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Proximate, morphological and elemental characteristics of pizza base enriched with dried leaves powder of *Moringa oleifera* and pearl millet flour

Mishra Pallavi[1], Singh Neetu[2*], Singh Ayushi[3]

[1] M.sc. Scholar, Department of Food and Nutrition, School of Home Science, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Lucknow, Uttar Pradesh, India

[2] Associate Professor, Department of Food and Nutrition, School of Home Science, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Lucknow, Uttar Pradesh, India

[3] Research Scholar, Department of Food and Nutrition, School of Home Science, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Lucknow, Uttar Pradesh, India

Abstract

Objective: The present study aims to conduct proximate, morphological and elemental analysis of the formulated product with enrichment of dried leaves powder of Moringa oleifera and pearl millet flour.

Methods: The proximate analysis was done by the standard methods of AOAC to obtain the% of moisture, ash, fat, protein and carbohydrate present in the enriched product. The morphological and elemental analysis was done using SEM with EDS analysis to analyse the structure, texture atomic weight and elements present in the product with different magnification level.

Result: The results suggested 0.44% moisture, 0.756% ash, 2.3g fat, 15.96g protein and 87.536g carbohydrate content by proximate analysis. SEM indicated Amorphous nature with rough texture of the pizza base with oval shape of the sample and the elemental analysis by EDS showed presence of some minerals that are O, Na, Mg, Cl, K, Zr, in all of them with weight% 80.67, 3.94, 0.76, 6.11, 1.50, 7.01 and the atomic weight% 91.13, 3.10, 0.57, 3.12, 0.69, 1.39 respectively.

Conclusion: The study indicated that the enriched product is rich in nutrients and safe for consumption of every age group and can be eaten by the people who are suffering from lifestyle diseases.

Keywords: *Moringa oleifera*, pearl millet, proximate analysis, morphology, elemental analysis

Introduction

Proliferation has resulted in aesthetic mixing of different meals and therefore, Pizza got initiated to India through China in mid 80's **(**Vanshika Sharma and Dr. Ashish.M.Mohite.2020) [1]. The contemporary Pizza as we know it today, derived in Naples, Italy, as a popular and cheap fast meal for working class Neapolitans. However, the Pizza in its most essential form as a seasoned flat bread has now been favoured world wide (Syed Saif Alam.et.al.2022) [2]. Pizza is engrossed globally and is the food of possible course of action of a mass urbane population. It is a kind of flat bread that is chemically or yeast leavened comprising alternate kinds of toppings, especially including of cheese, chicken and tomato sauce with some possible change relative to the choice of consumer.

The Pizza dough base or crust constitutes about 40% of the weight and around 60% consists of topping (Ali Asghar.et.al.2012). Pizza production (yeast fermentation, mechanical and thermal phases) may influence the retrieval of bioactive compounds after improvement with special flours. Actually, it would distinct from other bakery products enlisted because of variances in the food matrix, leavening agents, baking variables. Therefore, subordinating on the fortification level and the kind of by-product, a different effect on the rheological and textural qualities may be attained (Ancuta Nartea.et.al.2023) [4].

Pizza dough is an involute, viscoelastic material, and its constituents play vital role in the dough's producibility, the gas holding capacity throughout fermentation, production and the baking process. The production of the gluten network is also primary throughout mixing, in which starch and water are included, and can influence later the enlargement of the dough during leavening (Clelia Covina.*et al*.2023). During the Pizza baking process in an oven, concurrent heat and bulk adough/crumb conversion leading to protein denaturation and the development of a crust or base (Anilleo. *et al*.2023).

Researchers have pursued to pay more to the use of composite flour in the development of better food products, especially in bakery goods. Pearl millet (*Pinnisetum glaucum)* are primarily found in arid and semi-arid parts of the world with good source of energy, minerals, vitamins, dietary fibre and polyphenols. Some possible health benefits of the millets comprises anti-oxidative and anit-diabetic activity (Florence A.Bella.et.al.2022). Moringa oleifera as it is known as "miracle tree" has numerous health benefits. It accommodate nutrients, as well as secondary products that have health benefits. Enrichment of bread dough with moringa leaf powder has been turned up to increase bread

Moringa leaf powder was expected to boost it by about 54 and 56% respectively. The bioactive compounds present in Moringa oleifera makes it a potential functional food ingredient (LINA NOVI ARIANI.et.al.2022) [8].

Bakery products are scrutinized as the best products for fortification though 70% daily calorie requirement is given up by bread. There are multiple studies present on anti-oxidant fortified bread which authented a higher level of available ant-oxidants in enriched products. In distinction to bread, pizza have higher crust area than crumb because

pizza dough is basically formulated with lower amount of oil and water and pressed or rolled into flat shape and therefore, it is being devoured and liked by group of people world-wide. Thus, both products may have variations in textural characteristics and shelf-life which makes the pizza base, an acceptable product for the present study (Narashans Alok Sagar and Sunil Pareek.2020) [9].

The scientific studies on pizza are minimal therefore, the present experiment was undertaken with the objective to determine the effects of addition of Moringa oleifera leaf powder and pearl millet flour on the rheological characteristics of pizza dough. Further functional properties were also analysed in whole pizza base after fortification with Moringa oleifera leaf powder and pearl millet flour. As vital parameters colour analysis, physiochemical parameters, and shelf life of the pizza base were analysed.

Materials and method

The study was carried out at the Department of Food and Nutrition, School of Home Science,
BBAU, Lucknow, Uttar Pradesh, India.

1. Proximate analysis of the pizza base made with moringa and pearl millet

The created product underwent proximate analysis using the AOAC Standard Method.

1.1. The moisture percentage of the Moringa and pearl millet-enriched pizza base was calculated by taking a sizable amount of the sample (5g), which was then transferred to a clean, dry glass dish and dried at a temperature of 700C. After the drying period, the sample was removed from the hot-air oven, kept in the dessicator, and then the sample was weighed after cooling (Muhammad Asif Khan.et.al. 2023 [10].

$$\text{moisture content (\%)} = \frac{\text{weight of sample(g)} - \text{weight of dried sample(g)}}{\text{weight of the sample(g)}} \text{X } 100 \quad (1)$$

1.2. Total inorganic matter, also known as total ash content, was calculated. A sample of value-added pizza base that had been oven-dried was charred before being fired in a muffle furnace at temperatures between 4500C and 5000C for six hours to produce greyish ash (Muhammad Asif Khan.et.al.2023) [10].

$$\text{ash content (\%)} = \frac{\text{final weight (g)} - \text{crucible weight (g)}}{\text{weight of sample (g)}} X\ 10 \quad (2)$$

1.3. The kjedahl apparatus was used to predict the sample's protein content. A digestion flask was filled with two grammes of the sample, three grammes of a K2SO4: CuSo4

SeO2 (100:20:1) digestion mixture, and ten millilitres of pure sulfuric acid. The volume was then built up to 100 ml using distil water after the contents were quantitatively transferred to a 100 ml volumetric flask. The freed ammonia was collected in 30 ml of 2% boric acid solution with 1-2 drops of mixed indicator (10 ml of 0.1 percent bromocresol green+ 2 ml of 0.1 HCL) from a 10 ml aliquot of the digested mixture that had been distilled with more than 30% NaOH. A blank was also simultaneously digested and distilled. Crude protein was intended by the subsequent rule:

$$\text{N (\%)} = \frac{\text{vol.of 0.1N HCL used (titration)x 0.0014}}{\text{weight of sample (g)x volume (ml)}} \text{X } 100 \quad (3)$$

Crude protein = N (%) X 6.25

1.4. A sample that was free of moisture was used to determine the amount of crude fat using the Soxhlet apparatus. Three grammes of the sample were placed in an extraction thimble and ethanol was used to carry out the extraction (Muhammad Asif Khan *et al.*, 2003) [10].

The fat content was obtained according to the following formula:

$$\text{Fat content (\%)} = \frac{\text{wieght of empty flask and extracted flask (w2)} - \text{weight of empty flask (w1)}}{\text{weight of sample (g)}} \text{X } 100 \quad (4)$$

1.5. The carbohydrate content was calculated by subtracting the total percentages of moisture, ash, protein, and crude fat from 100%. This revealed the quantity of carbohyudrate, also known as nitrogen-free extract (Muhammad Asif Khan *et al*.,2023) [10].

Nitrogen free extract (NFE) = 100 – [(moisture% + protein% + ash% + crude fat %)]. (5)

1.6 The percentages of crude protein, crude fat, and carbohydrate were multiplied by the suggested values (2.44, 8.37, and 3.57, respectively), to give the sample energy value (in kcal) (Muhammad Asif Khan.et.al. 2023) [10].

2. SEM of moringa and pearl millet pizza base

The elemental analysis of the pizza base and evaluation of the morphological structure were both done using SEM-energy dispersive X-ray spectroscopy (SEM-EDS). Pizza base samples that had been desiccated were mounted on spectrum holders and given a gold coating using DC sputtering (sputter and carbon coater Agar Scientific B7340). 2000X and 5500X magnifications with 10 kV acceleration voltage were used to investigate the sample's microstructure (Nontsikelelo Noxolo Tafu and Victoria A. Jideani 2022; Clellia Covino *et al*. 2023) [11, 5].

Result and Discussion

1. Proximate analysis

Table 1: Values for proximate analysis of pizza base enriched with Moringa leaves powder and pearl millet flour

Parameters	Values
Moisture	0.44%
Ash	0.756%
Protein	15.96g
Fat	2.3g
Carbohydrate	87.536g

1.1. Moisture content

In comparison to earlier studies, normal pizza bases sold in the market and those enriched with various other supplements and flour blends showed moisture contents ranging from 2 to 4 percent, while the sample's pizza base

enriched with moringa leaves and pearl millet flour had a moisture content of 0.4 percent, which is acceptable for pizza base storage for 7 to 10 days.

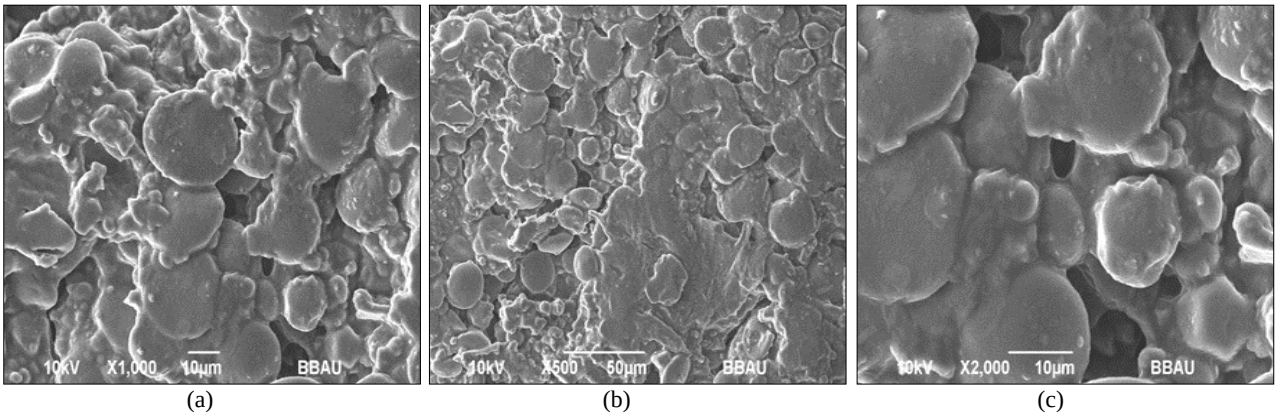
1.2. Ash content
The ash content obtained from the moringa and pearl millet pizza base was 0.756% as moringa was incorporated and it normally has 1% ash content which is higher than that of fruits and the formulated product was made from dried leaves of moringa and pearl millet therefore the% ash content was equal or showed least differences in the other supplemented pizza bases with different flour blend.

1.3. Protein content
The protein level in the formed product produced was 15.96g, although the typical values of protein contained in market pizza bases vary from 12.5 to 13g. The inclusion of moringa leaves, which are excellent sources of protein, and pearl millet, which has a typical protein content of 9–10g, is primarily responsible for the high protein content. Human health estimates that a diet's protein level was beneficial to health. When compared to pizza sold on the market, which comes in various proportions and serving sizes, the prepared product has a good level of protein.

1.4. Fat content
The fat amount in the market-available pizza bases ranged from 5.8 to 6.5 g, which is somewhat high enough without toppings and cheese, but the formulated product's fat content was 2.3 g, which is considerably lower than market-available pizza bases. The daily recommended fat consumption is 25–40g, according to the RDA. Moringa and pearl millet have typically low fat contents, and after solar drying the moringa leaves, the fat content fell somewhat. Sun drying is also a relatively low-nutrient content loss procedure. The product's achieved fat content is adequate to meet the fat requirements of one meal. The body needs fat to aid in the absorption of vitamins like vitamin A, D, E & K.

1.5. Carbohydrate content
Depending on the size and percentage of the pizza foundation, the market's supply of pizza bases typically comprises 120–150g of total carbohydrates. The computed carbohydrate content from the product was 87.536g, which was low compared to market pizza bases. The amount of carbohydrate produced was typical because the other ingredients used to make the product (refined flour) were rich in carbohydrate.

2. SEM with EDS of moringa and pearl millet pizza base
The formulated substance had an amorphous structure and a rough feel. The atomic structure of anamorphous structure mimics that of a liquid and lacks organisation (it is not crystalline).



(a) (b) (c)

Fig 2.1: Images of SEM at different magnifying power for moringa and pearl millet pizza base [(a). X,1000, (b). X, 500, (c). X2,000] magnification level.

Unless specifically stated otherwise, amorphous materials mentioned in the field of material science and engineering are typically solids. The product's morphology was assessed at various magnification levels, indicating the close view to identify the particle size and the product's structure at the various magnification levels (x2,000, x1000, and x500) in fig. 3.2.1.
Depending on the magnifying glass, the particle size changes. A further magnification revealed that the pizza base's particles are oval-shaped. The ionisation energy is shown in the EDX spectrum's abscissa, whereas the count is shown in the ordinate. A given element will be more prevalent in the place or region of interest if its counts are greater.
The elements of the formulated product are O, Na, Mg, Cl, K, Zr, in all of them weight% are 80.67, 3.94, 0.76, 6.11, 1.50, 7.01 and the atomic weight% are 91.13, 3.10, 0.57, 3.12, 0.69, 1.39.

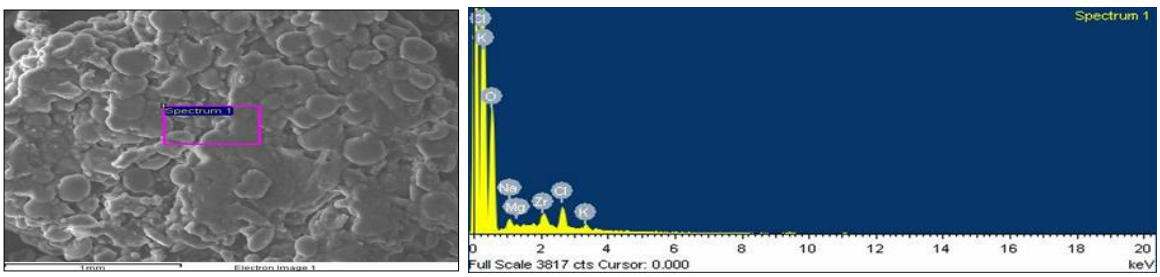


Fig 2.2: EDX with graph for moringa and pearl millet pizza base

Conclusion

The study demonstrated the proximate values of the developed product moringa and pearl millet pizza base. As per the evaluation and analysis it showed a low moisture content as 0.44% due to incorporation of dehydrated leaves powder of moringa and pearl millet flour which shows less absorbability towards the water and the baking process. The ash content was also approximately normal as referred to leaves or vegetables which was0.756% as the moringa leaves incorporated in the pizza base were solar dried and grounded to fine powder to avoid loss of nutrients and to increase the shelf life of the product and the other ingredients used were also low in moisture content and had a low ash value. If taking about the protein content it estimated good protein content 15.96g which a good amount as compared to market pizza bases. The fat content present in the pizza base is somehow low as it has only 2.3g fat which indicates that obesity and people suffering from other lifestyle diseases can include them in their meal to avoid heavy fat food items. The carbohydrate content obtained from the developed product was 87.536g which is low and can be eaten by the people who are suffering from lifestyle diseases and to overcome it. The morphological structure when analysed at different magnification level identified the structure and texture of the pizza base through SEM as it the nature of the product was amorphous with rough texture due to incorporation of pearl millet flour and moringa leaves powder which is high in fibre. The EDS values indicated the presence of certain minerals like O, Na, Mg, Cl, K, Zr, in all of them with weight% 80.67, 3.94, 0.76, 6.11, 1.50, 7.01 and the atomic weight% 91.13, 3.10, 0.57, 3.12, 0.69, 1.39 respectively. Overall the analysis indicated that the product is safe to consume with nutritional benefits and overcoming lifestyles diseases in today's era.

Conflict of interest

The author has declared there is no conflict of interest.

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