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Development, standardization and sensory and nutritional analysis of Beetroot powder fortified cookies

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Abstract
Fruits and vegetables are very crucial sources of nutrients especially micronutrients like vitamins and minerals. Beetroot is a crop belonging to the Chenopodiaceae family having bright crimson color. Beetroot is very useful due to its medicinal characteristics. The study was conducted to develop and standardize the formula for preparation of beetroot powder fortified cookies and its sensory and nutritional assessment. Cookies with four different compositions having different blends of beetroot powder and refined wheat flour in the ratios 100:00, 95:05, 90:10 and 85:15were prepared and analyzed. The proximate composition of cookies with different concentrations beetroot powder ranging from 5 % to 20% indicated incremental values of protein content from 7.29% to 8.12%, crude fiber from 0.93%to 1.27%, Ash content from 0.91% to 1.24%. Fortification with beetroot powder resulted in rise of intensity of red color. The hardness of cookies was observed to increase with rise in temperature- time exposure and increasing concentration of beetroot powder. It was concluded from sensory analysis that cookies with 10% beetroot powder were accepted widely.

Keywords: chenopodiaceae, beetroot, fortified, assessment

1. Introduction
Baking is a method of cooking food that uses prolong dry heat normally in an oven [1].Indian bakery industry is one of the biggest sectors in the country's processed food industry [2]. Cookies are flat, sweet baked products. Cookies hold an important position in snack food due to variety in taste, Crispiness and digestibility. Beetroot or table beet is a biennial plant that is cultivated for its thick fleshy roots in early spring.It is an excellent dietary supplement being rich in minerals, nutrients and vitamins and also has unique phytoconstituents which have several medicinal properties. Intense red color of beetroot derived from high concentration of betalains a group of phenolic secondary plant metabolites. Betalains are used as natural colorant by food industry but, also received increasing attention due to possible health benefits in human especially their antioxidant and anti-inflammatory activities. Other benefits include inhibition of lipid peroxidation and increased resistance to oxidation of low density lipoproteins [3]
Functional foods having medicinal properties are in great demand for proper functioning of body system and potential health benefits. As a result functional foods containing more dietary fibershave been developed specially in bakery products like cookies. The present research was designed to put emphasis on the use of beetroot powder in development of cookies.

2. Materials and methods
The present research work was carried out in department of food science and technology, Dr. Ulhas Patil College of Food Technology, Jalgaon.

2.1 Raw Materials
The raw materials required for the given product i.e. refined wheat flour, Beetroot powder, Sugar, Fat, Skim milk powder, Baking powder and flavor etc. were procured from local market.
The beetroot powder was procured from Tirupati Enterprises, Bhavnagar.

2.2 Preparation of cookies
Beetroot powder fortified cookies were prepared by substituting refined wheat flour with beetroot powder. Various blends were prepared by using refined wheat flour and beetroot powder in the ratio of 100:00, 95:05, 90:10 and 85:15. The cookies were prepared by using different formulations and standard procedure mentioned in following flow chart.

Table 1: Composition of Beetroot Powder fortified cookies

Ingredient	T_0	T_1	T_2	T_3
Refined Wheat Flour (gm)	100	95	90	85
Beetroot Powder(gm)	0	05	10	15
Fat(gm)	50	50	50	50
Sugar(gm)	50	50	50	50
Skim milk Powder(gm)	10	10	10	10
Baking Powder(gm)	1	1	1	1
Vanilla Essence(ml)	1	1	1	1

(T_0=100:00, T_1=95:05, T_2=90:10, T_3=85:15)

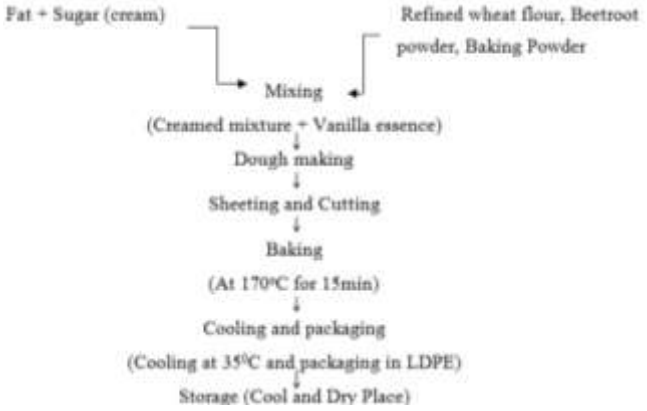

Fig 1: Process Flow Chart for preparation of cookies

2.3 Physical evaluation of cookies

Weight, diameter, thickness and spread ratio of cookies were calculated as per AACC method 1976.

2.4 Chemical composition

Chemical analysis of cookies for determination of moisture, crude protein, crude fat and ash content was performed according to standard method. The carbohydrate content was determined by subtracting sum of values of moisture, total ash, crude fat, crude fiber and crude protein from hundred.

The calorific value was determined by addition of values obtained from product of percent crude protein, percent crude fat and carbohydrates present in sample by their respective calorific values i.e. 4, 9 and 4.

3. Results and Discussion

3.1 Chemical Composition

Moisture content of control cookies was found to be 2.72 % and that of cookies fortified with beetroot powder shown incremental values from 2.92% to 4.12%. Crude protein content of control cookies were found to be 8.63% and that of cookies containing blends of beetroot powder and refined wheat flour shown successive values from 7.29% to 8.12%. Ash content of cookies containing incremental levels of beetroot powder was in ranged from 0.82% to 1.24%. Crude fibre content of control cookies and cookies with beetroot powder shown values ranging from 0.93% to 1.27%. The fat content of cookies was observed to decrease from 23.78 % to 21.83%

It was observed that with rising levels of beetroot powder in cookies there were increase in calcium, phosphorous, and iron content of cookies. However, zinc content was found to be decrease.

Table 2: Chemical composition of beetroot powder fortified cookies

Treatment	Moisture (%)	Protein (%)	Fat (%)	Carbohydrates (%)	Ash (%)	Crude fiber (%)
T_0	2.72	8.63	23.78	63.12	0.82	0.93
T_1	2.92	7.29	22.73	65.22	0.91	0.98
T_2	3.42	7.83	21.40	64.98	1.12	1.07
T_3	4.12	8.12	21.83	63.72	1.24	1.27

Table 3: Effect of beetroot powder on micronutrients

Treatment	Calcium (mg/100gm)	Phosphorous (mg/100gm)	Iron (mg/100gm)	Zinc (mg/100gm)	Calorific value
T_0	31.22	131	0.93	0.76	501.02
T_1	34.12	372	1.36	0.57	494.61
T_2	39.98	478	2.33	0.42	483.84
T_3	43.26	498	2.78	0.39	483.83

3.2 Physical analysis of cookies

The cookies from T_0 to T_3 shown slight increase in the values of weight, diameter, thickness and spread ratio.

Table 4: Effect of Beetroot powder on physical parameters

Treatment	Weight	Diameter	Thickness	Spread Ratio
T_0	14.98	54.8	10.15	5.39
T_1	15.08	54.9	10.18	5.39
T_2	15.10	55.2	10.25	5.38
T_3	15.12	55.4	10.44	5.30

3.3 Sensory Evaluation

Sensory analysis of cookies was conducted by panel of 10 semi-trained judges. 9-Points hedonic scale was used for sensory evaluation

Table 5: Sensory Evaluation of cookies

Treatment	T_0	T_1	T_2	T_3
Color	7	7.0	8.0	7.5
Appearance	7.5	7.5	7.5	7.2
Taste	7	7.0	7.9	7.5
Flavour	7.5	8.0	7.5	7.6
Overall Acceptability	7.25	7.30	7.72	7.45

4. Conclusion

In the Present study it was found that the with beetroot powder fortified cookies has shown good nutritional values with respect to Carbohydrates, Fats, Proteins. Beside this the cookies has also shown the significant rise in levels of iron, magnesium, and potassium as compared to control cookies. From the present study it can be concluded that beetroot powder fortified cookies can serve as a good alternative to provide nutritional product to consumers.

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