EFFECT OF BLEND RATIO OF FINGER MILLET FLOUR ON THE PHYSICAL PROPERTIES OF THE WHEAT-FINGER MILLET BREAD

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ABSTRACT

The study was undertaken to analyze the effect of different blend ratio of finger millet flour on the physical properties of the bread prepared from white flour and finger millet flour. The bread was prepared using five different blend ratios of white flour and finger millet flour i.e. 90:10 (B_1), 80:20 (B_2), 70:30 (B_3), 60:40 (B_4) and 50:50 (B_5). The control bread served as 100% white flour. The different physical properties of bread such as loaf weight, loaf volume and specific loaf volume are analyzed during the study. The loaf weight of the bread was found to be 431, 436, 445, 455.5, 470g, the loaf volume was noted as 1166.37, 1148.15, 1031.10, 1041.42, 951.18 cc and specific loaf volume was recorded as 2.71, 2.63, 2.32, 2.29 and 2.02 cc/g for the blend ratio B_1, B_2, B_3, B_4 and B_5, respectively. The loaf weight was found to be increased with the increased proportion of finger millet flour, while the loaf volume and specific loaf volume was decreased with the increased proportion of the finger millet flour. From the sensory score, it was observed that the change in physical structure of the bread was acceptable up to finger millet incorporation level of 20%. Thus, finger millet flour can be substituted up to 20% in white bread which was superior in the nutritional quality in terms of fiber, calcium and minerals in comparison to control bread and helpful to people in weight management due to higher fiber and lower physiological energy.

KEY WORDS: Loaf weight, loaf volume, specific loaf volume, white-finger millet bread,

INTRODUCTION

Bread is a staple food consumed worldwide. Bread is generally prepared from white flour, yeast, sugar, fat, salt, water, etc. by a series of operations like mixing, kneading, fermentation, proofing and baking (Dewettinck *et al*., 2008). White flour is nutritionally poor due to extraction of endosperm during the making of white flour. So, white bread prepared from the white flour is rich in

carbohydrate and protein yielding only physiological energy. So necessity arises to fortify this white bread with fiber, vitamins and minerals. Millets are small-seeded with different varieties such as pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), kodo millet (*Paspalum setaceum*), proso millet (*Penicum miliaceum*), foxtail millet (Setaria italic), little millet (Panicum sumatrense), and barnyard millet (*Echinochloa utilis*) (Ahmed *et al.*, 2012). Finger Millet (*Eleusine coracana, Ragi)*, a type of millets, is rich in quality protein, iron, calcium, phosphorus, fibre and vitamin content. The calcium content is higher than all cereals and iodine content is said to be highest amongst all the food grains. Ragi (Finger Millet) has best quality protein along with the presence of essential amino acids, vitamin A, vitamin B and phosphorus (Gopalan *et al.*, 1987). So, the Finger millet can be a good source of diet for growing children, women, old age people and patients. It helps to control blood glucose levels in diabetic patients very efficiently and considered to be ideal food for diabetic individuals due to its low sugar content and slow release of glucose/sugar in the body (Lakshmi and Sumathi, 2002). The study was undertaken to evaluate the effect of Finger Millet flour on the physical properties of white bread.

MATERIAL AND METHODS

The study was carried out at School of Baking and Department of Processing and Food Engineering, Junagadh Agricultural University, Junagadh, Gujarat (India) during 2014-15. White flour was procured from local market of Junagadh.

Preparation of finger millet flour

The finger millet seeds were procured from the Vasad (Gujarat) and then it was milled in the domestic mixer to produce Finger Millet Flour (FMF) (35 mesh).

Preparation of white bread fortified with FMF

The bread was prepared using straight dough method (AACC, 1995) as given in the Plate 1. The formulation decided for the preparation of bread is given in Table 1. The FMF fortified white bread was developed by replacing white flour with FMF at 10, 20, 30, 40 and 50 per cent. For 250 g of white flour/FMF, yeast (8g), sugar (45g), fat (18g), HPMC (3.75g), salt (5g) and water (150-165 ml) were added. Yeast was allowed to rise in luke warm water for ten minutes prior to mix in the flour. Then the flour was mixed with the remaining ingredients and kneaded gently and allowed for fermentation for one hour. Then the dough was kept in a greased pan for final proofing and then shifted to baking oven for baking at 200ºC for 20 minute and allowed to cool. The cooled bread loaf was sliced and packed and used for analysis.

Physical characteristics of breads

Loaf weight

Bread loaf is weighed in laboratory scale weighing balance and weight of bread loaf was recorded in gram (Table 1).

Loaf volume and specific loaf volume

Loaf volume of bread was measured by Rapid Displacement method as given by Giami *et al.* (2004) and recorded and shown in Table 1. The volume of bread was measured one hour after removing from oven and weighing.

A box of fixed dimensions (18.3 x 10 x 7 cm) of internal volume 1281 cm^3 was put in a tray, half filled with Finger Millet seeds, shaken vigorously 4 times, then filled till slightly overfilled, so that overspill fell into the tray. The box was shaken again twice, and then a straight edge

was used to press across the top of the box once to give a level surface. The seeds were decanted from the box into a receptacle and weighed. A weighed loaf was placed in the box and weighed seeds were used to fill the box and leveled off as before. The overspill was weighed and from the weight obtained the weight of seeds around the loaf and volume of seed displaced by the loaf were calculated. Then using this, loaf volume and Specific loaf volume of the bread was calculated using following formula.

Specific volume = (Loaf volume)/Loaf weight (cc/g)

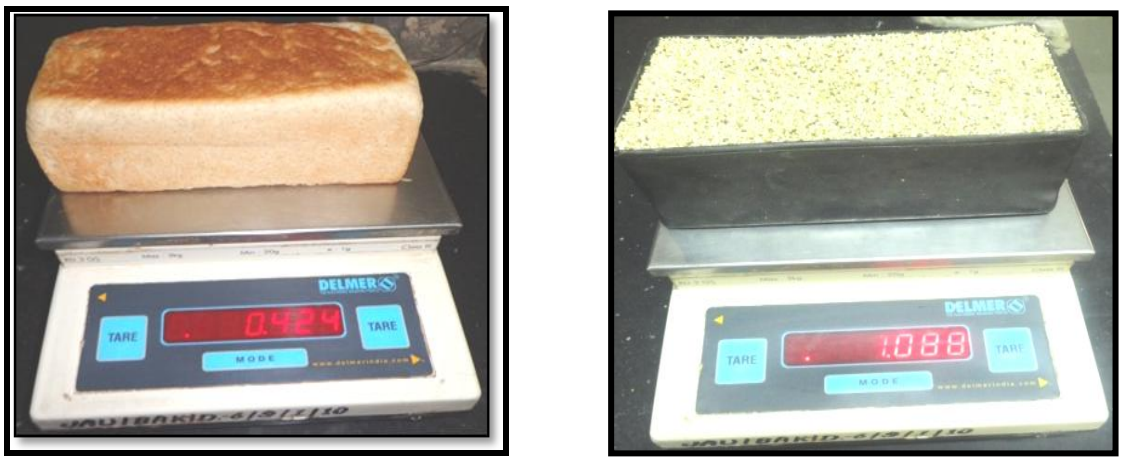


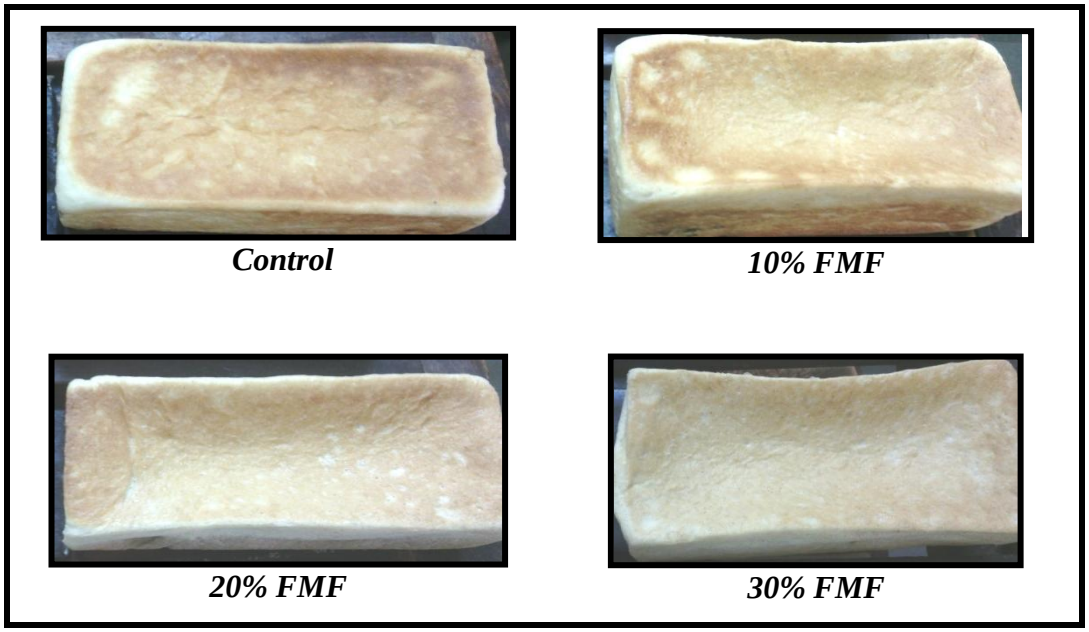
Plate 1: Measurement of loaf weight and loaf volume

Statistical analysis

All the experiments in this study were repeated two times and the mean values are reported. Statistical analysis was done to study the effect of blend ratio on physical properties of bread such as loaf weight, loaf volume and specific loaf volume by Completely Randomized Design using *BASICA* statistical software (Panse and Sukhatme, 1985). The results of white bread fortified with finger millet bread were compared with the control bread i.e. bread made with only white flour.

RESULTS AND DISCUSSION

Physical properties of bread such as loaf weight, loaf volume and specific loaf volume are presented in Table 1. In the present study significant decrease at $p \leq 0.01$ in physical characteristic of the bread was observed with the increase in substitution level of Finger Millet Flour. It might be due to increased level of non wheat flour such as FMF due to its low gluten content, which is mainly responsible for the maintaining viscoelastic properties of bread dough. However, no significant difference ($p \leq 0.01$) was found between control and 10% FMF incorporated bread loaf weight, loaf volume and specific loaf volume. Loaf weight of the bread was found to be increased with the increased proportion of FMF. It is due to less retention of carbon dioxide gas in the blended dough resulting dense bread texture and higher loaf weight. Maximum loaf weight was found for the bread containing 50% FMF while lower loaf weight was recorded for control bread.



Loaf volume of the bread was found to be decreased with the increased substitution level of FMF. The decrease in loaf volume of the bread was due to dilution effects on gluten with addition of non wheat flour such as Finger Millet flour. Gluten fraction of white flour is responsible for the elasticity and framework of the loaf during baking. Additionally, fiber content of the Finger Millet flour also imparts adverse effect on loaf volume due to less gas retention produced during yeast fermentation. Rai *et al.* (2011) and Ballolli *et al*. (2014) has also reported a decrease in loaf volume with a progressive increase in the proportion of non gluten flour such as maize meal and rice flour and foxtail millet flour, respectively. From the Table 1, it can also be seen that the specific loaf volume of the bread was decreased as the substitution level of Finger millet flour increased. The difference among the five treatments was significantly higher at 1 per cent significance level. As the loaf weight was increasing and loaf volume was decreasing, the specific loaf volume was also found to be decreasing with the increase in level of supplementation of non wheat flour. The results obtained were also in line with the results reported by Lorenz and Dilsaver, 1980, Mongi *et al.*, 2011 and Karuppasamy *et al.,* 2013. The study demonstrated that replacement of white flour with the FMF made the bread far superior to the control bread in terms of crude fibre, calcium, ash and quality protein. Though, the bread prepared with FMF up to 50% was nutritionally richer than the control bread, but the physical characteristics of the bread decreased. Thus, considering the acceptable physical properties of the bread, incorporation of FMF with the white flour can be limited to 20 per cent.

CONCLUSION

Findings of the present study concludes that Finger Millet Flour can be incorporated into white flour for making white bread up to 20 per cent substitution level for producing nutritionally enriched bread. The results found that as the FMF incorporation level increased the loaf weight of the bread, while the loaf volume and specific loaf volume of the bread decreased with the increased proportion of FMF. However, the

white breads prepared with FMF up to 50% level nutritionally far superior to the control bread, but physical characteristics were decreased with the increased level of FMF. The resulted FMF enriched white bread was nutritionally superior to control bread, in terms of crude fibre, calcium, quality protein, minerals and having lower physiological energy. The enriched bread is a good option for the people in weight management and prevention of constipation and colon cancer due to lower physiological energy and higher crude fibre.

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Table 1: Physical characteristics of the FMF enriched white bread

	FMF Enriched White Bread							
	B_1	**B_2**	**B_3**	**B_4**	**B_5**	**S.Em. ±**	**C. D. at 1%**	**Test**
Loaf Weight (g)	431	436	445	455.5	470	1.4405	4.5388	**
Loaf Volume (cc)	1166.37	1148.15	1031.10	1041.42	951.18	2.7859	8.7780	**
Specific Loaf Volume (cc/g)	2.71	2.63	2.32	2.29	2.02	0.0050	0.0158	**

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