

Original Research Article

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## Millet Incorporated Pizza Base

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### ABSTRACT

The present study was conducted to evaluate nutritional importance of foxtail millet incorporated pizza base and barnyard millet incorporated pizza base. The results on functional properties showed that barnyard millet flour had significantly higher water absorption (158.63 ml/100g), fat absorption (146.67 ml/100g), while refined wheat flour had significantly higher emulsion activity (42.99 %), emulsion stability (40.70 %), dough raising capacity (92.54 %) and wet and dry gluten content (26.42 and 9.22 %, respectively). Each of foxtail millet flour and barnyard millet flour blends with refined wheat flour (50:50, 50:50 and 50:25:25) had higher amount of water absorption capacity compared to refined wheat flour. The other functional properties showed declining trend with increased incorporation of millet flour. Nutrient analysis of foxtail millet and barnyard millet indicates that the barnyard millet had significantly higher amount of moisture (11.86%), total ash (2.07%) and crude fat (3.5%), while foxtail millet had significantly higher level of crude protein (15.9%), crude fibre (7.51 %), carbohydrates (73.4) and energy value (333 kcal/100g). Texture profile analysis of the products showed that the foxtail millet incorporated pizza base had significantly higher hardness (218.1 N), barnyard millet incorporated pizza base had significantly higher values for chewiness (153 N x mm) and gumminess (81.82 N) while foxtail millet and barnyard millet incorporated pizza base had higher springiness (0.66 mm) and cohesiveness (0.37). Therefore it can be concluded that both foxtail millet incorporated and barnyard millet incorporated pizza base are nutritionally rich and suitable for prevention and control of diabetes and cardiovascular diseases.

#### Keywords

Millet, Pizza base, Barnyard millet flour, Foxtail millet flour

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### Introduction

A number of small grain cereal grasses are termed as millets. They are also known as pseudo cereals. According to their grain size, millets are categorized as major and minor millets. Foxtail millet is a good source of phosphorous, iron and vitamins like thiamine, riboflavin, folin and niacin (Anon., 2004).

Barnyard millet is a rich source of dietary fibre 13 per cent with good amounts of soluble and insoluble fibres. The protein content of barnyard millet is 12 per cent having 81 percent digestibility. Despite being so nutritious these millets visibility waned in recent decades due to the popularity of rice and wheat during the green revolution. Millets are not only being consumed like rice or

turned into flour for baking or cooking rotis, they are being packaged into foods and used in various recipes and value added products. These tiny wonder grains have a long way to go before they become as ubiquitous as rice and wheat, but their growing list of fans is a sign that the grains are here to stay (Sarita *et al.*, 2014).

Pizza is a universally popular and important food product with its origin traced to the Naples region in Italy. According to USDA, pizza consumption has more than tripled since the 1970's and is likely responsible for the most significant share of sauces and cheese used and purchased in fast food restaurants. Traditionally, the flattened bread dough of pizza crust is made from wheat flour. Wheat is also popularly used to make other baked products such as pasta, breakfast cereals, and bread. Wheat is a preferred ingredient in baked goods, including leavened breads and pizza bread, because of its ability to form a cohesive dough with the ability to trap gas and allow for mechanical sheeting. Wheat gluten is responsible for the formation of gas pockets and allowing for sheeting. This unique property of gluten makes wheat essential for the commercial production of light and leavened products such as bread and pastry.

The high calorie and low fibre content of pizza makes it unsuitable for consumption by people suffering from diabetes and cardiovascular disease, therefore incorporation of millet flour in the pizza base may enhance its nutritional quality and makes it suitable for the people with above said diseases. Though some work has been done on incorporation of finger and barnyard millet flour in baked products like bread, buns, cookies etc. However very little information on formulation of millet incorporated pizza base is available.

## **Materials and Methods**

### **Procurement of materials**

The foxtail millet and barnyard millet were procured from millet processing unit of Processing and Food Engineering Department UAS Campus Raichur. The yeast, bread improver, cheese, refined wheat flour and other materials were procured from local market of Raichur.

### **Product development**

Different blends of foxtail millet flour and barnyard millet flour were prepared by mixing with refined wheat flour. Different proportions of ingredients like yeast, sugar, salt, bread improver and oil were incorporated to develop the best product.

### **Formulation of foxtail millet flour and barnyard millet flour incorporated pizza base**

Foxtail millet flour (FMF) and barnyard millet flour (BMF) have been blended with refined wheat flour to make flour blends viz. 50:50, 50:50, 50:25:25 (RWF: FMF OR BMF). Among the different flour blends standardized flour blends were selected and given in Table 1.

Physical characteristics, Functional properties and Proximate analysis were done for the all treatments with 3 replications.

## **Results and Discussion**

The water absorption capacity of foxtail millet flour blend decreased from 146.24-131.93ml/100g, also reported the increasing trend in water absorption capacity in foxtail and barnyard millet flour blends (25% and 25% millet incorporation) with maximum water absorption capacity 146.24 ml/100g.

A decreasing pattern was seen in the dough raising capacity with the increase in millet flour incorporation. In foxtail and barnyard millet flour blends, it showed as 45.62 per cent. All the millet flour blends differed significantly from each other, as well as from refined wheat flour (Table 2).

The wet gluten of foxtail and barnyard millet flour blend was found to be lowest (9.8 per cent) compared to foxtail millet flour incorporation and barnyard millet incorporation. Similarly the dry gluten content of foxtail and barnyard millet flour incorporation was lowest (3.3 per cent), while highest (15.2 per cent) for foxtail millet flour incorporation. Choudhary and Jood (2013), also reported the similar decreasing trend in gluten content with increased foxtail millet flour incorporation in refined wheat flour blends. With incorporation of 50 per cent foxtail millet flour, the dry and wet gluten content of flour decreased to 4.81 and 15.2 g/100g from 9.22 and 26.42 /100g (dry and wet gluten content of wheat flour), respectively.

### **Proximate composition**

Proximate composition of foxtail millet, barnyard millet and refined wheat flour incorporated pizza has been presented in Table 3.

### **Moisture**

The highest moisture content was found in barnyard millet incorporated pizza base (30.40 per cent), followed by foxtail millet incorporated pizza base (26.65 per cent) and refined wheat flour pizza base (24.27 per cent). Moisture content of all three pizza base differed significantly from each other.

### **Total ash**

The total ash content of formulated product was 2.46 per cent for foxtail millet

incorporated pizza base, 1.55 per cent for barnyard millet incorporated pizza base and 0.42 per cent for refined wheat flour pizza base. All three formulated pizza base were significantly different from each other.

### **Crude protein**

The crude protein content of foxtail millet incorporated pizza base was 10.5 per cent. Barnyard millet incorporated pizza base had crude protein content of 9.77 per cent. The foxtail millet and barnyard millet flour incorporated pizza had crude protein of 9.48 per cent. All the three formulated products differed significantly from each other.

### **Crude fat**

The crude fat content of barnyard millet incorporated pizza base was found significantly higher (6.17 per cent) as compared to foxtail millet incorporated pizza base 4.27 per cent and foxtail millet and barnyard millet flour incorporated pizza base found to be 6.10 per cent.

### **Sensory quality of millet incorporated pizza base**

The sensory quality of foxtail millet incorporated pizza base using score card method has been presented in Table 4. The pizza base with product code A, B, C and D were chosen for further evaluation.

### **Colour**

In context of colour and appearance of crumb, the product with 25% foxtail millet flour and 25 % barnyard millet flour incorporation (A) obtained mean score of 7.1. Pizza base with 50 % foxtail millet flour (C) did not differ significantly with B, with mean score of 6.5. Refined wheat flour pizza (D) obtained mean score of 7.3.

## **Texture**

The mean sensory score of A was 7 for texture of crumb and found non significantly different from the control pizza base. The product B obtained the mean score of 6.1 and texture of crumb of the product differ significantly from control pizza base. The texture of crust of formulated pizza base was found highest for control pizza base (mean score of 7.5), followed by A, C and B which obtained the mean score 7, 6.5 and 6.1 respectively. Products B and C were significantly different from the control pizza base.

## **Flavour**

Both A and B were found non significantly different from control pizza base in parameter of flavour with mean score of 7.1.

## **Taste**

Product A obtained higher mean score of 6.9 for taste as compared to other combinations and was non-significantly different from control pizza base. Product B did not differ significantly from product C with mean score of 6.1.

## **Overall acceptability**

The overall acceptability of product A was found with mean score of 7. Product A did not differ significantly from control pizza base.

Texture Profile Analysis is a popular double compression test for determining the textural properties of foods. The texture of any food has various parameters and directly related with the consumer's sensory expectations. The advantage of TPA as an analytical method is that it can quantify multiple textural

parameters in just one experiment. In present study, hardness, springiness, cohesiveness, gumminess and chewiness of the products were measured and been presented in Table.

Hardness is the force required to compress the material by a given amount indicating degree of force required at first bite by the molars to penetrate sample. The hardness of the formulated pizza base was found significantly higher in foxtail millet incorporated pizza base (220.60 N), followed by barnyard millet incorporated pizza base (212.61 N), foxtail and barnyard millet flour incorporated pizza base (204.27) and refined wheat flour pizza base (174.11 N).

Gumminess is the energy required to overcome attractive forces between the food and any surface it is in contact or can be defined as the compression between the tongue and palate to indicate degree to which the product adheres to the palate. The gumminess of the barnyard millet flour incorporated pizza base was found to be highest (81.82N), as compared to foxtail millet incorporated pizza base (79.36 N), foxtail and barnyard millet flour incorporated pizza base (73.4) and refined wheat flour pizza base (57.03 N). All pizza base were significantly different from each other with regard to gumminess.

Chewiness is the energy required to chew a solid food into a state ready for swallowing. It indicates rubbery texture of product during mastication. The chewiness of the foxtail millet incorporated pizza base was 150.1 N x mm, while barnyard millet incorporated pizza base, foxtail millet and barnyard millet incorporated pizza base and refined wheat flour pizza base had chewiness of 153, 140.23 and 124.32 N x mm, respectively. All the pizza base were non significantly different from each other.

**Table.1** Standardized flour blends

S.No.	RWF (%)	FMF (%)	BMF (%)
1	100	-	-
2	50	50	-
3	50	-	50
4	50	25	25

RWF – Refined wheat flour FMF – Foxtail millet flour BMF – Barnyard millet flour
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**Table.2** Functional properties of foxtail millet, barnyard millet and refined wheat flour blends

	Water absorption (ml/100 g)	Dough raising capacity (%)	Wet gluten (%)	Dry gluten (%)
<b>RWF (100%)</b>	131.93	92.54	26.42	9.22
<b>RWF:FMF (50:50)%</b>	137.23	42.58	15.2	4.81
<b>RWF:BMF (50:50)%</b>	137.13	59.20	12.86	3.54
<b>RWF:FMF:BMF (50:25:25)%</b>	146.24	45.62	9.80	3.30
<b>MEAN</b>	138.13	59.98	16.07	5.21
<b>S.D</b>	5.44	20.72	6.60	2.63
<b>C.V (%)</b>	0.03	0.34	0.41	0.50
<b>C.D</b>	3.08	11.72	3.73	1.48

**Table.3** Proximate composition of foxtail millet flour, barnyard millet flour and refined wheat flour incorporated pizza

Treatments	Moisture content (%)	Ash (%)	Protein (%)	Fat (%)	Fibre (%)	Carbohydrate (%)
<b>C</b>	24.27	0.42	8.17	3.17	0.62	63.36
<b>FMP</b>	26.20	2.46	10.50	4.27	3.97	52.54
<b>BMP</b>	30.40	1.55	9.77	6.17	3.58	48.54
<b>FBP</b>	26.65	1.70	9.48	6.10	2.50	53.57
<b>MEAN</b>	27.38	1.73	13.16	6.25	2.85	75.05
<b>S.D</b>	2.45	0.87	2.01	1.95	1.77	5.49
<b>C.V (%)</b>	0.089	0.50	0.15	0.31	0.62	0.07
<b>C.D</b>	1.38	0.49	1.13	1.10	1.00	3.10

C – Control (refined wheat flour pizza)  
 FMP – Foxtail millet flour incorporated pizza  
 BMP – Barnyard millet flour incorporated pizza  
 FBP – Foxtail and barnyard millet flour incorporated pizza

**Table.4** Sensory quality of millet incorporated pizza base

Parameter	Colour	Texture	Flavour	Taste	Overall acceptability
<b>A</b>	7.1	7	7.1	6.9	7
<b>B</b>	6.6	6.1	7	5.9	5
<b>C</b>	6.5	6.5	6.3	6.1	6.3
<b>D</b>	7.3	7.6	7.5	7.5	7.3
<b>MEAN</b>	6.87	6.8	7.3	6.72	6.3
<b>S.D</b>	0.98	1.03	0.84	1.03	1.30
<b>C.V (%)</b>	0.14	0.15	0.11	0.15	0.20
<b>C.D</b>	0.55	0.58	0.47	0.58	0.73

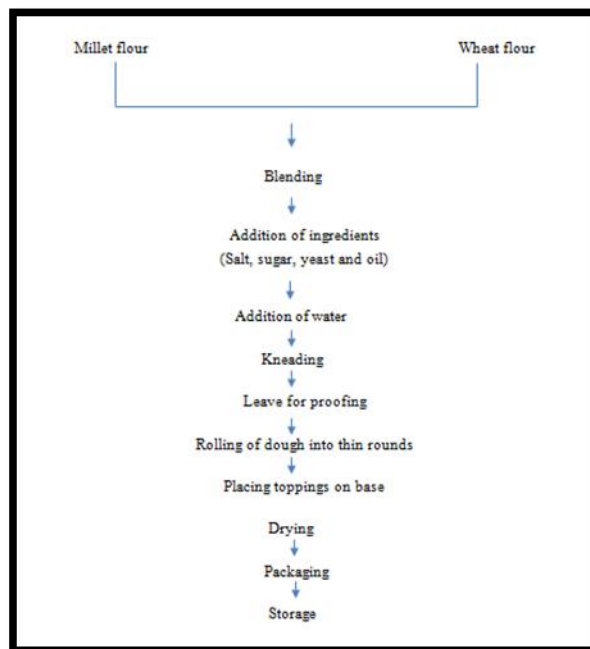
A: pizza base with 25 % foxtail millet and 25% barnyard millet flour incorporation

B: pizza base with 50% barnyard millet flour incorporation

C: 50% foxtail millet flour incorporation

D: 100% refined wheat flour (control)

**Formulation of foxtail millet and barnyard millet incorporated pizza base**







**Barnyard millet and foxtail millet flour incorporated pizza**



**Barnyard millet flour incorporated pizza**



**Foxtail millet flour incorporated pizza**



**Refined wheat flour pizza**



**Barnyard millet and foxtail millet flour incorporated pizza**



**Barnyard millet flour incorporated pizza**



**Foxtail millet flour incorporated pizza**



**Refined wheat flour pizza**

Springiness is the elastic recovery that occurs when the compressive force is removed. The control pizza base had maximum springiness (0.95 mm) as compared to foxtail millet and barnyard millet incorporated pizza base, which had springiness of 0.48mm and 0.51 mm respectively. No significant difference was found between springiness of both millet incorporated pizza base.

Cohesiveness is the strength of the internal bonds in the sample indicating masticatory analysis for degree to which mass holds together at the most extreme point during the mastication process. Among all four pizza base, refined wheat flour pizza base has significantly higher cohesiveness (0.47), followed by foxtail millet and barnyard millet flour incorporated pizza base, barnyard millet incorporated pizza base (0.33) and foxtail millet incorporated pizza base (0.31). Significant difference was observed between cohesiveness of all four products.

Hence concluded, in the present study food products viz. foxtail millet incorporated and barnyard millet incorporated pizza base were formulated and evaluated for physical properties and nutrient composition. Foxtail millet flour, barnyard millet flour, refined wheat flour and flour blends were studied for functional properties. With the findings of present study, it can be concluded that foxtail millet and barnyard millet are nutritionally richer than the conventional refined wheat flour used in the bakery products. The high

nutrient content of these millet incorporated pizza base make them nutritionally superior than conventional pizza base.

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