

A UNIFIED APPROACH TO THE DEVELOPMENT OF VALUE-ADDED PASTA AND EVALUATING SENSORY ATTRIBUTES

Prashant Kumar Srivastava* and Neetu Singh

Department of Foods & Nutrition

Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow-226025, Uttar Pradesh

Pasta is a fast-growing food industry sector. As a result of rising customer demand, India's manufacturing industry is booming. According to Mariani-Constantini, wheat is a derivative food, and pasta is the world's second-most popular wheat-based product after bread. Many hypotheses arise about how it started (Giacco R *et al.*, 2016). Pasta and other types of noodles are rich in carbohydrates but deficient in minerals and proteins. It is primarily used to make noodles.

The use of refined wheat-based products can frequently result in nutritional imbalances. Dietary fibre and mineral content are abundant in root and tuber products. Fibrous diets have been associated with valuable qualities such as improved bulk motility, reduced cholesterol, and minimising the glucose level in the blood, preventing the risk of obesity, type 2 diabetes, and cardiovascular disease; and working as probiotics, which help to eliminate the risk of cancer as well as constipation (Slavin *et al.*, 2008). However, a number of varieties of noodles are fortified and produced from different varieties of grains like rice, pulses, millets, buckwheat, potato starch, and other varieties of roots and tubers were reported. In order to continue to increase the economic growth and consumer awareness of healthy lifestyles, the use of non-conventional flour, enriched with the help of natural plant nutrients and other functional components has been highlighted (Sun *et al.*, 2019). The products produced with yam have excellent mass density and texture quality. Research has shown that elephant foot yam flour is suitable for producing high quality food snacks. Yam has been used for a long time in traditional Chinese medicine as an immune and health food in China.

Mushrooms have been used as human food as well as medicine for several centuries. It is considered nutritious because its calories and fat are minimal yet rich in protein and fiber (Manzi *et al.*, 2006).

The addition of mushroom powder significantly enhanced the quantity of soluble, insoluble, and total dietary fibre in pasta samples (Xikun *et al.*, 2018). Some studies have been done in which 10% to 20% of mushroom powder was added to cereal-based

products like noodles and pasta to see which ones tasted the best (Kulkarni *et al.*, 2012). Dry leaves of the drumstick tree can also be used instead of iron tablets for the treatment of anaemia because they contain 14 times more iron than beef. Moringa can reduce the risk of anaemia disease naturally without the use of any synthetic supplements. One of the important sources of zinc is *Moringa oleifera*, which is also essential for good semen count (Srivastav *et al.*, 2021). Drumstick leaves have 25.5 to 31.03 mg per kg zinc content (Shija *et al.*, 2019). When the ratio of dried moringa leaves and oat flour is substituted into wheat flour pasta, it reduces the moisture content in the prepared product, which is a positive signal of their capability to extend the shelf life of a product (Olua *et al.*, 2014). When wheat (25%) base flour is mixed with moringa leaf flour and oat flour, and pasta is made successfully after the fortification, it improves the pasta's physiochemical properties and makes it taste better (Getachew *et al.*, 2020). The objectives for this study are to develop functional pasta by using yam, mushroom, and moringa leaf powder; and characterization of functional pasta to improve its nutritional and sensory properties. The food industry has recently made a real effort to produce newer functional pasta products that are rich in nutrients and bioactive compounds. The increased demand for healthy food by health-conscious consumers has prompted researchers and food manufacturers to design pasta products that are high in minerals, vitamins, and fibre and have a low glycemic index.

Pasta is a perfect vehicle for health improvement with its low cost, long lifespan, and high calorie intake. The World Health Organization (WHO) and the Food and Drug Administration (FDA) consider pasta a suitable vehicle for the incorporation of nutrition supplements (Nilusha *et al.*, 2019). So, the current study is looking at how to combine protein-rich supplements (like mushrooms) with yam and moringa leaf, which are high in minerals and vitamins, to make a better protein and mineral supplement.

The total time of experimental studies consisted of nine months (October 20–June 21). In the above conceptual experimental design, phases 1 and 2 are for collecting the samples and getting them ready for experiment. Furthermore, Phase 3 is

*Corresponding author : prashantks907@gmail.com
Date of receipt: 11.03.2021, Date of acceptance: 12.07.2022

product development, and Phase 4 is about sensory characteristics for the demonstration. The sample for any study is selected, collected, and characterized as an appropriate raw material for product development. In the present study, three samples were taken as raw materials and selected. This conceptual framework has its own sample technique for results and findings. Multiple methods are used for the processing raw ingredient and development of functional pasta as shown in Fig. 1.

Unconventional pasta made by different flours, water (20%), salt, gum Arabic, and CMC (carboxymethyl cellulose). First, mix all the powdered ingredients in a big bowl, then add water accordingly. The mixing and kneading processes take 15 minutes to produce a stiff, plastic and homogeneous dough. Then the ready dough is fed into the extruder while applying pressure so as to extrude the dough through a series of die orifices. At different compositions, we prepared the functional pasta: C – Refined Wheat flour (100 %), T1 - Yam (90%) + Mushroom powder (5%) +Moringa leaf flour (5%), T2 - Yam (70%) Mushroom powder (15%) +Moringa leaf flour (15%), T3 -Yam (80%) + Mushroom powder (15%) +Moringa leaf flour (5%), T4 - Yam (75%) + Mushroom powder (20%) +Moringa leaf flour (5%), T5 – Yam (80%) + Mushroom powder (10%) +Moringa leaf flour (10%)

A pasta-making machine (model: Dolly; La Monferrina, Asti, Italy) was used in the present study, in which relatively dry dough was forced into the holes in the die under a pressure of approximately 6895 kPa. A standard weight of raw material (256 g) was used for each experimental run. The extruded products (Macaroni, Rigatoni Form – a tubular shape with a ribbed surface, of 0.92 mm thickness, 5.3 mm external diameter, and 32.0 mm length) were cut into pieces of uniform size by means of a knife moving over the outer die surface. After being extruded, the cone-shaped pieces were dried at 60 °C for 45 minutes, until the final product had less than 13% moisture. It was then put into zip-polythene pouches that are sold in stores.

Recipe of raw functional pasta, for each treatment, included 100g of dried pasta, 1 tablespoon of olive oil, 1 tablespoon of noodle masala, 1 chilly, and salt to taste, which are required to be boiled in hot water for 5–6 minutes. Then it was sautéed with noodle masala, adding salt and chilli powder, and served on a plate in hot condition. Sensory evaluation included evaluation for color, appearance, taste, aroma, mouth-feel, and overall acceptability.

Each of the five attributes was evaluated using a nine-point hedonic scoring scale, with a very much liked product, retaining its original shape and with a smooth body and texture, flavour and taste, colour and

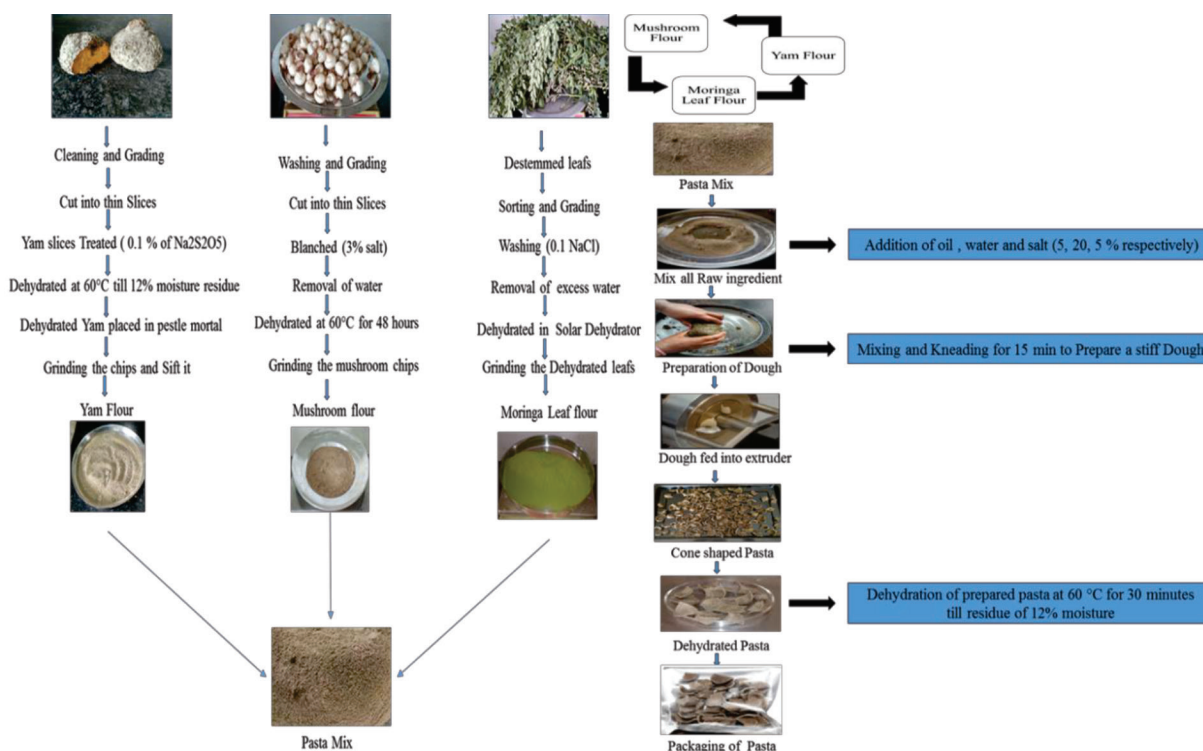


Fig. 1. Pasta preparation process

Table 1. Total extraction yield

Selected Raw Sample	Initial Weight (Raw)	Final Weight (Dehydration)	Total Extracted Yield (%)
Yam	1000 grams	450 grams	45
Mushroom	1000 grams	115 grams	11.5
Moringa Leaf	900 grams	117 grams	11.7

Table 2. Sensory evaluation of functional pasta based on various sensory characteristics

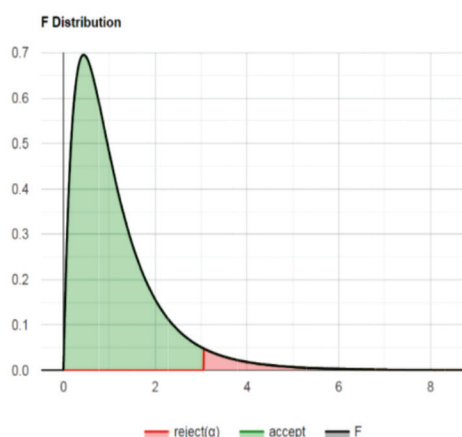
Treatment	Flavour and Taste	Body and Texture	Colour and Appearance	Aroma	Overall Acceptability
Control	8.6	9.2	9	8.4	8.8
T ₁	6.8	6.6	6.4	6	6.25
T ₂	6.6	6.6	7	6.2	6.8
T ₃	7	6.8	7.6	7.4	7.2
T ₄	7.6	7.4	7.4	7.2	7.4
T _{5*}	8.4	8.8	9	8.5	8.67

appearance, aroma, and overall acceptability, scoring 9; and a much disliked, extensively deformed product, scoring 1. The percentage yield of yam, mushroom, and moringa leaf flour from the raw stage to the final dehydrated sample is shown in Table 1.

It was found that participants accepted all the pasta samples with additional yam, mushrooms, and moringa leaves. Table 2 shows the data from the sensory evaluation of unconventional pasta that was influenced by different treatments.

To verify and statistically validate the result, we did an ANOVA one-tailed test according to the data set. The results obtained by the statistically validated are shown in Table 2.

Fig. 2 represents the F-value distribution among the groups T1 to T5. The p value obtained is less than 0.05 (Table 3), which shows the results are statistically significant.

**Fig. 2. F-value distribution**

Sensory scores of developed unconventional pasta with varied proportions of yam, mushroom, and moringa flour are shown in Fig. 4. The overall quality of the pasta with 10% mushroom, 80% yam, and 10% moringa leaf powder is the most acceptable, and the sensory score is as follows: 8.4, 8.8, 9, 8.5, and 8.67 for their flavour and taste, body and texture, colour and appearance, aroma, and overall acceptability, respectively. In this study, we found the most important parameters of pasta in terms of texture and colour are influenced by yam and mushroom flour, as shown in Fig. 4. Products are made from yam flour and have a good expansion ratio, bulk density, and acceptable texture qualities. The study showed that the EFY flour is suitable for the production of food-quality snack products. (Suriya *et al.*, 2016). The overall acceptability of pasta mostly relies on flavour, texture, and color. The study shows that yam, mushroom, and moringa flour are unusual ingredients for making pasta because they make the

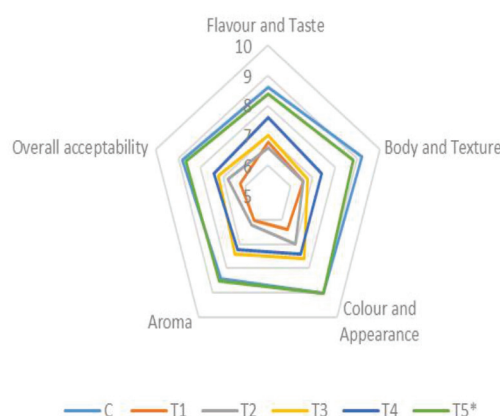
**Fig. 3. Sensory score of unconventional Pasta**

Table 3: Statistical Analysis of Validation of Organoleptic Propertie

Source	Df	Sum of Square	Mean Square	F Statistic	P-value
Groups (T1-T5)	4	291.000000	72.750000	22.38	0.000003
Error (within T1-T5)	15	48.750002	3.250000		
Total	19	339.750002	17.881579		

pasta healthier and taste better. During the processing of selected raw samples, the highest yield was seen in the yam sample, followed by moringa and mushroom, respectively. The mushroom yield percentage was low due to excessive moisture content. Yam and mushroom flour frequently influence some sensory attributes, like texture and flavour, of the unconventional pasta. The overall quality of pasta with 10% mushroom, 80% yam, and 10% Moringa leaf powder is the most acceptable according to the quality parameters used in this study.

Authors' contribution

Conceptualization and designing of the research work (NS): Execution of field experiments and data collection (PKS): Analysis of data and interpretation (PKS): Preparation of manuscript (PKS, NS).

LITERATURE CITED

- Giacco R, Vitale M and Riccardi G 2016. Pasta: Role in Diet. In Caballer B et al. (Eds), *The Encyclopedia of Food and Health*, Academic Press, Oxford, pp. 242-45.
- Kulkarni S, Desai D, Ranveer and Sahoo R 2012. Development of nutrient rich noodles by supplementation with malted ragi flour. *Int Food Res J* **19**: 309-13.
- Manzi P S, Marconi Aguzzi A and Pizzoferrato L 2006. Commercial mushroom nutritional quality and effect of cooking. *Food Chem* **84**: 201-6.
- Marido G, Habtamu Admassu and Fatih Yildiz 2020. Production of pasta from Moringa leaves - oat - wheat composite flour. *Cogent Food & Agri* **1**: 1-6.
- Shija A, Rumisha S F, Oriyo N M, Kilima S P and Massaga J 2019. Effect of Moringa oleifera leaf powder supplementation on reducing anemia in children below two years in Kisarawe district, Tanzania. *Food Sci Nutr* **7**(8): 2584-94.
- Slavin J L 2008. Position of the American Dietetic Association: Health implications of dietary fiber. *J Am Diet Assoc* **108**:1716-31.
- Srivastav P K, Singh N and Anukriti. 2021. Versatile profile of Moringa and its role for growth as a functional food: A review. *Plant Arch* **21**: 16-21.
- Sun K N, Liao Ai-Mei, Zhang F, Thakur K, Zhang J, Huang J, Wei Z 2019. Microstructural, textural, sensory properties and quality of wheat-yam composite flour noodles" *Foods* **8**: 519.
- Suriya M, Baranwal G, Bashir M, Reddy CK, and Haripriya S 2016. Influence of blanching and drying methods on molecular structure and functional properties of elephant footyamJFoodSciTechnol(Amorphophalluspaeoniifolius) flour. *LWT Food SciTechnol* **68**: 235-243