OPTIMIZATION OF FORMULATION AND DEVELOPMENT OF BEETROOT FORTIFIED IDLI AND ITS PHYSICO-CHEMICAL CHARACTERIZATION

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ABSTRACT
Idli is one of the most important balanced breakfast foods in India and the other countries. The present study was undertaken to determine the enhancement of nutritional value of idli by fortification of beetroot in idli batter. Idli were prepared from rice and black gram the ratio 3:1 was constant and fortification of beetroot at 5%, 10%, 15% and 20% after fermentation. The developed idli were analyzed for physicochemical properties, organoleptic evaluation and nutritive value of the idli. The result revealed that 15% fortification of beetroot was accepted in the terms of sensory evaluation and nutritional value would make it as a complete balanced breakfast food for all age groups of people.
***Keywords**: Physical parameters, Idli, Beetroot, Organoleptic evaluation.*

INTRODUCTION
Idli is one of the foods which is prepared from low cost staple crop, which helps to improve the health. Cereals are used world-wide as a staple food, they are one of the important sources of carbohydrates, dietary proteins, vitamins, minerals and fibre for people all over the India. Most commonly cereals are used in combination with legumes to improve the protein quality of the fermented foods. The combination of cereals and legumes can be replaced by the millets in breakfast foods. In the traditional idli batter, fermentation takes place due to the microflora present in the raw materials and the environment leading to the several changes that has impact on digestibility and nutritional value bringing about desirable changes (Soni and Sandhu)

Beetroot also simply known as beet it is popular as a new super food due to recent studies claiming that beetroot and beet juice can improve athletic performance, increases blood circulation and lower blood pressure. Incorporating in new products it is highly nutritious food. It sprouted everywhere, especially in drinks and juices. Beetroot or table beet belongs to same family as sugar beets (beta vulgaris) are nutritionally and genetically different. Sugar beets are white in colour and it is used for sweetening manufactured foods and sugar extraction. But sugar cannot be obtained from beetroots. Beetroot are unique. It is very good source of manganese, copper and potassium and also an excellent source of folate. Beetroot are rich combination of betalain pigments both betaxanthins (yellow pigments) and betacyanins (red violet pigments). They are also a good source of dietary fibre, phosphorus, iron, magnesium, vitamin C and vitamin B.

Black gram has a mucilaginous material which makes it a valuable ingredient in idli preparation. The chief protein presents in black gram are albumins, globulins and glutelins. Beetroot is used in idli preparation. The present study was carried out to analyze the physical and physiochemical

properties of batter and beetroot fortified idli with a view to determine the organoleptic acceptability.

MATERIAL AND METHODS

The raw materials namely rice, decorticated black gram and beetroot were purchased from a local market.

Basic formulation of Idli batter

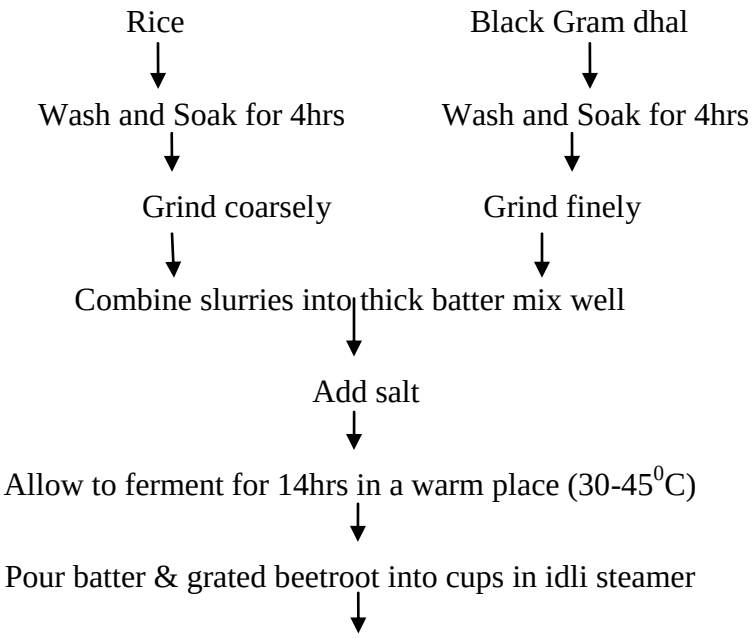
The four blends of idli batter from rice decorticated black gram and beetroot were prepared with adequate quantity of water and salt. The proportion of ingredients and the composition is given in the Table 1, for four different formulations.

Table 1: Proportion of ingredient and the composition of Idli

Ingredients	Weight of Ingredients in gm			
	A	B	C	D
Rice	75	75	75	75
Black gram	25	25	25	25
Beetroot	5	10	15	20
Salt	1.5	1.5	1.5	1.5

Preparation of batter

The rice and decorticated black gram was soaked in water for 4hrs separately. The soaked mass was subjected to wet grinding to yield a coarse and beetroot was grated separately. The wet ground mass was blended in different ratio with water and salt as shown in Table 1 was allowed to ferment in the incubator at different temperature i.e. 30ºC, 34 ºC, 38 ºC, 42 ºC and 45 ºC. During its fermentation, property of batter i.e. pH and titrable acidity were determined. After fermentation of the batter, the grated beetroot was added in the batter and mix well, then pour the batter in the slots of idli steamer and steamed it for 20 min. The complete flow chart is shown in Figure no 1.



Steam for 20 min

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Ready for serving

Figure 1: General Flow Chart for Idli Preparation

Determination of Physico Chemical properties of batter

The physico-chemical properties namely changes in pH, and titrable acidity were determined for all the compositions at different temperature i.e. 30ºC, 34 ºC, 38 ºC, 42 ºC and 45 ºC were determined. The pH was determined by use of a pH meter and titrable acidity was determined in terms of percent of acid in the sample lactic acid bacteria (Nielsen 1994).

Organoleptic evaluation of Idli

The developed idli were served to a group of 30 semi trained panelists for the evaluation of appearance, colour, flavor, taste, texture and over all acceptability on a 9 point hedonic scale with a scores ranging from 9 to 1 where 9 & 1 represented, like extremely and dislike extremely respectively. The quality parameters were quantified and the mean scores of the evaluation were calculated.

Nutritive value of the developed Idli

Nutrients like carbohydrates, proteins, fat, fiber, calcium and energy were analyzed. Total carbohydrates were determined by volumetric method as described by Lane Eynon method (Ranganna 2004), Protein by Micro-kjeldhal method, fat by Soxhlet extraction method, fiber by AOAC method, calcium content was determined by KMno4 titration method as described by Ranganna (2004).

RESULT AND DISCUSSION

Changes in Physicochemical properties of batter

The pH value of batter at different fermentation temperature was measured & is shown in Table 2. There is an increasing trend of acidity level i.e. decrease in pH value with fermentation temperature, irrespective of blend ratio. Soni and Arora (2000) have reported that the contribution of lactic acid bacteria & yeast towards the acid and gas production. Also, black gram provides a maximum number of wild type microorganisms for fermentation.

pH: The results of the study indicates that with an increase in temperature, there was found to be a decrease in the pH of the batter. It was found that the pH of batter decrease from 5.9 at 30^0C to 4.8 at 42 ºC.

Titrable acidity: The study showed an increase in the titrable acidity with rise in temperature. The titrable acidity of batter was increased from 0.19 at 30^0C to 0.36 at 42 ºC.

Table 2: Effect of temperature on pH and acidity of idli batter

Temperatures	**30ºC**	**34ºC**	**38ºC**	**42ºC**	**45ºC.**
pH	5.9	5.6	5.4	4.8	4.6
Acidity	0.19	0.23	0.28	0.36	0.39

Sensory evaluation of idli

Table 3: Sensory evaluation of beetroot fortified idli

Beetroot% in Idli blend	Texture	Flavour	Taste	Appearance	Colour	Overall acceptability
5%	7.1	7.3	7.5	7.6	7.5	7.4
10%	7.4	7.6	7.5	7.7	7.8	7.8
15%	8.0	7.8	7.7	7.9	7.9	8.0
20%	8.0	7.6	7.8	7.8	7.6	7.9

The result obtained by the sensory evaluation of different ratios of beetroot fortified idli. Among the different ratios 15% beetroot fortified idli has got highest score followed by 5%, 10% and 20%. The texture attributes was found to be same score i.e 8.0 at 15% and 20%. and 7.4 and 7.1 score at 10% and 5%.The flavor attributes has got score of 7.8 at 15% and 7.6 scores was obtained in both 20% and 10% and 7.3 score obtained at 5% beetroot fortified idli. The taste attributes has got highest score i.e 7.8 at 20% and 7.7 score at 15% and 7.5 score at both 10% and 5%. The appearance attributes has got score of 7.9 at 15% followed by 20%, 10% and 15% i.e 7.8, 7.7 and 7.6. The colour attributes 7.9 score at 15% and the score 7.8, 7.6 and 7.5 at 10%, 20% and 5%. The overall acceptability at 15 % beetroot fortified idli has got highest score 8.0 followed by 20%, 10% and 55 i.e. 7.9, 7.8, and 7.4.The data shows that at 15% beetroot fortified idli was highly acceptable.

Nutritive value of the developed Idli

The nutritional composition of steamed idli is shown in Table 4 & Figure 2.

Table 4: Proximate composition of steamed Idli

Nutrients (g/100g)	Beetroot fortified Idli
Energy (Kcal)	181.56
Carbohydrate	27.07
Protein	9.86
Fat	3.76
Fiber	0.22
Calcium mg	40

The obtained result shows that the nutritional value of the developed idli carbohydrate content was 27.07 g, protein 9.86 g, fat 3.76 g, fibre 0.22 g and calcium content was 40 mg. The total energy expressed in terms of Kcal per 100 g. The energy value was 181.56 Kcal.

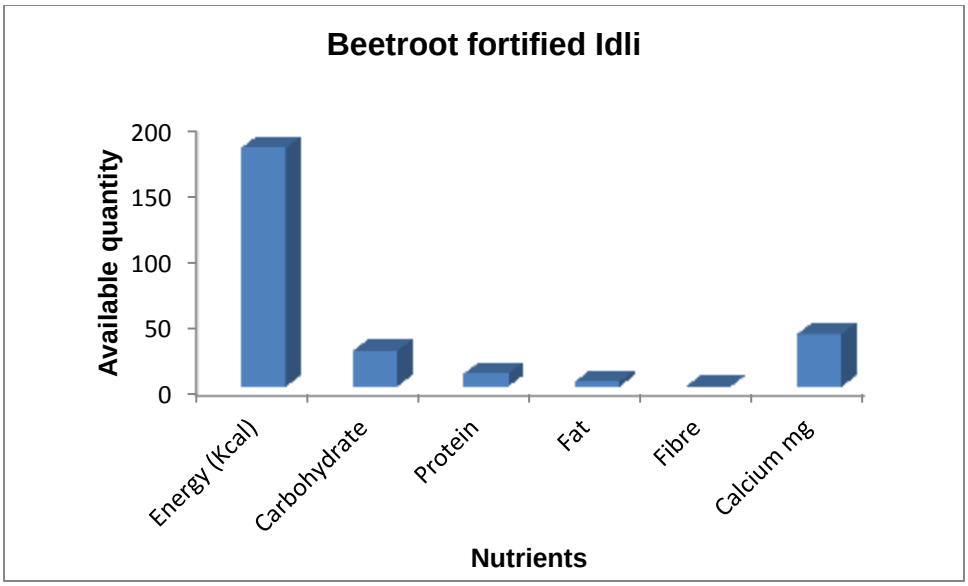

Figure 2: Nutritional composition of steamed Idli

CONCLUSION

Beetroot was used in idli preparation at different variation rice and black gram 3:1 ratio was constant. According to sensory evaluation of the idli the overall acceptability of 15% beetroot fortified idli has highest overall acceptability score 8.0 as compare with 5%, 10% and 20% beetroot fortified idli. The fortification of beetroot had good impact on the nutritive value by increasing the carbohydrate, protein, fat, fiber, calcium and energy Kcal per 100gm content in the developed idli. Thus beetroot idli is found to be acceptable, palatable and nutritious.

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