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Value added pizza base formulation with incorporation of millets, flaxseed and peanut

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Abstract
Pizza is a popular baked product due to its easy preparation method and palatability. This particular dish is being favoured among youngsters in India. The current study was conducted to evaluate the proximate composition and acceptability of prepared pizza made with whole wheat flour, finger millet flour, little millet flour, flaxseed and peanut. Pizza base made from whole wheat flour (100%) only served as control. Other four formulations of pizza base were prepared by combining whole wheat flour (WWF), finger millet flour (FMF) and little millet flour (LMF) in different proportions such as (T_1) 80:10:10, (T_2) 70:15:15, (T_3) 60:20:20 and (T_4) 50:25:25, respectively. The amount of peanuts and flax seed remained constant for all the treatments except the control. All the treatments were subjected to organoleptic evaluation, proximate and mineral analysis by using standard analytical procedures. The products were evaluated for their organoleptic scores for colour, texture, flavour, taste and overall acceptability by using nine-point hedonic scale and significant difference was observed in organoleptic parameters of all the treatments. The T_2 pizza base was observed to show highest scores for organoleptic parameters the developed product and possessed higher amount of protein, fat, fibre, calcium, phosphorous and iron as compared to the control one.

Keywords: Pizza base, finger millet, little millet, organoleptic, proximate, mineral

Introduction
The term pizza was first introduced in 10th century in a manuscript from the town of Gaeta in Southern Italy. Modern pizza evolved from flatbread dish in Naples, Italy in 18th or early 19th century. Despite being a traditional Italian product, the consumption of pizza is widespread almost all over the world. Increasing adoption of Western dietary habits contributes majorly to growing popularity of pizza. It has universal preference among all age groups with dominant consumers being from the age group of 10-30 years.

Baking is a process characterized by many fundamental physical processes such as evaporation of water, volume expansion, gelatinization of starch, denaturation of protein and crust formation etc. As soon as the dough is properly baked into a product, superior sensory features are developed. Fresh bakery products like bread, pizza usually present an appealing brownish and crunchy crust, a pleasant aroma, fine slicing characteristics, a soft and elastic crumb texture and mouthfeel (Giannou *et al.*, 2003) [4]. Despite all its desirable characteristics, all bakery products being prepared from refined wheat flour pose a risk of high glycaemic index and an increased chance of health issues for normal as well as diabetic persons. Thus, this aspect needs to be focused by nutrition researchers to develop more nutrient enriched protective food items having no risk of any diseases.

Now a days, millets are on the central point of value addition and nutrient enrichment of various processed foods like biscuits, cookies and extruded products. Due to its valuable benefits for human health, people are shifting their preference towards the millet based foods (Poojitha *et al.*, 2022) [9]. Finger millet (*Eleusine coracana*), commonly called as ragi is an annual herbaceous hardy crop of family poaceae. Owing to its low glycaemic index and high fibre content, ragi can help in management of diabetes, obesity and other cardiovascular diseases (Bhatt *et al.*, 2003) [3]. Little millet (*Panicum sumatrense*) is a minor cereal which is recognized for several health benefits due to the presence of bio-active nutraceuticals such as tocopherols, carotenoids and its lower glycaemic index makes it beneficial for diabetic people.

Flaxseed (*Linium usitatissimum*) is obtained from a flowering plant of family Lineaceae. It is rich in fibre, protein, polyunsaturated fatty acids such linoleic and linolenic acids, thiamine, magnesium and phosphorus. Flaxseeds are good source of several plant compounds, including *p*- Coumaric acid, ferulic acid, phytosterols and lignans. Besides being anti-carcinogenic, lignans decrease risk of heart disease and metabolic syndrome.

Peanut (*Arachis hypogaea*) are packed with monounsaturated i.e. oleic acid and polyunsaturated fatty acids and protein. Peanuts are low in carbohydrates which makes them a good choice for people with diabetes. Thus, the present study was planned to formulate millet based pizza base by using whole wheat flour, finger millet, little millet, flax seed and peanuts.

Materials and Methods

Procurement of raw ingredients

The raw ingredients such as whole wheat flour (WWF), finger millet (FM), little millet (LM), flaxseed and peanut were purchased from local market, Bhubaneswar, Odisha.

Preparation of millet flour

The finger millet and little millet grains and were cleaned washed properly under tap water to remove unwanted debris and soaked overnight followed by sun drying for 8-10hours. The dried grains were ground with the help of a pulveriser and sieved to obtain finely ground flour and stored in air tight container for further research work.

Table 1: Formulation of flour for pizza base preparati

Formulations	Finger millet flour (%)	Little millet flour (%)	Whole wheat flour (%)	Flaxseed (%)	Peanut (%)
C_0	0	0	100	0	0
T_1	10	10	80	5	5
T_2	15	15	70	5	5
T_3	20	20	60	5	5
T_4	25	25	50	5	5

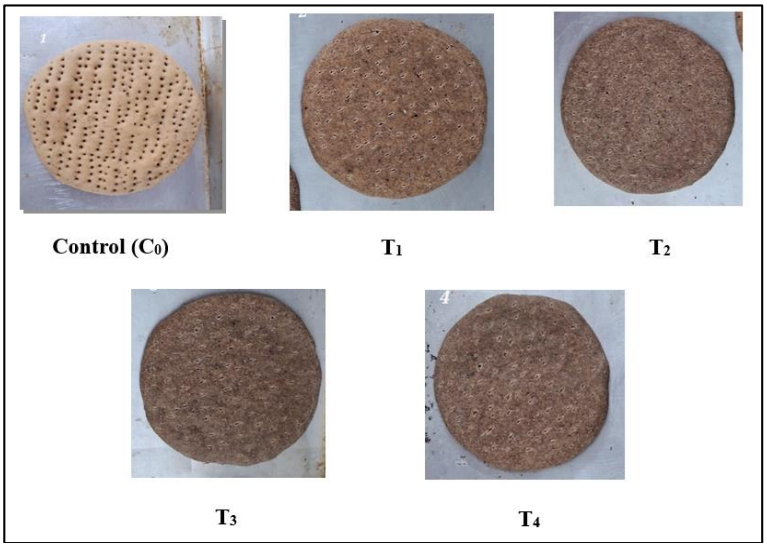

Fig 1: Different formulations of pizza base

Procedure for preparation of pizza base

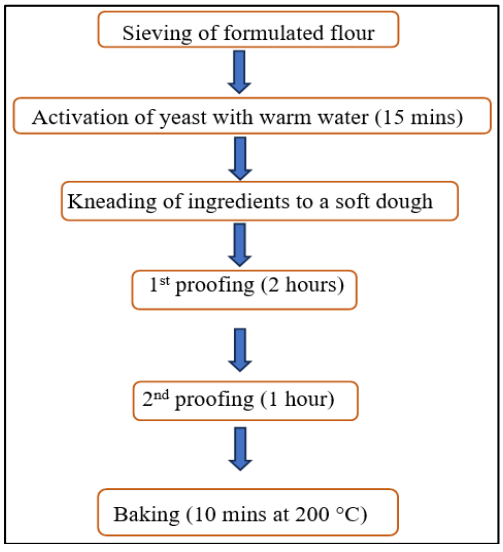

Fig 2: Flowchart for preparation of pizza base

Nutrient analysis of developed pizza base

The sensory evaluation, proximate composition and mineral analysis were conducted by following the standard procedures (A.O.A.C, 2000) [2] for the all treatments with three replications.

Sensory Evaluation

A total of five variations of pizza base were prepared and presented for evaluation including four formulations of millet based and the control one. Ten semi-trained judges, selected from faculty, students and staff assessed the organoleptic characteristics of the pizza bases. The judges were given samples and separate score cards with a nine-point Hedonic scale system in which 1 being the dislike extremely and 9 being the like extremely to evaluate the pizza base for colour, texture, flavour, taste and overall acceptability (Peryam and Girardot, 1952) [8].

Statistical Analysis

The analysis of variance (ANOVA) technique was used to statistically analyse the data related to the proximate

composition and mineral analysis.

Results and Discussion

Functional properties of formulated flours

Water absorption capacity (WAC) was noticed to be the highest in whole wheat flour i.e., 132.33 ml/100 g and the lowest in T_4 formulation i.e., 122.24 ml/100 g while preparing the dough. Dough raising capacity (DRC) was found to be highest in control than the millet incorporated variations. Likewise, both wet and dry gluten content were found to be highest in whole wheat flour i.e. 34.98% and 8.92%, respectively and lowest in T_4 variation i.e., 20.56% and 4.90%, respectively. All the functional properties decreased with increasing proportions of both finger millet and little millet.

Table 2: Comparison of different functional parameters

Treatments	WAC (ml/100 g)	DRC (%)	Wet gluten (%)	Dry gluten (%)
C_0	132.33	72.56	34.98	8.92
T_1	128.29	53.68	28.15	7.93
T_2	126.27	51.76	25.97	6.24
T_3	124.25	48.90	22.39	5.35
T_4	122.24	46.78	20.56	4.90

Proximate and mineral composition of pizza bases

All the proximate values pizza bases were noted and the result showed increased value of ash (1.58-2.15%), moisture (21.09-23.13%), fat (4.54-5.33%), fibre (4.46-5.01%) and decrease in protein (12.82-11.89%) and carbohydrate (55.49-52.48%) as the addition of millet flours increased. Similar results were observed by Singh *et al*. (2012) [13] in his research on bread prepared from composite flour incorporating wheat flour, barnyard millet, proso millet and finger millet flour. All the proximate values were higher than the control sample except the carbohydrate content which decreased significantly (p<0.05). Increased fibre content was due to good crude fibre ratio in finger millet, little millet and flaxseed (Khattab *et al*., 2007) [7].

Except protein, carbohydrate and phosphorus all the other values increased significantly (p<0.05) as the millet proportion increased from 10% (T_1) to 40% (T_4). In the pizza bases the range of values of developed formulations were calcium (91.10-115.89 mg/100 g), iron (4.98-6.12 mg/100 g) and phosphorous (348.09-369.90 mg/100 g). All the millet based formulations were found to contain higher amount of calcium, iron and phosphorous. Similar results were reported during development of multigrain pizza base by Agrawal and Verma (2016) [1].

Table 3: Comparison of proximate composition of developed pizza (g/ 100 g dry matter basis)

Treatment	Ash (%)	Moisture (%)	Protein (%)	Fat (%)	Fibre (%)	Carbohydrate (%)
C_0	1.96^{ab}±0.12	18.08^{b}±0.67	11.16^{b}±0.32	3.50^{b}±0.41	2.99^{b}±0.14	62.29^{a}±0.58
T_1	1.58^{b}±0.09	21.09^{a}±0.29	12.82^{a}±0.04	4.54^{a}±0.25	4.46^{a}±0.24	55.49^{b}±0.56
T_2	1.69^{b}±0.05	21.68^{a}±0.09	12.43^{a}±0.35	4.83^{a}±0.15	4.60^{a}±0.32	54.95^{b}±0.68
T_3	1.78^{b}±0.10	22.68^{a}±0.54	12.29^{a}±0.30	5.24^{a}±0.37	4.90^{a}±0.26	53.09^{b}±0.08
T_4	2.15^{a}±0.14	23.13^{a}±0.57	11.89^{ab}±0.42	5.33^{a}±0.29	5.01^{a}±0.32	52.48^{b}±0.36
CD at 5%	0.34	2.64	1.00	0.98	0.84	3.63

Table 4: Different mineral values of developed pizza base formulations (mg/100 g on dry matter basis)

Treatment	Calcium (mg/100 g)	Iron (mg/100 g)	Phosphorus (mg/100 g)
C_0	46.80^{e} ± 0.76	4.24^{d} ± 0.05	325.44^{e} ± 0.28
T_1	91.10^{d} ± 0.45	4.98^{c} ± 0.08	369.90^{a} ±0.98
T_2	102.37^{c} ± 0.41	5.08^{b} ± 0.04	352.81^{b} ± 0.08
T_3	109.67^{b} ± 0.42	5.24^{bc} ± 0.02	350.29^{c} ± 0.15
T_4	115.89^{a} ± 0.49	6.12^{a}± 0.67	348.09^{d} ± 0.20
CD at 5%	1.40	0.24	0.89

Sensory evaluation of developed pizza bases

In the pizza base increasing proportion of little millet and finger millet significantly affected the sensory score of colour (7.4-6.1), texture (7.6–6.5), flavour (7.6-6.6), taste (7.4-6.2) and overall acceptability (7.7-6.5) depicted in Table 4.4. The difference in score for colour may be the increment of finger millet proportion which darkened the pizza base. The score for texture decreased as millet concentration increased may be due to breads or bakery items formulated with gluten free flour are denser and harder than regular gluten containing flour bread (Rajiv *et al*., 2011) [10]. Formulations T_2 (20%) and T_3 (30%) were considered more accepted than the other two formulations as per the overall acceptability score.

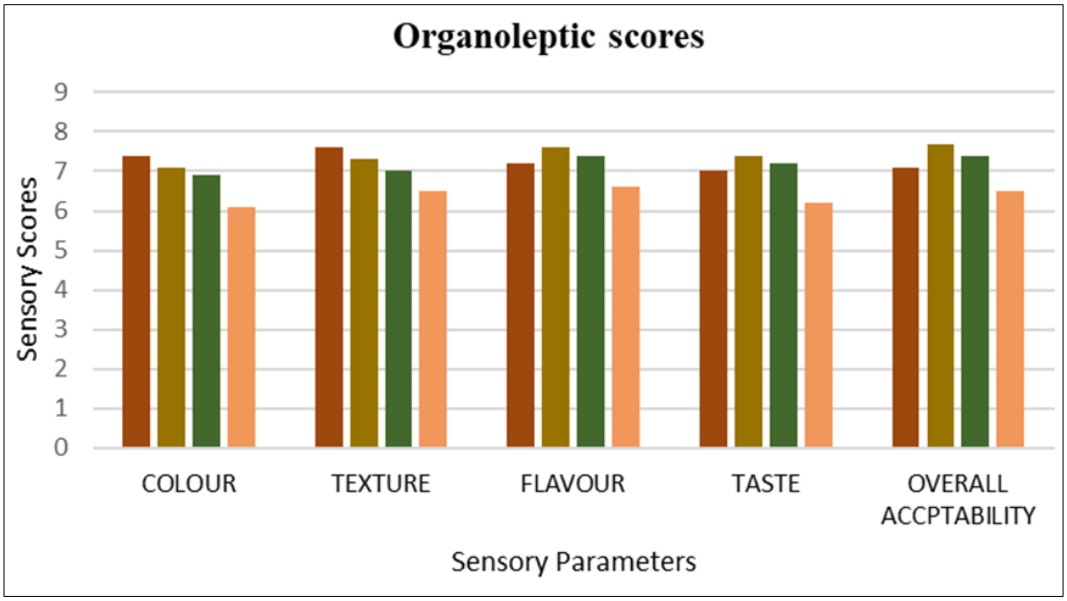

Fig 3: Sensory evaluation of pizza bases

Conclusion

The study concluded that by incorporation of finger millet, little millet, flaxseed and peanuts with whole wheat flour in different proportions, the overall nutritive value increased in terms of both proximate and mineral composition. The finger millet and little millet flour incorporated pizza base contained higher amount of protein, fibre, fat, calcium, phosphorous and iron. From the above study five different formulations of pizza bases were prepared. Functional, proximate, sensory aspects of the developed pizza bases were evaluated. From the analysis it was observed that with addition of finger millet, little millet, flaxseed and peanut, significant changes in the quality of formulated pizza bases have been observed. The finger millet and little millet flours can be added up to 15-20 percent to obtain the optimum nutritional benefits without the organoleptic scores being affected. It can be a better alternative for people suffering from diabetes mellitus, obesity and cardiovascular diseases because of its low carbohydrate and high fibre content. Also, being rich in calcium, iron and phosphorous, the millet based pizza can ensure good nutrition for all age group particularly for growing children, adolescents, pregnant and lactating women as well as the older people by fulfilling their micronutrient needs.

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Conflict of Interest

The authors declare no conflicts of interest. They bear sole responsibility for the content and composition of the paper.

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