

FORMULATION AND QUALITY ASSESSMENT OF NUTRITIONALLY RICH PIZZA BASE

ABSTRACT

The ill effects of junk foods are widely known, as it is acknowledged that their regular consumption may cause irreparable damage to the body. The role of millet-rich foods in offering protection against diabetes and heart disease is well established, which has led to an interest in increasing nutrients in developed pizza bases. The present research has been conducted to develop and standardize a "millet-based pizza base" made using whole wheat flour, Kodo millet, buckwheat flour, and brown rice flour. The developed pizza base is noted to have advantages over a normal base made from refined wheat flour. Sensory evaluation by a panel of 25 members using a nine-point scale showed that T₃ was the most preferred among the samples, suggesting its potential as a standardized pizza base. Nutrient analysis revealed protein content ranging from 7.13% to 9.5%, fat from 1.59% to 1.75%, fiber from 0.798% to 0.913%, moisture from 36.12% to 37.08%, and ash from 0.91% to 0.98%. Overall, the study concluded that these value-added pizza bases offer superior nutritional benefits compared to conventional options.

Keywords: *Kodo Millet, Buckwheat, Brown Rice, Incorporated, Formulation, Nutritional Composition.*

INTRODUCTION

In the world where dietary preferences and health-conscious choices reign supreme, the emergence of millet-based pizza bases as a revolutionary product that caters to both taste

and dietary preferences is observed. Our composite grains-based pizza base, crafted from nutrient-rich whole wheat flour, kodo millet flour, buckwheat flour, and brown rice flour, is highlighted, which redefining the pizza experience.

In this research, the benefits of millet-based pizza bases are explored. Creating a pizza base using wheat flour, kodo millet, buckwheat, and brown rice flour is considered a fantastic way to enjoy a healthy, nutritious alternative to replacing regular pizza; millet flour is viewed as a much healthier replacement. Research has found that the combination of refined wheat flour with cheese is deemed a very unhealthy combination.

It's interesting to see how pizza has become such a popular food choice in India, reflecting broader cultural shifts influenced by western norms. The statement highlights the growing popularity of fast food in Indian society, with pizza being a significant example. This trend is supported by data indicating substantial growth in the Indian pizza market, which has been expanding rapidly over recent years.

The mention of INR 1,500 crores as the size of the pizza market in India underscores its economic significance and the increasing consumer demand for this particular type of fast food. The annual growth rate of 26% indicates a robust and sustained increase in consumption, suggesting that pizza has become a staple in the diets of many Indians.[9]

This cultural adoption of pizza reflects not just changing dietary preferences but also broader societal changes, such as globalization and the influence of western culture on traditional Indian lifestyles. It's a testament to how food can serve as a marker of cultural exchange and adaptation in today's interconnected world.[5]

cultural and agricultural significance: wheat is referred to as the "king of cereals" and is one of the most important staple food crops worldwide. It belongs to the grass family (*Triticum*) and is cultivated extensively.

major wheat producing states in India: Uttar Pradesh, Madhya Pradesh, Punjab, Haryana, Maharashtra, and Gujarat are identified as major wheat-growing states in India. Uttar Pradesh is noted as the largest wheat-producing state in the country.

varieties of wheat: the passage categorizes wheat into three major types: hard, soft, and durum. Each variety differs in its nutritional composition, particularly in protein levels. Hard wheat, for instance, is highlighted for its high protein and gluten content, making it ideal for bread making.

uses of wheat: wheat is primarily milled into whole wheat flour, commonly used to make unleavened flatbread known as "chapati" locally in India. Additionally, wheat flour serves as

a major ingredient in a variety of bakery products worldwide, including breads, biscuits, cookies, cakes, pasta, and noodles.

Nutritional and health benefits: wheat offers several nutritional benefits. Whole wheat is recognized for reducing the risk of heart diseases by lowering cholesterol levels, blood pressure, and reducing blood coagulation time. It is rich in magnesium and vitamin e, which are beneficial for asthma management.

Functional properties of gluten: gluten, a protein found in wheat, plays a crucial role in baking. It forms a network of fibres that trap carbon dioxide and steam during baking, creating a light, porous structure in bread and other baked goods.

Kodo millet; Kodo millets or magical millets are the must-have millets in your meals. Kodo millet or *paspalum scrobiculatum* belongs to the family poaceae, and is locally known as rice grass, ditch millet, cow grass in English, *araka* in Telegu and *kodra* in Marathi. Kodo millet grains are annual grains ranging from light red to dark grey. The cultivation of kodo millets started in India about 3000 years ago. Apart from India, it is cultivated in Russia, China, Africa and Japan. In India, it is widely grown in Madhya Pradesh, Tamilnadu, Karnataka, Gujarat and Chhattisgarh.[13]

Among all millets available, it is well known for the highest drought resistance and produces high yield in a short duration thus is of great economic value. India is the world leader in the production of kodo millets, and thus its cultivation is of great economic significance. Kodo millets are cultivated in the kharif season (monsoon season) and are available in different varieties, namely indira kodo, jawahar kodo, tnau, etc. Kodo millets are processed into high value foods and drinks. Apart from economic and culinary benefits, kodo millets have numerous health benefits. Let us explore more about this superfood's nutritional value, health benefits, and side effects.[13], [14]

Kodo millets are packed with the goodness of carbohydrates, proteins, and dietary fibers. It contains vitamins like niacin and riboflavin and minerals like calcium, iron and phosphorus. The phytochemicals found in kodo millets include antioxidants along with phenolic compounds like vanillic acid, gallic acid, tannins, ferulic acid, etc. [12]

Kodo millets show numerous scientifically proven properties; some of these properties are it may have antioxidant properties; it may lower blood glucose levels, it, may lower blood pressure.it may have anti-allergic properties, it may be able to halt the abnormal growth of cells, it may have the ability to reduce abnormally high lipid levels and also it may have antibacterial properties.

Buck wheat flour; It is one of the most popular pseudo millets in India and is often used during the fasting period of the Navratri's in India it is a crop suitable for cultivation in marginal lands and yields harvests in a short time. Commonly cultivated in the Himalayan region, it supports the livelihood of the hilly population.

Common buckwheat was domesticated and first cultivated in inland Southeast Asia possibly around 6000 BCE, and from there spread to Central Asia and Tibet, and then to the Middle East and Europe, which it reached by the 15th century. Domestication most likely took place in the western Yunnan region of China.[15]

The oldest remains found in China so far date to circa 2600 bce, while buckwheat pollen found in Japan dates from as early as 4000 bce. It is the world's highest-elevation domesticate, being cultivated in Yunnan on the edge of Tibetan Plateau or on the plateau itself. Buckwheat was one of the earliest crops introduced by Europeans to North America. Dispersal around the globe was complete by 2006, when a variety developed in Canada was widely planted in China. In India, buckwheat flour is known as *kuttu ka atta* and has long been culturally associated with many festivals like Shivratri, Navratri and Janmastami. On the day of these festivals, food items made only from buckwheat are consumed.[1]

Brown rice; Brown rice flour is the lightest of all the whole grain flours that can add texture, nutrition, and subtle flavour to many baked goods. Like any other whole grain flour, brown rice flour contains the exterior bran-rich layer of the grain, making it more nutritious than white rice flour. Brown rice flour has a slightly gritty texture with bone-white colour and has a mild, toasty flavour. However, the taste often ranges from clean and creamy to nutty. It is gluten-free and can enhance lightness in cakes or crispness in cookies. You can use it in place of all-purpose flour to make gluten-free foods.[2]

MATERIALS AND METHOD

The present study was carried out on the topic entitled "Formulation and Quality Assessment of Nutritionally Rich Pizza Base" the experiment was conducted at Food Process Engineering laboratory, Department of Processing and Food Engineering at Food Process Engineering Laboratory, Vaugh Institute of Agricultural Engineering and Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The study aimed to formulate and assess nutritionally enriched pizza base samples labeled as T0 (control) and T₁, T₂, T₃ incorporating varying ratios of whole wheat flour, kodo millet flour, buckwheat flour, and brown rice flour. Treatments T₁ (30% whole wheat, 15.38% kodo millet, 10.25% buckwheat, 7.6% brown rice), T₂ (25.64% whole wheat, 17.94% kodo millet, 12.76% buckwheat, 7.6% brown rice), and T₃ (20.51% whole wheat,

20.51% kodo millet, 15.38% buckwheat, 7.6% brown rice) were developed to enhance the nutritional profile of traditional pizza bases, aiming for improved consumer acceptance.

Procurement of raw materials

Raw material used in the preparation of the millet-based pizza base is arranged from the local market of Prayagraj. The company Grandma millet provide 100 percent organic millets located in Prayagraj, all the millets used in our experiment were provided from them.

Ingredients

Whole wheat flour, Kodo millet, Buck wheat flour, Brown rice flour, activated yeast, and Salt are key ingredient that are used in the preparation of the pizza base.

Equipment's

These are some major equipment's which is used while formulation of nutritionally rich pizza base Oven, Pizza Stone or Baking Sheet, Pizza Peel, Mixing Bowls, Measuring Cups and Spoons, Rolling Pin, Cutting Board, Sharp Knife or Pizza Cutter, Dough Scraper, Pastry Brush, Stand Mixer with Dough Hook, Dough Proofing Box or Container, Cooling Rack, Perforated Pizza Pan, Thermometer and Pizza Oven.

Preparation of Pizza Base samples

The nutritious pizza base was developed by mixing of whole wheat flour, kodo millet flour, buckwheat flour and brown rice flour in three different ratios indicated as T₁ (30%:15.38%:10.25%:7.6%), T₂ (25.64%:17.94%:12.82%:7.6%), and the last combination T₃ (20.51%:20.51%:15.38%:7.6%), The pizza base prepared only from refined wheat flour was taken as control (T₀).

Experimental process

Pizza Base was prepared as per the outline given Pizza Base dough was prepared by blending all the ingredients in quantity as mentioned in the above paragraph. Yeast was first activated in luke warm water with salt for 10-15 min at 35-40 °C. Activated yeast was added into the mixed ingredients. Calculated quantity of concentrated flours was added into the mixing bowl for preparation of dough for the experimental samples. Some additional amount of water was added into the dough for maintaining equal water quantity in control samples. Control sample dough was prepared by adding only whole wheat flour. Therefore, control samples were prepared with full replacement of millet flour. All the ingredients, yeast and salt were mixed properly to form uniform dough. Dough was kneaded, covered with wet cloth and kept at room temperature for double volume raise. Thereafter, the dough was portioned to 125 g. Each portion of dough was made into the round ball and flattened with help of wooden roller to diameter of about 7 inches. Docking was done on it by using

tip of the knife. The flattened and docked dough was kept at room temperature covered with wet cloth for final proofing for 30 min. The desired proofed dough was baked in electrically operated oven at 200-220°C for 5-10 min. The Pizza Base was then cooled slowly to room temperature and packed in polyethylene pouches. The products were stored in room temperature till the analysis.

Nutritional Composition

The standardized developed pizza base sample T₃ and the control sample T₀ were subjected to the nutritional analysis for comparison purpose. *The AOAC (1990)* method was used to determine moisture, crude, ash and crude fiber content. For determination of protein content Micro Kjeldhal method was used, for fat content determination Soxhlet Method is used.[12]

Determination of Protein Content (*The AOAC (1990)*)

The **Micro Kjeldahl** method is a widely used technique for determining the protein content in various samples, including food, feed, and biological materials. This method involves digestion of the sample to release nitrogen from proteins, followed by distillation and titration to quantify the nitrogen content, which is then used to calculate the protein content.

Determination of fat content through Soxhlet method:

Determining fat content through the **Soxhlet method** involves using solvent extraction to isolate and quantify fats from a sample. This method is particularly suitable for samples where fats are embedded in a matrix that is resistant to other extraction methods.

Determination of fiber Content through chemical digestion method:

The determination of fiber content through **Chemical Digestion** involves using chemical treatments to dissolve non-fibrous components of a sample, leaving behind the fibers for analysis. This method is particularly useful for samples where fibers are embedded in a matrix that cannot be easily removed by physical or solvent-based methods.

Determination of Moisture Content through hot air oven method:

Determining moisture content using the hot air oven drying method is a common technique used across various industries to quantify the amount of moisture present in a sample. This method involves drying the sample in a controlled environment to remove moisture without significantly altering other components.

Determination of ash content by Muffle furnace method:

Determining ash content by using a muffle furnace involves heating a sample to high temperatures to combust organic materials, leaving behind inorganic residue (ash). This method is commonly used in various industries, including food, agriculture, and environmental analysis.

RESULT AND DISCUSSION

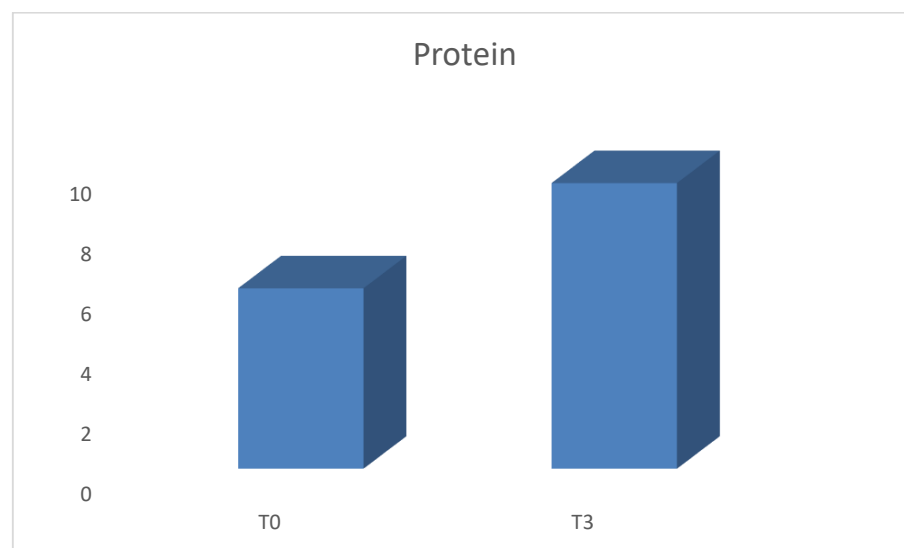
As a result of nutritional and sensory analysis, it is concluded that the treatment T₃ in all three treatment T₁, T₂, and T₃ have higher protein content, fiber and ash content, and lower fat content, and moisture content, and in the sensory analysis containing color, taste, flavor, texture appearance and overall acceptability T₃ have got 8.6 which is the best among all the treatments.

Protein content of treatment T₁, T₂, and T₃ are 7.13%, 8.20%, and 9.5% respectively so on the fiber content of treatment T₁, T₂, and T₃ are 0.798%, 0.875%, and 0.913% respectively, And the fat content of these three treatments is 1.75%, 1.56%, and 1.46% respectively, Moisture of the treatments T₁, T₂, and T₃ are 37.08%, 36.95%, and 36.12%, The ash content of the treatment T₁, T₂, and T₃ are respectively are 0.91%, 0.93%, and 0.98% respectively.

Table.1 Comparative proximate content of Control and T₃ pizza base

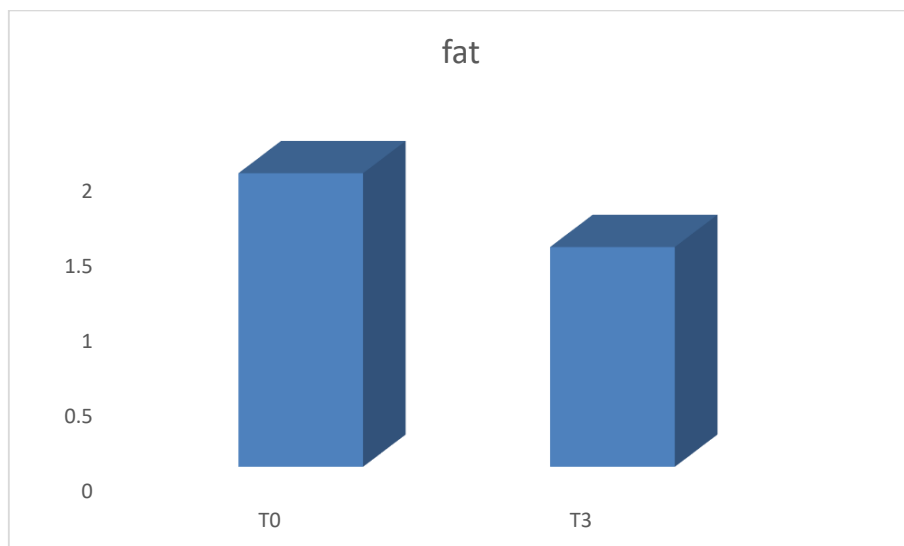
| NUTRIENTS | CONTROL T ₀ | STANDARIZED T ₃ |
|-----------------|------------------------|----------------------------|
| PROTEIN | 6 | 9.5 |
| FAT | 1.75 | 1.46 |
| FIBER | 0.605 | 0.913 |
| MOISTURE | 38.25 | 36.12 |
| ASH | 0.95 | 0.98 |

Fig.1 Protein content comparison of T₀ and T₃ pizza base samples



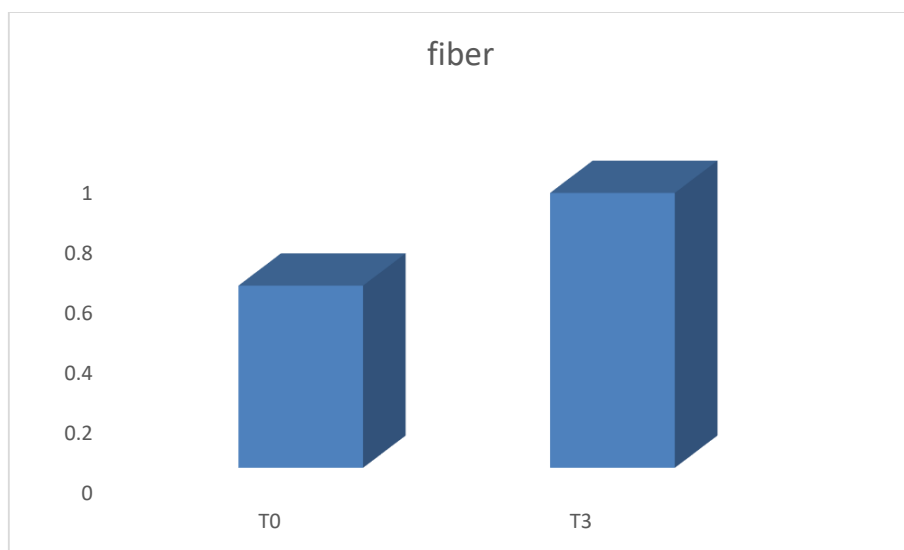
After protein content analysis it is found out that as the amount of composite flour content kodo millet, buck wheat flour and brown rice increase the amount of protein content also increases that is why the content of protein is higher in sample T₃ in comparison of sample T₀ as mentioned in fig. 1.

Fig.2 Fat content comparison of T₀ and T₃ pizza base samples



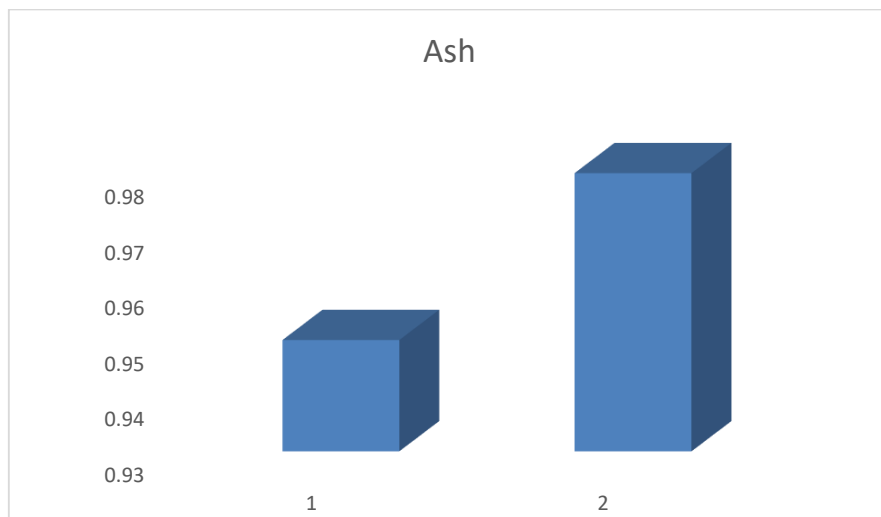
During the fat content analysis, it is observed that the content of fat decreases as the amount of composite flour content increases in the sample that why the sample T₃ has the lowest amount of fat in compare to all other samples and also lower in compare to T₀, as shown in fig, 2.

Fig.3 Fiber content comparison of T₀ and T₃ pizza base sample



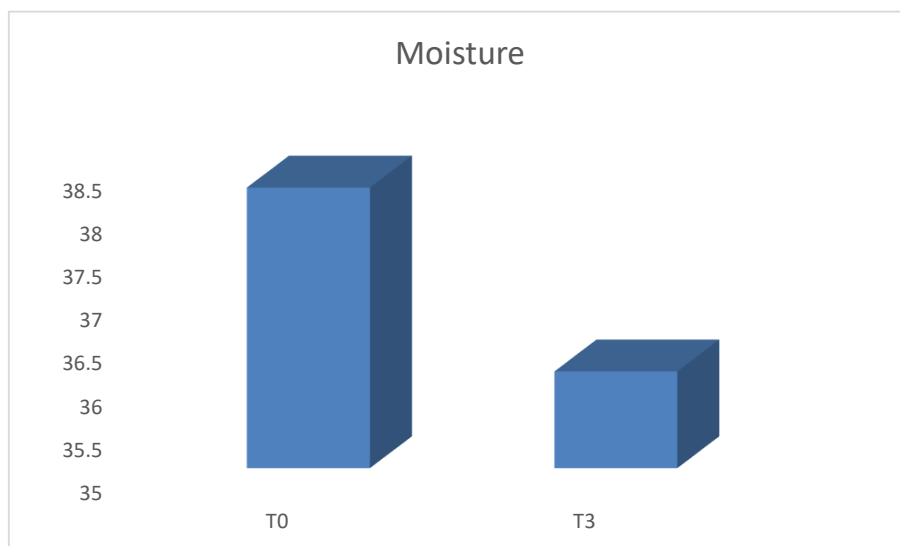
In the analysis of fiber content, it is analysed that the amount of fiber content increases as the content of composite flour increases that is why sample T₃ has higher fiber content as compare to the sample T₀, as mentioned in fig. 3.

Fig.4 Ash content comparison of T₀ and T₃ pizza base samples



After ash content analysis it is found out that as the content of kodo millet, buck wheat flour and brown rice increase the amount of ash content is increases that is why the content of ash is higher in sample T₃ in comparison of sample T₀ as mentioned in fig. 4.

Fig.5 Moisture content comparison of T₀ and T₃ pizza base samples



During the moisture content analysis, we observe that the content of moisture decreases as the amount of composite flour content increases in the sample that why the sample T₃ has

the lowest amount of moisture content in compare to all other samples and also lower in compare to T_0 , as shown in fig, 5.

CONCLUSIONS

On the basis of present study, it can be concluded that the developed value-added pizza base T_3 is more nutrient rich than the control pizza base T_0 . It has higher amount of protein and fiber, whereas lower amount of fat, moisture, and ash as compared to control pizza base sample T_0 . The developed pizza base samples were subjected to sensory evaluation. Nine-point hedonic rating scale method was used for organoleptic evaluation of the products. The results showed that sample T_3 (20.51%:20.51%:15.38%:7.6%), was most acceptable with regards to all sensory parameters.

RECOMMENDATION AND SUGGESTION

In present scenario when there is rise in non-communicable disease such as obesity, diabetes and high blood pressure due to lack of nutrients in daily food routine the developed value-added pizza base T_3 may be helpful. Thus, it can be a replacement for the conventional refined wheat flour pizza base which can cause serious health issues.

References

1. **Anonymous 2024a**; <https://betterwithmillets.com/buckwheat-millet/>
2. **Anonymous 2024b**; <https://www.healthifyme.com/blog/brown-rice-flour/>
3. **Agrawal Anu & Verma Anisha. (2016)**. Development of multigrain flour pizza base for value addition. *International Journal of Advanced Research*. 4. 1115-1120. 10.21474/IJAR01/1311.
4. **Biljwan M., Naik B., Sharma D., Singh A., & Kumar V. (2019)**. Recent development in dough-based bakery products: A mini review. *The Pharma Innovation Journal*, 8(5), 654-658.
5. **Bunkar D. S., Goyal S. K., Meena K. K., & Kamalvanshi V. (2021)**. Nutritional, functional role of kodo millet and its processing: a review. *International Journal of Current Microbiology and Applied Sciences*, 10(01), 1972-1985.
6. **Gulia S., and Kawatra A. (2022)**. Evaluation of pizza base prepared with pearl millet and Chia seeds: A healthy alternative. *The Pharma Innovation Journal* 2022.
7. **Kaur, V., & Sharma, A. (2017)**. Development of low-fat bakery products: A review. *International Journal of Food Science and Nutrition*.
8. **Kanaujiya Garima, and Singh Neetu. (2017)**. To nutritional profile of dietary fibre pizza base and sensory evaluation of develop product. *Int. J. Adv. Res. Ideas Innov. Technol* 3 (2017).
9. **Kumar Dewendra & Patel Safera & Naik Rajesh & Mishra Niraj. (2016)**. Study on Physical Properties of Indira Kodo-I (*Paspalum Scrobiculatum* L.) Millet. *International Journal of Engineering Research and. V5*.
10. **P Bhavya, S Suchiritha, Devi P., Janaki Srinath, P Sreedevi. (2020)**. Development sensory evaluation of millet-based pizza base. *Int J Chem Stud* 2020;8(4):3502-3504
11. **Pundir M., Singh G., Rather M. F., & Parry N. A. (2024)**. Comparison study of starch from Kodo millet and other millets: Comparison study of starch. *Sustainability, Agri, Food and Environmental Research*, 12(1).
12. **Saini Manju, Wadhawan Nikita and Lakhawat Sarla. (2021)**. Nutritional Composition of Developed Value-Added Pizza Base using Whole Wheat Flour, Quinoa Flour and Lotus Stem Powder. *Int.J.Curr.Microbiol.App.Sci.* 10(07): 620-628.

13. **Sharma S., Sharma N., Handa S., & Pathania S. (2017).** Evaluation of health potential of nutritionally enriched Kodo millet (*Eleusine coracana*) grown in Himachal Pradesh, India. *Food chemistry*, 214, 162-168.
14. **Swamy K.R.M.2023.** “Origin, domestication, taxonomy botanical description, genetics and cytogenetics, genetic diversity and breeding of kodomillet (*Paspalum scrobiculatum* L.)”. *International Journal of Current Research*,15, (09), 25898-25921.
15. **Wang H., Fu Y., Zhao Q, Hou D., Yangs X., Bai S., & Shen, Q. (2022).** Effect of different processing methods on the millet polyphenols and their anti-diabetic potential. *Frontiers in nutrition*, 9, 780499.
16. **Wang, Ya; Nie, Zihan; Ma, Tingjun (2022-02-24).** "The Effects of Plasma-Activated Water Treatment on the Growth of Tartary Buckwheat Sprouts". *Frontiers in Nutrition*. 9: 849615.