

DEVELOPMENT AND FORMULATION INSTANT SOUP MIX WITH SPROUTED FINGER MILLET

^{1*}Nadiminti shanthi , ¹Dr. A. Swaroopa Rani, ²R. Nanda Kishore Reddy

^{1*}Student Department of Food Technology and magement, Oil Technological & Pharmaceutical Research Institute, JNT University, Anantapuramu-515001, Andhra Pradesh, India.

¹Professor, Head & Chairman-Board of Studies, Department of Food Technology, Oil Technological & Pharmaceutical Research Institute, JNT University, Anantapuramu-515001, Andhra Pradesh, India.

²Co founder, Nutry Food Industries, Garladinne, Anantapuramu, Andhra Pradesh, India.

[Nadiminti shanthil@xyz.com](mailto:Nadiminti_shanthil@xyz.com), [Dr.A Swaroopa Rani 2@xyz.com](mailto:Dr.A.Swaroopa.Rani.2@xyz.com), [R.Nanda kishore Reddy 3@xyz.com](mailto:R.Nanda.kishore.Reddy.3@xyz.com)

Abstract—This study focuses on the development and formulation of an Instant soup mix incorporating with sprouted finger millet powder, Addressing the need for convenient, health oriented food products that promote the consumption of this traditional super food. Sprouted finger millet (*Eleusine coracana*) rich in iron, zinc, calcium, vitamins, and protein. Sprouting process enhances its nutritional value and bioavailability, making it an excellent addition to a healthy diet. These soup mix contain high level of dietary fiber and low level of glycemic index help to support heart health reduce cholesterol levels improve blood circulation, digestibility and Support bone health support healthy skin. So this soup mix is consumed by a wide range of people they are growing childrens, old age people and people with gluten intolerance, because finger millet is called as naturally gluten free. This process involved sprouting finger millet grains to improve their nutritional profile followed by drying and milling into fine powder. these sprouted finger millet powder was combined with dehydrated tamato, garlic, onion and spices, these soups are designed for instant preparation by adding hot water providing instant meal. This study contributes to global efforts to combat malnutrition. The final product evaluation scores for texture, aroma, taste, and overall appearance for market acceptability.

Key words - instant soup mix, sprouting process, malnutrition, gluten free, alnutrition

INTRODUCTION

Instant soups are typically regarded as a comfort food that works for everyone. One kind of soup designed for quick and simple cooking is called an instant soup. It is possible to market soup as a completely dry product, soup is one of the most popular instant foods that people enjoy. Many Indians, particularly those who live in large cities, have modern lifestyles that require fast-paced, practical items in practically every area. In addition to being quick and simple to make, instant foods are hygienic and free of microbiological contamination (Tamlurkar et al., 2006)¹. Soup is a traditional cuisine that can be categorized as an appetizer and served warm when you're sick or cold. Due to the time-consuming nature of making soup, commercially manufactured quick soup has supplanted homemade soup in the modern world (Niththiya et al. 2014)². The finger millet (*Eleusine coracana* L.), also referred to as ragi or mandua, is widely grown throughout India and the world. Nearly 60% of the world's finger millet production comes from India, making it the primary producer (S. Kamini et al., 2011)³. Finger millet is a key crop in adaptive areas and a good source of minerals, lipids, and protein, iron, calcium even though it is not traded on worldwide markets. (Vijayakumari et al., 2003)⁴. Finger millet was sorted, cleaned, soaked in water, and sprouted using a modified version of the process outlined by (Onyango et al. Citation 2012)⁵. After a thorough washing, the grains were left to soak for 12 hours at room temperature (about 25 °C) in clean tap water. The grains were then spread out on trays lined with pre-sterilized and moistened jute sacks after being drained. For 48 hours, the grains were sprayed with water at 12-hour intervals. The tomato (*Lycopersicon esculentum*), sometimes known as red tomatoes or tomato plants, is Mexico's most widely distributed export worldwide and has a wide range of culinary applications (CLÉMENT, 1996)⁶. tomatoes. 93.5 percent water, 0.9 grams of (sanchez, N., et al., 2013)⁷. One useful nutritional, therapeutic, and functional qualities. Furthermore, it is the second most advanced crop in the world after tomatoes (Sharma et al., 2016)⁸. a number of studies are being conducted to create high-added-value preparations with notable favorable bioactivities (Chadorshabi et al., 2022)⁹. Grown worldwide, garlic (*Allium sativum* L.), a plant in the Amaryllidaceae family, has several health advantages. In 1550 B.C., influenza, cholera, dysentery, and typhus were among the diseases for which garlic was employed as medicine because there were no pharmaceutical products or antibiotics accessible (Petrovska, et al., 2010)¹⁰. It has moderate amounts of selenium, calcium, magnesium, manganese, iron, and potassium, phosphorus, zinc, and sulfur, and low amounts of sodium, vitamin A, vitamin C, and the B-complex (Agarwal, K.C. et al., 1996)¹¹. The pepper family's genus Piperaceae includes blooming plants such as herbs, small trees, and shrubs. Five genera, including Piper, Peperomia, Zippelia, Manekia, and Verhuellia, and over 3600 species make up this class. With over 2171 species, the Piper and Peperomia genera contain the majority of the species (Stevens, et al., 2001)¹². The activation of nuclear factor erythroid 2-related factor 2, peroxisome proliferator-activated receptor gamma, cyclooxygenase-2, A flowering plant in the Apiaceae family, cumin (*Cuminum cyminum*) is indigenous to East India and the eastern Mediterranean. Cumin is called "jeera" or "jira" in India, and it is known as "zira." According to (Nadeem et al. (2003)¹³. source of vitamins B and E as well as a number of nutritional minerals, particularly iron. The main volatile components of cumin include terpenoids, cymene, and cuminaldehyde (Bettaieb et al. 2011)¹⁴. Chilli, which belongs to the Solanum family, is also referred to as bird pepper, cayenne, paprika, hot pepper, and sweet pepper. In this genus, there are 25 distinct species. According to (Pickersgill (1997)¹⁵. Sweet corn, sometimes referred to as sugar corn, is a hybridized type of maize (*Zea mays* L.) that is cultivated especially to have more sugar and produce green ears 75 to 90 days after planting. 5-6% sugar, 10% starch, 3% water-soluble polysaccharides, and 70% water are all present in sweet corn. Carrots are a domesticated form of the wild carrot, *Daucus carota*, which is found in southern Asia and Europe. Originally cultivated in Persia for its leaves and seeds, this plant is Though

greens are occasionally consumed as well Carrot is the most important crop in the Apiaceae family. This type of root vegetation is found all over the world(B. Cotes, et al., 2018)¹⁶. There are several skin diseases that carrots can help prevent and treat. This crop contains antioxidants that can help heal skin conditions like dermatitis, rashes, acne, pimples, and skin problems brought on by a lack of vitamin A.

2. MATERIALS AND METHODS:

Raw materials: The materials that are required in the preparation of soup are sprouted finger millet powder, tomato powder, garlic powder, onion powder, black pepper powder, cumins powder, chilli powder, dehydrated sweet corn, dehydrated carrot, salt.

preparation of sprouted finger millet powder:

Commercial finger millet grains and were sourced from the local market in Palampur, Himachal Pradesh, while honey was obtained from the Institute of Himalayan Bioresource Technology. The finger millet grains were thoroughly washed to remove dust and debris, then soaked overnight in water (1:4 w/v) at room temperature. The soaked grains were wrapped in moist muslin cloth and left to germinate in the dark at 28 ± 2 °C for 24 hours. Once sprouted, they were dried in a hot air oven at 50 ± 3 °C for one hour. The dried grains were then ground, sieved through a 42 mesh screen (0.354 mm), and the resulting sprouted finger millet flour was stored in Ziplock bags.

. processing of raw materials:

Various ingredients were meticulously prepared to ensure the nutritional quality and shelf stability of a finger millet soup mix. Finger millet seeds were cleaned, sun-dried, and ground into flour; some were also germinated or popped before processing. Tomato powder was made by blanching, slicing, and drying tomatoes at 60°C, followed by grinding and sieving. Garlic powder was prepared by blanching cloves, drying at 60–65°C, grinding, and sieving. Onion powder was made from cleaned, peeled onions, sliced, dried at 60°C, ground, and sieved. For chilli powder, mature chillies were cleaned, dried, and ground while avoiding overheating, then sieved and packed. Black pepper seeds were cleaned and ground under controlled temperatures to optimize energy use. Cumin powder was produced by precooling seeds and using grinding or flaking techniques to retain oil content. All powders were stored in airtight containers to preserve flavor and extend shelf life.

Preparation of sprouted finger millet soup:

A nutritious and shelf-stable finger millet soup mix was formulated using carefully selected ingredients and standardized procedures. Premium finger millet grains were cleaned and dried (hot air oven or sundried) to reduce moisture and microbial risk, then ground and sieved into fine flour. Dehydrated vegetables were ground into coarse powders and stored. The final formulation included 50% finger millet flour, 20% dehydrated vegetable powder, 10% pulse flour, 10% maize flour (as thickener), and 10% spice mix (cumin, black pepper, garlic powder, salt). Ingredients were precisely weighed, blended using a ribbon blender, and screened through a magnetic sieve to remove metal contaminants. The mix was packaged in laminated, nitrogen-flushed pouches to prevent oxidative spoilage and stored in cool, dry conditions. This ready-to-cook mix offers the traditional taste of vegetable soup with added health benefits from finger millet.

^{1*}Nadiminti shanthi, ¹Dr. A. Swaroopa Rani, ²R. Nanda Kishore Reddy

^{1*}Student Department of Food Technology and mangement, Oil Technological & Pharmaceutical Research Institute, JNT University, Anantapuramu-515001, Andhra Pradesh, India.

¹Professor, Head & Chairman-Board of Studies, Department of Food Technology, Oil Technological & Pharmaceutical Research Institute, JNT University, Anantapuramu-515001, Andhra Pradesh, India.

²Co founder, Nutry Food Industries, Garladinne, Anantapuramu, Andhra Pradesh, India.

[1Nadiminti shanthil@xyz.com](mailto:¹Nadiminti shanthil@xyz.com), [2Dr.A Swaroopa Rani 2@xyz.com](mailto:²Dr.A Swaroopa Rani 2@xyz.com), [3R.Nanda kishore Reddy 3@xyz.com](mailto:³R.Nanda kishore Reddy 3@xyz.com)

FILLING AND SEALING

The obtained finished goods is filled in a tetra -pouches or the Low Density Polyethylene pouches. The pouch consists of zip lock at the top of the pouch. The product is filled according to the pouch size. The product filled in the pouch is sealed in a continuous sealer machine. The sealed product is kept for storage stability

PREPARATION OF INSTANT SPROUTED FINGER MILLET POWDER AND SPICES POWDER

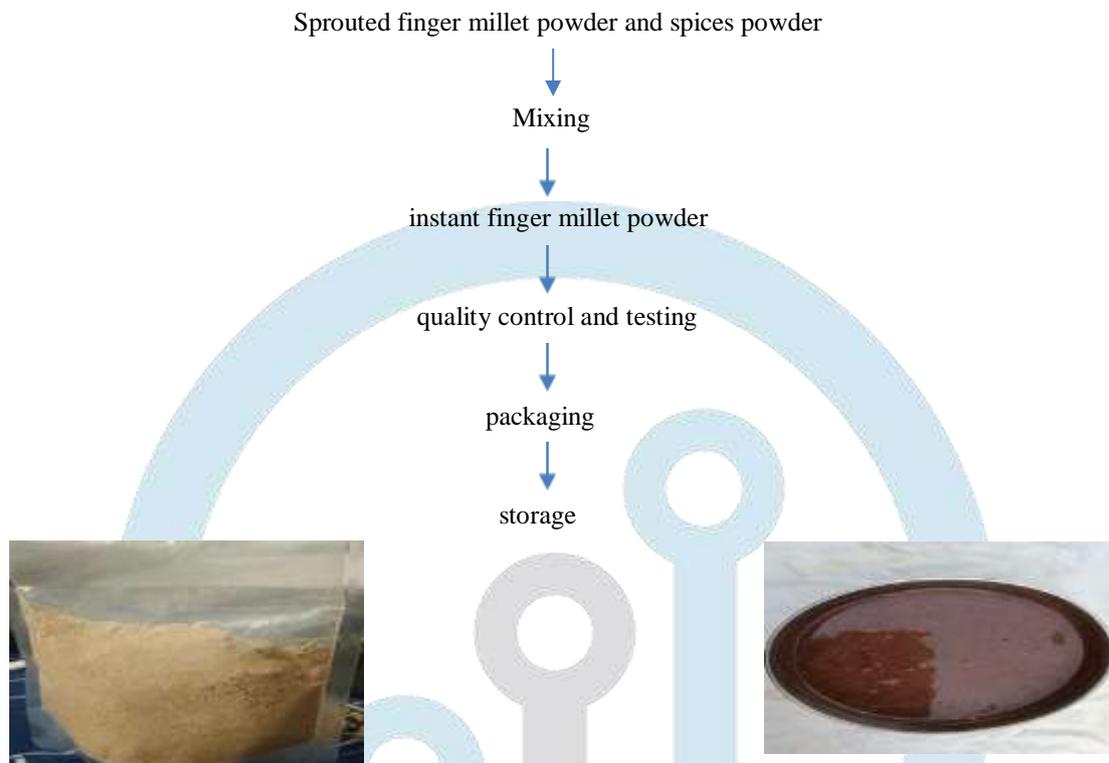


Figure 1: instant sprouted finger millet soup powder

figure 2: instant sprouted finger millet soup mix

FORMULATIONS

The formulation is developed with the focus on sprouted finger millet as the primary ingredient, due to its rich nutritional profile, particularly in calcium and dietary fiber. A higher percentage of sprouted finger millet is maintained compared to other ingredients. Wheatgrass powder is included as a natural source of iron and antioxidants, enhancing the nutritional value of the mix. Brown rice is incorporated for its complex carbohydrates and nutrient content. Variations between formulations 1 to 4 involve changes in mesh size and the proportion of ingredients. Specifically, these adjustments focus on optimizing texture and nutrient balance by altering the quantities of sprouted finger millet, quinoa, and brown rice. The total formulation weight is standardized to 150g.

Table:1 formulations

Ingredients	F1	F2	F3	F4
Sprouted finger millet powder	65	60	65	61
Tomato powder	23	23	18	22
Cumin powder	5	5	5	5
Black pepper powder	3	3	3	3
Onion powder	7	7	7	7
Garlic powder	5	5	5	5
Chilli powder	3	3	3	3
Dehydrated sweet corn	15	15	15	15
Salt	9	9	9	9
Dehydrated carrot	15	15	15	15

METHODS

Moisture content: To measure the accurate amount of water present in the sample. Moisture content is analyzed by the oven drying method at 105°C for 3hrs (AOAC 2000). Formula: $Moisture = \frac{W_2}{W_1} \times 100\%$

Ash content: To measure the minerals present in it. Ash content is analyzed by using muffle furnace at 550°C for 6hrs (AOAC 2000).

Formula: Ash = $W_2 / W_1 \times 100\%$

pH: It is determined by the digital pH meter.

Titration acidity: The measure of un-dissociated acids in the sample.

Formula: Acidity = $\frac{\text{Titrate value} \times \text{equivalent weight of NaOH} \times \text{normality of NaOH}}{\text{weight of the sample}}$

Acid Insoluble Ash: To measure contaminants like sand in the sample (AOAC 941.12)

Formula: Acid insoluble ash = $\frac{\text{weight of residue after acid treatment}}{\text{Original weight of the sample}} \times 100\%$

Carbohydrates: the measure of carbohydrates is by using fehling solution performed according to FSSAI manual method.

Formula: Total Carbohydrates (%) = Volume of sample used (ml) × dilution factor × 100

Protein: the protein content is determined by kjeldahl method.

Formula: Nitrogen% = $\frac{\text{Volume of HCl} \times \text{Normality of HCl} \times 1.4007}{\text{Weight of sample in gm}}$

Protein (%) = Nitrogen (%) × 6.38

Crude fiber: Determined using the method of AOAC (2000).

Formula: Crude fibre = $\frac{\text{Weight of the fibre [(W}_2\text{-W}_1) - (W_3\text{-W}_1)] \times 100}{\text{Weight of the sample (g)}}$

Iron

Iron is determined by using UV-Visible spectrophotometer

Iron (mg/100g) = $\frac{\text{concentration (mg/L)} \times \text{volume (mL)}}{\text{Weight of sample (g)}} \times 100$

Calcium

Calcium determined by using UV-Visible spectrophotometer

Calcium (mg/100g) = $\frac{\text{concentration (mg/L)} \times \text{volume (mL)}}{\text{Weight of sample (g)}} \times 100$

Sensory Analysis:

The sensory analysis is done according to hedonic scale rating (table 2). The formulations are exposed to sensory analysis along with control. Different panelist gave the rating for sensory attributes like color, flavor, taste, appearance, taste and overall acceptability. The mean score is the overall acceptability.

Table: 2 Hedonic Scale

OPINION	RATING
Like extremely	9
Like very much	8
Like moderately	7
Like slightly	6

Neither like nor dislike	5
Dislike slightly	4
Dislike moderately	3
Dislike very much	2
Dislike extremely	1

3.RESULTS AND DISCUSSION

sensory evaluation:

plays a vital role in determining the consumer acceptance and market success of a food product. The sprouted finger millet soup was assessed for color, flavor, texture, taste, and overall acceptability using a 9-point Hedonic scale. Results indicated high consumer preference, particularly due to the soup's smooth texture and enhanced flavor resulting from the sprouting process. Sensory scores remained consistently high throughout the trial period, reflecting good quality stability. As unfavorable sensory attributes can lead to rejection before microbial spoilage, factors like taste, flavor, and appearance are key to the soup's acceptance and shelf life.

Table: 2 Sensory evaluation of the Sprouted finger millet soup

Sensory attributes	formulation 1	Formulation 2	Formulation 3	Formulation 4
Colour	8	8.5	9	8
Flavour	8.5	9	8.5	8.5
Consistency	8	8.5	8.5	8
Taste	8.5	9	8.5	8.5
Appearances	8	8	9	8
Overall acceptability	8	8.5	9	8

Physico Chemical Analysis

According to the results of physico-chemical analysis, it clearly states that developed and optimized variation was rich in iron and protein compared to control due to addition of instant soup mix with sprouted finger millet. It was also expressed that the moisture content and acidity of optimized variation was less compared to the control. Less moisture content gives longer shelf life to soup mix powder. With less moisture, the flavours can be more pronounced.

The analysis revealed that the developed soup mix with sprouted finger millet was richer in iron and protein than the control. Moisture content and acidity were lower in the optimized formulations, which contributes to a longer shelf life and more pronounced flavors. Among the formulations (F1–F4), moisture ranged from 8.0% to 8.3%, while acidity stayed low (0.04%– 0.06%). Lower moisture and acid levels enhance storage stability.

Table: 4 Physico Chemical Analysis

Parameters	F1	F2	F3	F4
Moisture	8.3%	8.2%	8.0%	8.1%
Ash	1.3%	1.2%	1.0%	1.3%
Acid insoluble ash	0.35%	0.36%	0.37%	0.32%
Ph	4.2	4.3	4.5	4.4
Acidity	0.05%	0.06%	0.04%	0.05%

Nutritional analysis

According to the nutritional analysis, it clearly states that developed and optimised formulation was rich in iron and calcium compared sample due to the addition sprouted finger millet soup. The iron and folate content can treat for anaemia and protein content can treat for malnutrition.

The nutritional analysis of the sprouted finger millet soup mix shows significant improvement in nutrient content compared to the control. All formulations (F1–F4) demonstrated a notable increase in protein, fiber, iron, calcium, and vitamin B6. F4 had the highest protein (10.06 g), fiber (7.9 g), and calcium (225 mg), making it the most nutrient-rich formulation. Carbohydrate content decreased from 81.9 g in the control to 61.16 g in F4, indicating a shift toward a more balanced and health-oriented composition. The presence of vitamin B6 and increased iron levels further support the product's potential in addressing nutritional deficiencies like anemia and calcium-related issues. Overall, the soup mix is highly nutritious and suitable for improving dietary quality.

Table: 5 Nutritional Analysis

PARAMETERS	control	F1	F2	F3	F4
Carbohydrates[g]	81.90	55.05	56.03	59.01	61.16
Protein[g]	2.5	9.47	9.68	10.04	10.06
Fiber[g]	4.0	5.0	6.0	7.0	7.9
Iron [mg]	-	2.23	2.59	3.31	3.22
Calcium [mg]	85	220	223	224	225
Vitamins B6	-	0.26	0.19	0.25	0.3

Microbial analysis

The microbial analysis was done in 0 days and 30 days and 60 days.”

This indicates a time-based microbial evaluation to check the microbial load or contamination over a storage period.

Table 5 Microbial Analysis

0 days	30 days	60 days
Nil	7.5×10^3 CFU/ml	7.6×10^3 CFU/ml

Initially, no microbial growth (0th day) was observed, indicating sterility. However, by the 30th day, microbial growth increased to 7.5×10^3 CFU/ml and remained stable at 7.6×10^3 CFU/ml on the 60th day. This indicates microbial viability or contamination over time.

Among the tested samples, Formulation III showed the most favorable values, suggesting it supported better microbial activity or had improved nutrient content. The stable CFU count also implies good microbial stability or probiotic potential.

This analysis is essential in microbiology to assess product safety, shelf-life, or probiotic effectiveness.

DISCUSSION

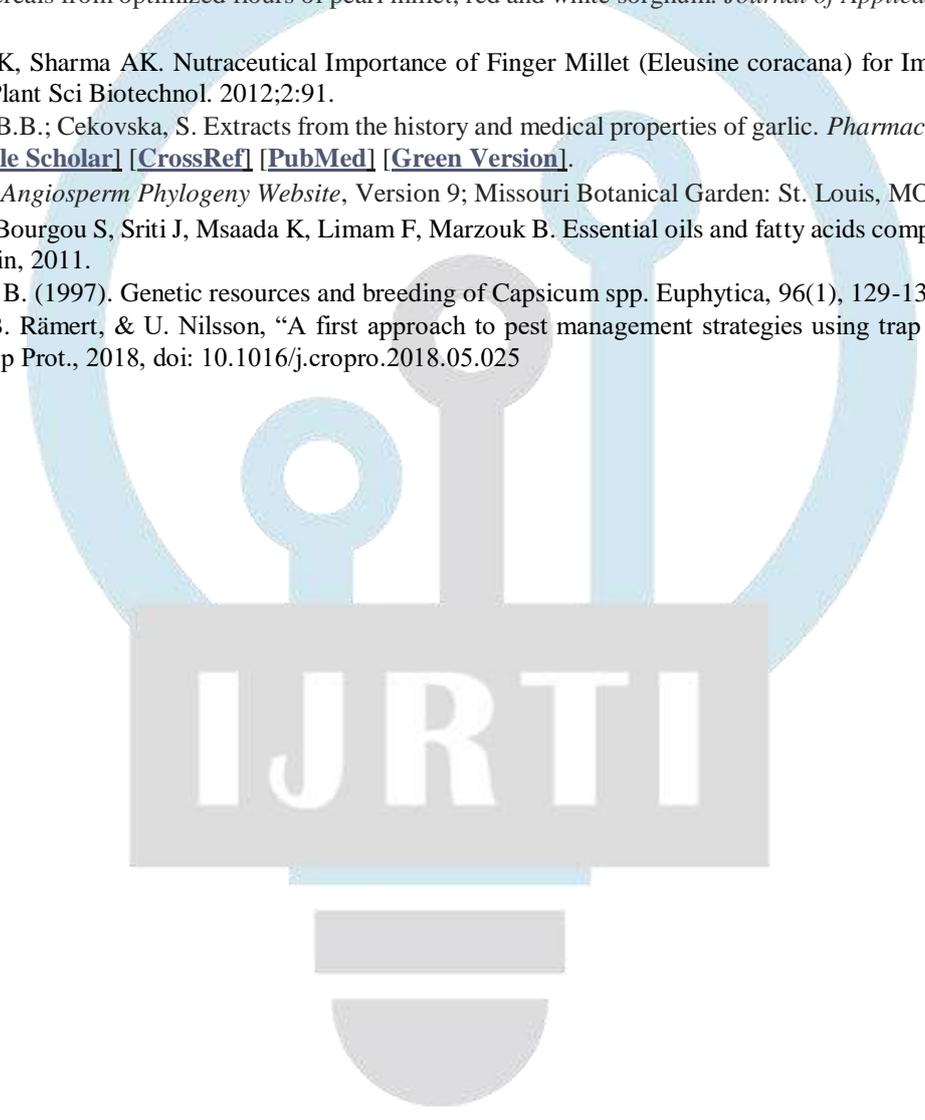
The goal of this study was to employ sprouted finger millet, which is high in protein, fiber, and vital minerals, to make a nutrient-dense soup. By raising vitamin levels, protein content, and mineral bioavailability while lowering anti-nutritional components, sprouting enhances its nutritional profile. In order to make a sustainable and well-balanced lunch, sprouted finger millet was combined with vegetables or legumes to create a delightful and nutritious soup. The ratio of sprouted finger millet to other ingredients was optimized during the standardization process, and the results of the sensory evaluation indicated that it was well-accepted. The nutritional analysis of the soup showed.

CONCLUSION

The sprouted finger millet soup blends tradition, nutrition, and flavor, making it a very promising functional food. Packed with fiber, minerals, antioxidants, and plant-based proteins, it controls blood sugar, aids in weight loss, supports heart health, and supports digestive health. Because the sprouting process increases the bioavailability of nutrients and keeps the soup devoid of artificial additives and preservatives, it appeals to consumers who are health-conscious. Current trends for healthy, functional foods are in line with this adaptable, ready-to-serve product, which fits into modern lives. The market for wholesome, quick food options is expanding, and it has a lot of potential.

REFERENCES

1. Tamlurkar, V. 2006. Role of Instant Foods in the Catering Industry. For: Faculty-Column in www.indianmba.com.
2. Niththiya, N., Vasantharuba, S., Subajini, M. and Srivijeindran S. (2014). Formulation of instant soup mix powder using uncooked palmyrah (*Borassus flabellifer*) tuber flour and locally available vegetables. Proceedings of Jaffna University International Research Conference. University of Jaffna, Jaffna, Sri Lanka. pp 198-202.
3. S. Kamini & S. Sarita. Quality Characteristics of Finger Millet Based Baby Food Preparation as Affected by Its Varieties and Processing Techniques. *Journal of Functional and Environmental Botany*. 2011, 1, 77-84.
4. Vijayakumari J, Mushtari BJ, Shamshad B, Sumangala G (2003) Sensory attributes of ethnic foods from finger millet. Paper presented at CCSHAU, Hisar. Recent trends in millet processing and utilization: 7–12.
5. Onyango, C. A., Ochanda, S. O., Mwasaru, M. A., Ochieng, J. K., & Mathooko, F. M. (2012). Development of instant breakfast cereals from optimized flours of pearl millet, red and white sorghum. *Journal of Applied Biosciences*, 51, 3559–3566.
6. Srivastava K, Sharma AK. Nutraceutical Importance of Finger Millet (*Eleusine coracana*) for Improved Human Health. *The Eur J Plant Sci Biotechnol*. 2012;2:91.
7. Petrovska, B.B.; Cekovska, S. Extracts from the history and medical properties of garlic. *Pharmacogn. Rev.* 2010, 4, 106–110. [[Google Scholar](#)] [[CrossRef](#)] [[PubMed](#)] [[Green Version](#)].
8. Stevens, P. *Angiosperm Phylogeny Website*, Version 9; Missouri Botanical Garden: St. Louis, MO, USA, 2001.
9. Bettaieb I, Bourgou S, Sriti J, Msaada K, Limam F, Marzouk B. Essential oils and fatty acids composition of Tunisian and Indian cumin, 2011.
10. Pickersgill, B. (1997). Genetic resources and breeding of *Capsicum* spp. *Euphytica*, 96(1), 129-133.
11. B. Cotes, B. Rämert, & U. Nilsson, “A first approach to pest management strategies using trap crops in organic carrot fields,” *Crop Prot.*, 2018, doi: 10.1016/j.cropro.2018.05.025

A large, light blue watermark logo is centered on the page. It features a stylized lightbulb shape with a circular top and a rectangular base. Inside the circle, there are three vertical lines of varying heights, resembling a stylized 'I' or a similar symbol. Below the circle, the letters 'IJRTI' are written in a bold, white, sans-serif font, set against a dark grey rectangular background. Below this background, there are two horizontal bars and a semi-circle, completing the lightbulb shape.

IJRTI