

FOOD WASTE MINIMIZATION THROUGH VALUE ADDITION OF THE UGLY'S

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ABSTRACT:

India holds the second position in the annual production of fruits and vegetables with 132 million metric tons worldwide. About 30-40 per cent of vegetable and fruit produce go misused in the country every year. Mostly imperfect produce often called “Ugly” fruits and vegetables are thrown into garbage heaps. Fruits and vegetables having odd shapes and blemishes are often discarded because they do not meet the market standards. Even though there is an oddity in appearance there is no impact on nutrition. To minimize this wastage, food colours have been developed using ugly fruits and vegetables through natural sun drying and these colours are incorporated into traditional recipes and their acceptability was tested. A significant difference was not observed between the food-colour-incorporated recipes and the traditional ones. The food-colour-added recipes were found to be acceptable. These food colours can be used as natural food additives in various food preparations at the commercial and domestic levels.

Key Words: Food wastage, Ugly fruits and vegetables, food colours, value-added products.

INTRODUCTION

Fruit and vegetables are thrown in large quantities in market yards. On an average half of the fruit and vegetables, harvested get rejected purely for cosmetic reasons. In general imperfect, misfits, off-sized often termed “Ugly” fruits and vegetables when sold commercially fail to reach market standards even though they are as nutritious as their aesthetically-pleasing counterparts and tend to fall into dumpsites. As stated by Central Institute of Post-Harvest Engineering and Technology 18 % of India's vegetable and fruit produce is wasted annually valued at Rs 13300 crores. In India, vegetable and fruit wastes comprise about 5.6 million tons annually and they are dumped in the outskirts of cities.

Ugly fruit and vegetable wastes are one of the main causes of pollution hence it is becoming very crucial to solve this problem. Twisted carrots, root vegetables in funky

shapes, and leaf greens with pest damage can be prepared into food colours using a simple method called drying. Food colours contain natural plant pigments which have anticarcinogenic and anti-inflammatory properties. These additives have a good shelf life and can be incorporated into traditional food preparations thereby adding value to them.

MATERIALS AND METHODS

Ugly fruits and vegetables such as carrots, beetroots, raspberries, blueberries, mangoes, spinach, and fenugreek leaves were collected from the local market.

Procedure for the development of food colours

Fruit and Vegetable Powders

Fruits and vegetables are washed in salt water and then under running tap water. They are grated finely and are spread on a steel plate and kept in direct sunlight for 3-4 days until total moisture got removed and the product was dry and crispy. The dehydrated fruits and vegetables are ground to a fine powder and packed in airtight containers.

Concentrated liquids

Concentrated liquids are also prepared using Ugly fruits and vegetables. The fruits and vegetables are ground to liquid and boiled until they reached a thick consistency, cooled and stored in an airtight container in a refrigerator.

Preparation of some commonly consumed recipes using food colours

Commonly consumed Indian recipes such as Kesari, Laddu, Cake, Cookies, Jams, Jellies, Biryani and Jeera rice were prepared using food colours made from Ugly fruits and vegetables.

Sensory Evaluation

The recipes prepared by adding food colours were used for evaluating sensory properties. A panel of 10 judges evaluated the recipes. A Multiple Sample Difference Test was used to evaluate the flavour and taste of the food colour incorporated recipes with that of traditional recipes (Maynard, 1965). A hedonic rating scale was also used to measure the degree of pleasurable and unpleasurable experience of tasting the recipes on a scale of nine points ranging from like extremely to dislike extremely with scores, like extremely=9, like very much=8, like moderately=7, like slightly=6, neither likes nor dislikes=5, dislike slightly=4, dislike moderately=3, dislike very much=2, dislike extremely=1 (Maynard, 1965).

Quality Analysis

Total bacterial count, yeast and mould counts and moisture content was evaluated using standard procedures. Moisture content was determined using AOAC method.

Statistical Analysis

The information acquired through sensory evaluation was statistically analyzed using Means, Standard deviations and ANOVA.

RESULTS AND DISCUSSION

In the present study, various natural food colours were obtained from Ugly fruits and vegetables. The orange colour was obtained from carrots. The red colour is from beetroot, pink from strawberries and raspberries. The blue colour was developed from blueberries, yellow colour from mangoes and green colour from spinach and fenugreek leaves. Fruits and vegetables hold a variety of pigments which have strong antioxidant properties and provide numerous health advantages. Carotenoids which impart yellow, orange and red colour possess anti-atherogenicity, anticancer and anti-inflammatory properties. They are strong antioxidants and can reduce oxidative stress (Young A.J and Lowe G.L 2018). Carotenoids help in delaying ageing, repairing the nervous system, preventing cardiovascular, cerebrovascular diseases, diabetes and osteoporosis (Roohbakhsh et al, 2017). Anthocyanins which give blue colour help in the prevention of cardiovascular diseases, diabetes and obesity. They also possess antioxidant, anti-inflammatory, anticancer and antimicrobial properties (Khoo H E et al, 2017 and Baby B et al, 2017). Betalains in beetroot help in detoxification along with antioxidant and anti-inflammatory support. They also help in cleaning the intestines and getting rid of bad odours and fungal infections from the body (Wang Lu et al, 2021).

Sensory Evaluation of Recipes prepared by incorporating food colours prepared from Ugly fruits and Vegetables.

The data on the Degree of difference in taste and flavour of recipes prepared by incorporating the food colours prepared from the Ugly's is given in table-I

Table – I Mean scores of Degree of Difference for taste and flavor

Attribute	Recipe	Mean ± S.D	f-value	p-value	Remarks
Taste	Kesari	0.6 ± 0.47	1.53	0.15	Not Sig
	Laddu	0.4 ± 0.81			
	Cake	0.2 ± 0.4			
	Cookies	0.4 ± 0.46			
	Jams	0.6 ± 0.51			
	Jellies	0.2 ± 0.54			
	Biryani	0.21 ± 0.51			
	Jeera rice	0.42 ± 0.23			
	Kesari	0.41 ± 0.45			
	Laddu	0.54 ± 0.4			
	Cake	0.12 ± 0.2			
	Cookies	1.4 ± 0.23			

Flavour	Jams	0.23 ± 1.4	1.45	0.22	Not Sig
	Jellies	0.6 ± 0.23			
	Biryani	0.12± 0.82			
	Jeera rice	0.23± 0.43			

When the Degree of Difference in taste and flavour between recipes prepared by incorporating the food colours prepared from the Ugly’s and traditional recipes was concerned no significant difference ($p \leq 0.05$) existed.

The data on the Direction of difference for taste and flavour of recipes prepared by incorporating the food colours prepared from the Ugly’s is given in table-II. The data on the Direction of Difference convey that a significant difference did not exist. The taste and flavour are same as that of the traditional sample.

Table – II Mean scores of Direction of Difference for taste and flavor

Attribute	Recipie	Mean± S.D	f- value	p- value	Remarks
Taste	Kesari	2.1 ± 0.62	2.12	0.11	Not Sig
	Laddu	1.5 ± 0.48			
	Cake	1.6 ± 0.45			
	Cookies	2.4 ± 0.48			
	Jams	1.4 ± 0.8			
	Jellies	1.9 ± 0.7			
	Biryani	2.2 ± 0.6			
	Jeera rice	1.5 ± 0.4			
Flavour	Kesari	2.2 ± 0	0.16	0.62	Not sig
	Laddus	1.7 ± 0.74			
	Cake	2.0 ± 0.63			
	Cookies	1.8 ± 0.4			
	Jams	1.8 ± 0			
	Jellies	1.5 ± 0.3			
	Biryani	1.4 ± 0.21			
	Jeera rice	1.3 ± 0.32			

The mean scores of Degree of Liking are presented in table – III. Analysis of mean

values of Degree of Liking on a nine-point Hedonic Rating Scale indicated that recipes were well accepted by all the panelists. The hidden flavour of fruits did not alter the taste and flavour of modified recipes instead gave an appealing colour. Incorporating these colours made the modified food more attractive compared to traditional recipes.

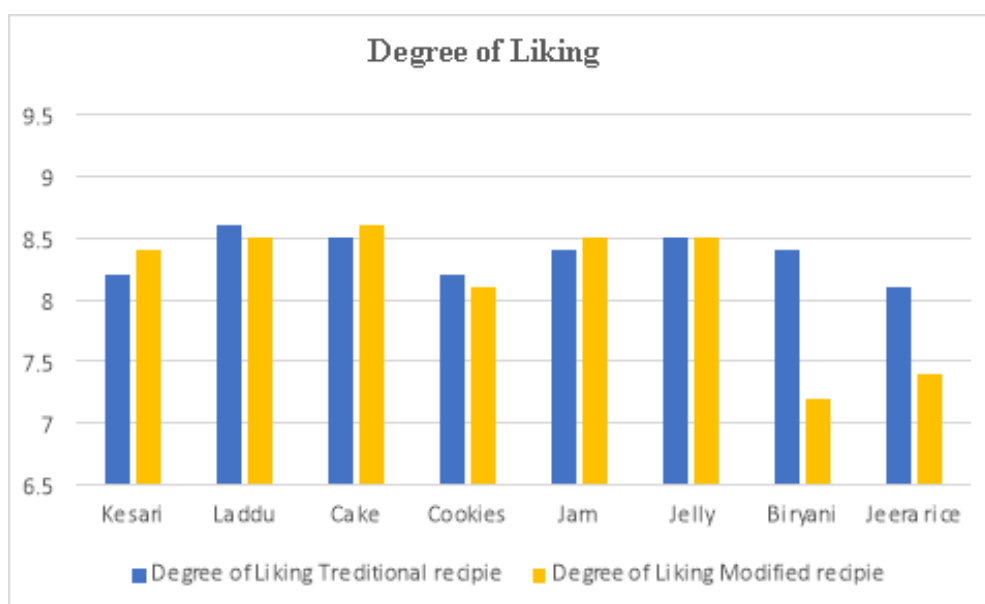
Table – III Mean scores of Degree of Liking

Name of the recipe	Sample	Mean \pm S.D	t- value	p- value	Remarks
Kesari	T	8.2 \pm 0.44	0.44	0.067	Not Sig
	M	8.4 \pm 0.14			
Laddu	T	8.6 \pm 0.32	2.121	0.061	Not Sig
	M	8.5 \pm 0.13			
Cake	T	8.5 \pm 0.54	1.231	0.062	Not Sig
	M	8.6 \pm 0.83			
Cookies	T	8.2 \pm 0.34	2.241	0.061	Not sig
	M	8.1 \pm 0.13			
Jams	T	8.4 \pm 0.13	1.432	0.056	Not sig
	M	8.5 \pm 0.21			
Jellies	T	8.5 \pm 0.44	1.341	0.061	Not sig
	M	8.5 \pm 0.54			
Biryani	T	8.4 \pm 0.53	2.683	0.028	Sig@5%
	M	7.2 \pm 0.81			
Jeera Rice	T	8.1 \pm 0.14	2.51	0.031	Sig@5%
	M	7.4 \pm 0.64			

T – Traditional Recipe

M – Modified Recipe

Fig – 1 Mean Scores of Hedonic Rating Scale indicating the Degree of Liking



Quality Analysis

Microbial Analysis

Despite fruits and vegetables being an essential source of nutrients, they are also excellent source of microorganisms which are pathogenic. Drying of fruits and vegetables reduces the moisture content and inhibits the growth of microorganisms. Hence there were no coliforms, enterobacteria, yeasts and molds. The bacterial load was also well within the admissible limits of $<10^2$ of total bacterial counts (Gilbert et al, 2000).

Table – IV Microbial Analysis of Samples

Sample	Standard Plate Count
Carrots	2×10^2
Beetroots	2.3×10^2
Raspberries	3×10^2
Blueberries	3×10^2
Mango	4×10^2
Spinach	2×10^2
Fenugreek leaves	2×10^2

Moisture Content

The safe moisture content for fruits and vegetables dried is about 20% or below, depending on the product. The moisture content ranged between 3.4 to 12.6 percent.

Table – V Moisture Content of samples

Sample	Moisture (%)
Carrots	8.5
Beetroots	10.8
Raspberries	3.4
Blueberries	5.2
Mango	12.6
Spinach	5.8
Fenugreek leaves	6.2

CONCLUSION

Colours in food make them appealing and pleasant to consume. Artificial colourants are generally added to food to make them attractive at the commercial and domestic levels. But they are proved to be toxic and carcinogenic. Now a day's people are conscious of consuming safe foods with added health advantages as an alternative to traditional foods. Hence preparation of food colours at home can be the best solution to this problem. The processing of the food colours is even easy at the domestic level and has a long shelf life. Ugly fruits and vegetables which are generally discarded can be used in the preparation since food wastage can be minimized and involves a low cost of production. Food colours made from ugly fruits and vegetables such as mango, beetroot, spinach etc can be used as a substitute for artificial food colouring substances, and they can be used as natural food additives.

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