
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 carrot in idli batter. Idli were prepared from rice and black gram the ratio 3:1 was constant and fortification of carrot 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 10% fortification of carrot 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.

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 fiber for people all over the India. Most commonly cereals are used in combination with legumes to improve the protein quality of the fermented foods. Idli makes an important contribution to the diet as a source of protein, calories and vitamins, especially B-complex vitamins, compared to the raw unfermented ingredients (Srilakshmi 2003). Fermented foods supply important nutrients, particularly proteins and amino acids. Idli batter fermentation is performed mainly by natural fermentation. Lactic acid bacteria (LAB) are one of the important classes of microorganisms that are known to produce lactic acid, acetic acid, ethanol, aroma compounds and have gained importance as it catalyses formation of dextran, bacteriocins, exopolysaccharides and several enzymes (Caplice, E. and G.F. Fitzgerald, 1999).

Carrot is cultivated across the world for its prized taproot. Carrots are naturally sugary, delicious and crunchy. Carrots are notably rich in antioxidants, vitamins and dietary fiber. They provide only 41 calories per 100gm, negligible amount of fat and no cholesterol. They are exceptionally rich source of carotenes and vitamin A. Carotenes converted into vitamin A in the liver cells. Beta carotene is the major carotene present in these roots. Beta carotene is one of the powerful natural antioxidant that helps protect human body from harmful oxygen free radical injury. In addition, it also carries out all the functions of vitamin A, such as maintain good eye health, growth and development. They also compose healthy levels of minerals like copper, calcium, potassium, manganese and phosphorus.

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. Carrot is used in idli preparation. The present study was carried out to analyze the physical and physiochemical properties of batter and carrot fortified idli with a view to determine the organoleptic acceptability.

MATERIAL AND METHODS

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

Basic formulation of Idli batter

The four blends of idli batter from rice, decorticated black gram and carrot 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
Carrot	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 carrot 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. 30°C, 34 °C, 38 °C, 42 °C and 45 °C. During its fermentation, property of batter i.e. pH and titrable acidity were determined. After fermentation of the batter, the grated carrots 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.

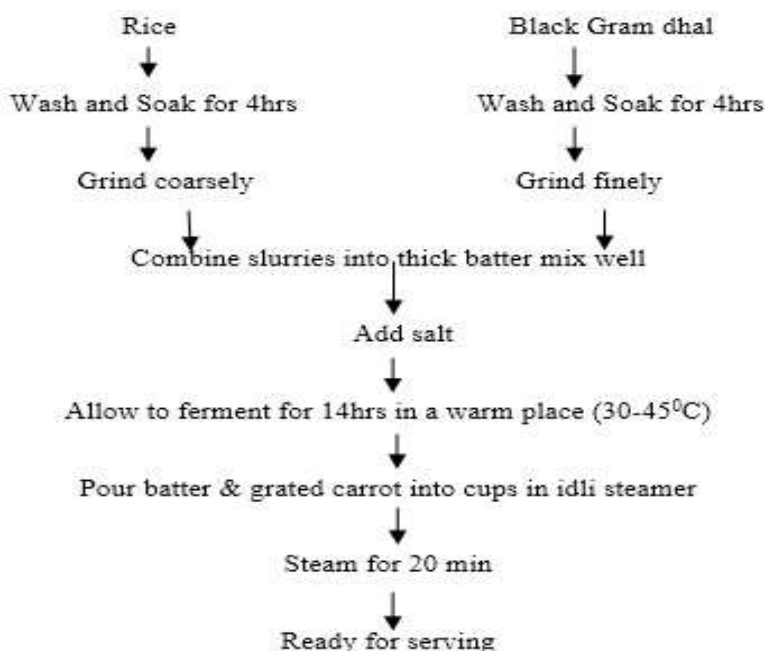


Figure 1: General Flow Chart for Idli Preparation

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. 30°C, 34 °C, 38 °C, 42 °C and 45 °C 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 6.02 at 30⁰C to 5.80 at 42 °C.

Titration acidity: The study showed an increase in the titration acidity with rise in temperature. The titration acidity of batter was increased from 0.25 at 30⁰C to 0.31 at 42 °C.

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

Temperature	30°C	34 °C	38 °C	42 °C	45 °C
pH	6.02	5.92	5.82	5.80	5.68
Acidity	0.25	0.29	0.30	0.31	0.33

Sensory evaluation of idli

Table 3: Sensory evaluation of carrot fortified idli

Carrot % in Idli blend	Texture	Flavour	Taste	Appearance	Colour	Overall acceptability
5%	7.2	7.0	7.5	7.3	7.5	7.7
10%	7.9	7.4	7.5	7.7	7.7	7.9
15%	6.8	7.2	7.3	7.4	7.2	7.3
20%	6.9	7.1	7.2	7.4	7.2	7.3

The mean acceptability scores obtained by the sensory evaluation of carrot fortified idli are shown in Table 3. Among the different variations 10% carrot fortified idli has got highest scores of 7.9 followed by 5%, 15% and 20% i.e 7.2, 6.8 and 6.9 was obtained for the texture attributes. Regarding the flavor attributes the score 7.4 was obtained at 10% and the score 7.0, 7.2 and 7.1 in 5%, 15% and 20% carrot fortified idli. The taste attributes score 7.5 was obtained by both 5% and 10% with the overall acceptability score 7.3 and 7.2 in 15% and 20%. The appearance attributes has got highest scores of 7.7 in 10% and the score of 7.4 was obtained in both 15% and 20% and the least score 7.3 was obtained in 5%. The colour attributes score 7.7 was obtained in 10% and the score 7.2 was obtained in both 15% and 20% the score 7.5 was obtained in 5%. The overall acceptability score of 10% carrot fortified was 7.9 and score 7.7 was found in 5% and the least score 7.3 was obtained in both 15% and 20% carrot fortified idli.

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)	Carrot fortified Idli
Energy (Kcal)	190.75
Carbohydrate	32.95

Protein	7.02
Fat	3.43
Fiber	0.48
Calcium mg	55.2

The obtained result shows that the nutritional value of the developed idli carbohydrate content was 32.95 g, protein 7.02 g, fat 3.43 g, fiber 0.48 g and calcium content was 55.2 mg. The total energy expressed in terms of Kcal per 100 g. The energy value was 190.75 Kcal.

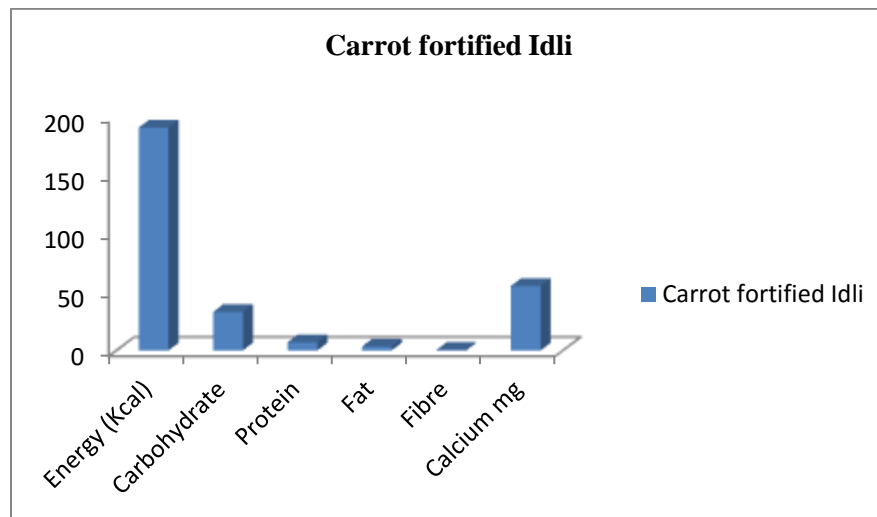


Figure 2: Nutritional composition of steamed Idli

CONCLUSION

Carrot 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 10% carrot fortified idli has highest overall acceptability score 7.9 as compare with 5%, 15% and 20% carrot fortified idli. The fortification of carrot 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 carrot idli is found to be acceptable, palatable and nutritious.

REFERENCES

- [1] Caplice, E. and G.F. Fitzgerald 1999: "Food fermentations: role of microorganisms in food production and preservation". *Int. J. Food Microbiol.*, 50: 131-149.
- [2] Nielsen, S. 1994. Introduction to chemical analysis of foods, Jones and Bartlett Publishers, London Pp.81-90.
- [3] Ranganna, S, 2004. Hand book of analysis and quality control for fruits and vegetable products. TATA McGraw Hill Publishing co, Ltd. New Delhi.
- [4] Soni, S.K. and Arora, J.K.2000. Indian fermented foods. *Journal of Food Processing and Biotechnological Application* 12:34-41.
- [5] Srilakshmi, B.2003. Food Science, Third Edition, New Age International (P) Limited, Publishers, P: 17-72, 245
- [6] Chavan JK, Kadam SS, Beuchat LR (1989) Nutritional improvement of cereals by fermentation. *Crit Rev Food Sci Nutr* 28:349-400
- [7] Davidson S, Meiklejohn AP, Passmore R (1963) Human nutrition and dietetics, 2nd edn. Livingstone, Edinburgh