, *tender maize burfi*, *aam ka murrabba*, cake and *malpuae*. All the twenty-five consumers liked the colour.

Preferences regarding type of packaging and quantity of colour in packets were also asked to the consumers. All the twenty-five consumers preferred bottle packing than the pouch packing and ten consumers preferred 5ml packing and ten gave preference to 10 ml packing, whereas four and two consumers preferred 15 and 20 ml packing of colour. All consumers were interested in purchasing natural colour at a cost even if it were to be higher than the synthetic colour (Table 4). Lange [19] studied how name and packaging information could affect orange juice liking under economical constraints. The author observed differences between hedonic responses under blind conditions when various information and economical constraints were given. Other researchers have investigated the influence of health and nutrition information on liking [20].

Organoleptic evaluation of food products prepared by consumers

Table 5 shows the percentage distribution of panel members by scores for various characteristics of food products. It was observed that score of 8 was given by 77% and 65% respectively for overall acceptability and colour. Scores revealed a very high acceptability of product with colour. The potential of consumer input into the development of food quality specifications has been described by McEwan [21] to relate sensory characteristics (as defined by a trained panel) and the acceptability range as defined by the consumer. The research involved canned grapefruit and it was shown that the main deterrent to quality acceptability was found to be any physical defect that was perceived to have a negative effect on the texture and flavour.

Market potential

In an increasingly competitive market, there is a great need to ask the existing and potential customers what they like and dislike through preference tests. The market potential of developed colour was assessed by interviewing 15 shopkeepers of general stores, as well as sweet homes of different area of Udaipur city. About 86% of shopkeepers sell powder or crystal form of colour. All the shopkeepers keep yellow colour and about 57% of shopkeepers sell red and green colour. The powder colour as well as liquid colour is sold at a price of Rs. 7 per 10g and Rs. 12 per 20ml respectively in the market. 71% of shopkeepers sold food colours of Rs. 500 to 1000 per year (Table 6).

Information obtained from shopkeepers of Sweet homes revealed that all shopkeepers use yellow colour in a various sweets while 63 and 50% were adding red and green colour in sweets along with yellow colour. Only powder form of colour was used by all shopkeepers. The shopkeepers used food colour mainly in *Boondi ke laddoo*, *Besan burfi*, *Jalebi*, *Kesar bhatti*, *Mava Bhatti*, *Coconut burfi*, *Mava burfi*, *Malpuae*, *Balushahi*. Some of them were also using colour additives in sweets like Apple shaped *mithai*, *Amrood mithai* and *Sitaphal mithai* in which colour is used mainly for decoration.

The result of information obtained from shopkeepers of both the shops i.e. general store and sweet homes indicated that 13% have knowledge about food colours obtained from synthetic sources. Out of fifteen, 7 shopkeepers had an idea about the health hazards of synthetic colour if it is not added within permissible limits. All 15 shopkeepers were interested to use and sell natural colour. All the shopkeepers were interested to purchase natural colour even at a cost higher than the synthetic colour (Table 6).

Table 4. Products prepared by consumers with developed colour.

S. No.	Details	Frequency
1.	Number wise distribution of the household preparation a. Total number of food products prepared b. Consumer prepared one product c. Consumer prepared two product d. Consumer prepared more than two product	31 18 6 1
2.	Name of the product prepared by the Consumers I. As per list of food items provided* a. Kheer (i) Rice kheer (ii) Vermicelli kheer b. Sweet rice c. Halwa (i) Wheat flour halwa (ii) Gram flour halwa d. Besan burfi e. Mango Shake f. Jalebi g. Ice cream h. Shrikhand i. Besan sev II. Innovative products made other than above a. Kheer (i) Sabu danna kheer (ii) Samma kheer b. Halwa (i) Semolina ka halwa (ii) Bottle gourd halwa c. Tender maize Jajria d. Tender maize burfi e. Aam ka murrabba f. Cake g. Malpuae	6 5 1 6 2 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 2
3.	No of Consumer approved the use of Colour	25
4.	Preference regarding type of packaging a. Bottle b. Pouch	25 0
5.	Preference regarding quantity of Colour in each packaging a. 5ml b. 10ml c. 15ml d. 20ml	10 10 4 2
6.	Interested to purchase food colours of natural sources at cost Even if more than the cost of synthetic colour	25

Table 5. Percentage distribution of consumers by acceptability scores of food products.

S. No.	Scores* Characteristics	7	8	9
1.	Colour	3 %	65%	32%
2.	Taste	-	74%	26%
3.	Flavour	6%	81%	13%
4.	Texture	3%	74%	23%
5.	Appearance	-	64%	32%
6.	Overall acceptability	-	77%	23%

* Evaluation scores of 9 point hedonic scale

Table 6. Assessment of market potential of turmeric colour by shopkeepers.

No.	Details	Number (%)
1.	No. of shopkeepers surveyed No. of shopkeepers of general store No. of shopkeepers of Sweet homes	15 7 (47 %) 8 (53%)
2.	Age of shopkeepers a. 20-30 years b. 30-40 years c. 40- 50 years d. More than 50 years	3 (20%) 7 (47%) 3 (20%) 2 (13%)
3.	Educational Qualification a. Secondary b. Senior secondary c. Graduates d. Post graduates	10 (67%) 2 (13%) 2 (13%) 1 (7%)
4.	Information obtained from shopkeepers of general store Sold food colours at their shop I. Kind of food colour sold a. Powder b. Liquid c. Both II. Type of food colour available in shop a. Yellow b. Green c. Red	7 (100%) 6 (86%) 3 (43%) 2 (29%) 7 (100%) 4 (57%) 4 (57%)
5.	Price at which colour sold in market a. Powder b. Liquid	7 Rs./ 10g 12 Rs./ 20ml
6.	Quantity of colour sold in a year a. 100-500 Rs. b. 500-1000 Rs. c. More than 1000 Rs.	2 (29%) 5 (71%) -
8.	Information obtained from shopkeepers of sweet homes Usage of food colours a. Yellow b. Green c. Red	8 (100%) 8 (100%) 4 (50%) 5 (63%)

9.	Form of food colours used a. Powder b. Liquid Type of colour used	8 (100%) Bush company (62 Rs./ 100 g)
10.	Name of the recipe in colour is used a. Boondi ke laddoo b. Besan burfi c. Jalebi d. Kesar bhatti e. Mava Bhatti f. Coconut burfi g. Mava burfi (Decoration) h. Malpuae i. Balushahi j. Apple shaped mithai (Decoration) k. Amrood mithai (Decoration) l. Sitaphal mithai (Decoration)	7 (86%) 8 (100%) 5 (63%) 3 (38%) 8 (100%) 6 (75%) 8 (100%) 5 (63%) 4 (50%) 4 (50%) 2 (25%) 2 (25%)
11.	Information obtained from shopkeepers of both the shops Knowledge about food colour obtained from sources i.e. synthetic and natural	2 (13%)
12.	Knowledge about health hazards of synthetic colour	7 (47%)
13.	Interested to use/ sell food colour from natural sources	15 (100%)
14.	Interested to purchase food colours of natural sources in cost a. less than the cost of synthetic colour b. Equal to the cost of synthetic colour c. More than the cost of synthetic colour	- - 15 (100%)

Conclusion

It can be concluded from this work that the water soluble liquid formulation prepared can easily be incorporated into sweet and savoury products. These products had very high acceptability scores. The FSCP being water insoluble finds its acceptable incorporation only in products wherein heated fat is used. The developed colour showed good market potential at consumer and shopkeeper level.

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