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Value added Instant Amaranth and Foxtail Soup Mix: Transformation of Conventional Foods into Health Promoters

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Abstract

Background: Owing to the changing lifestyle and need for convenience has instigated the food researchers and manufacturers to formulate the soup mixes in the ready to reconstitute form. Amaranth(pseudo-millet) and foxtail millet known to be a millennium crop or superfood with pertinent nutraceutical values comprising significant amount of protein, dietary fiber, micro-minerals, tocopherols, tocotrienols, phenolic compounds, flavonoids.

Objectives : Proposed experimental nutrition investigation aimed at designing instant soup mix using millets, dehydrated vegetables with determining nutritional quality & stability aspects.

Materials & methods: Formulated instant soup mix was Investigated for the proximate, minerals, physio-chemical properties using standard operating AOAC protocol. Sensory attributes were analyzed by using 9-point hedonic scale. Quality stability study was done at room temperature for a period of 30 days.

Results: Markedly sensory characteristics of the formulation was accepted with 8.5 sensory score. Proximate composition of the instant soup mix revealed a significant amount of CHO (68.59g/100gm), Protein (14.0g/100gm), Total Fat (5.3g/100gm), Crude fiber (2.21g/100gm), Dietary Fiber (16.8g/100gm), Total Moisture (2.936%). The minerals present are Zinc (2.84mg/100g), Iron (6mg/100g) and Folate (29.5mg/100g). Instant soup mix noticed to be free from microbial contamination.

Conclusion: The RTC soup mix aims to be hassle free, convenient, meal substituent contributing micronutrients such as iron, folate, zinc, calcium. Notably the value-added millet Formulation found to combat hidden hunger; a salient underlining risk factor for the burden of disease. It is often known to render antioxidant, cardio-protective actions, anti-microbial actions which could support in treating malnutrition, fetal development, constipation, anemia.

Keywords: Amaranth (pseudo millet), Foxtail millet, Instant soup mix, microbial quality, hidden hunger.

Introduction:

"Suddhah Sathvika aaha, Saradha Priyavadhi", Owing to the changing lifestyle and need for convenience food has instigated the researchers to formulate ready to reconstitute foods, without compromising on nutritive value of food.

Amaranth(pseudo-millet), millennium crop, foxtail millet a superfood with pertinent nutraceutical value, comprises of protein, dietary fiber, micro minerals, tocopherols, tocotrienols

Traditional functional food:

Plant resource have proven to comprise active biomolecules in nourishing and nurturing with reference to health functionalities as a food and medicine. In accordance recently there is an increased focus and demand towards cereal grains in food industry.

The term "pseudo-cereals "or pseudo-grain is one of any non-grasses that are used in much the same way as cereals. This indicates that the edible portions of these plants are their seeds, which are typically ground into flour and eaten similarly to cereals. Essentially the taste attributes and nutritional qualities are similar to cereals. The cereal grains known to be traditional functional food as a value-based substituent significantly comprising physico-chemical properties and nutritional values. (15)

For millennia, pseudo-cereals have been a staple diet consumed by the forefathers throughout history. Different pseudo-cereals are more common in different parts of the world. In the world's poorest regions, pseudo-cereals continue to be the staple of nourishment. For a very long time, they have grown in value in European nations. The most well-known pseudo-cereals include Khorasan, amaranth, buckwheat, sorghum, millet, and chia. Actually, quinoa, amaranth, chia, and buckwheat are the pseudo-cereals that have been investigated the most [1]. Markedly cereals known to be promising as a natural source for biophysiological mechanisms.

Millets- chemical composition & functional characteristics:

Amaranth has been well recognized since the time of the Aztecs, Mayans, and Incas [2]. During the 16th and 17th centuries, it spread widely as a grain, vegetable, weed, or crop in a number of different countries. Amaranth seeds were not just a food source; they were also revered. It was used in many religious and ceremonial rites [3]. Although this plant is valuable, its full potential has not yet been reached. Given the many benefits it provides to food producers, distributors, and consumers—all of which contribute to its great economic worth—it must to be made very clear. Amaranth belongs to the Amaranthaceae family of annual plants, which consists of about 70 species [2, 4-7].

The plants Amaranthus gangeticus Linn., Amaranthus mangostanus Linn., Amaranthus tricolor Linn., and Amaranthus blitum Linn. are grown as vegetables all over India. In addition to being used in salads and other recipes, amaranth leaves are occasionally suggested for medical purposes in African nations. [7]

Chemical composition:

Proteins, lipids, carbs, vitamins, and minerals are the primary biological components of amaranth [6]. Approximately 18% of amaranth seeds contain protein, which is higher than in typical cereals and varies depending on the plant variety, climate, soil type, and fertilization technique [5]

Amaranth seeds contain between 45 and 65 percent starch [8]. The fiber fraction (high level) of amaranth contains both soluble (mostly pectin) and insoluble components. This is a key category of chemicals. The lignin, cellulose, and hemicelluloses that make up the insoluble portion are good for the digestive system. Depending on where they come from, seeds typically contain 2–8% of their dry weight in fiber [3].

The plant's seeds and leaves have been shown to contain squalene, and they are also incredibly high in minerals and vitamins, particularly the B group [6]. Squalene percentages in amaranth oil range from 2–8% [4] to 6–8% [3] depending on the source and

writer. With an average of 3.3% of their weight in minerals, amaranth seeds are an excellent source of these nutrients. Iron and phosphorus are present in the highest amounts, whereas calcium, potassium, and magnesium levels are rather high.

Quantities of additional minerals were identified. The following other minerals have been found in amaranth: manganese, nickel, lead, cadmium, copper, zinc, sodium, chromium, and manganese, nickel, lead, cadmium, and cobalt. Cobalt is found in amaranth seeds and leaves. Amaranth seeds and leaves have trace levels of hemagglutinins, phytin and nitrates, oxalates, and polyphenols, saponins, and hemagglutinins contained in minute concentrations.

Foxtail

Foxtail millet is the oldest crop in the world. This crop is currently planted in semi-arid and tropical parts of Africa, Asia, Australia, and South America, particularly in China, India, Mali, Nigeria, and Niger. It has been farmed for 8000 years in China. (12,13) Due to its short growth season, resistance to insects and diseases, high tolerance to salinity stress, effectiveness in photosynthesis, and nutritional and medicinal qualities, foxtail millet has garnered interest from researchers. Foxtail millet is planted in 26 countries and is currently the second most produced crop worldwide. Setaria italic often known as "Kaon," is a significant crop in Bangladesh. (11)

Chemical composition:

Highly nutritious, easy to digest, and free of gluten and acid-forming foods is foxtail millet. Due to its low glycemic index, this item can be perfect for people with diabetes and celiac disease. Millets are rich in minerals such as iron, potassium, phosphorus, calcium, and zinc, as well as phytochemicals, phenolic acids, flavonoids, and essential amino acids. Crude fiber, found in foxtail millet, facilitates bowel movement and aids in digestion (14). Owing to its high nutritious content, foxtail millet has gained popularity as a component of cakes, soups, noodles, biscuits, and drinks. Furthermore, foxtail millet has a number of health benefits, including lowering the risk of heart attacks and cancer as well as cardiovascular disease and diabetes, aiding in weight loss, and lowering blood cholesterol levels.

Instant millet soup mix formulation:

Soup- as a meal substitute

Many Indians nowadays, especially those who reside in large cities, have fast-paced, practical lives that need efficiency in practically every area, including food preparation, processing, and presentation. It produces a culture that adores ready-to-eat and ready-to cook instant food products. Functional soup is one of the goods that could be turned into an immediate meal.

It is likely that soup originated at the same time as boiling was discovered to be an effective method of preparing food, making it one of humanity's first foods. It's a really quick way to cook. Soups can be made with vegetables, meat, fish, poultry, or a combination of all three. The ingredients are cooked in hot or boiling water until the flavour is extracted, creating a broth. Notwithstanding stylistic differences, boiling is a necessary step in the creation of any soup to extract the flavour and cause heat-induced compositional interaction. The word "soup" comes from the Teutonic word "suppa," which refers to a dish from the Middle Ages made of a thick stew served over bread slices called "sop," which are meant to absorb the liquid.

One traditional dish that can be categorised as an appetiser or a warm meal for a cold or illness is soup. Since making soup from scratch takes time, commercially prepared instant soups like canned, dried, and frozen soups have supplanted homemade soups in the modern day. Because of their high calorie and nutrient content, simplicity of preparation, and short serving time, instant mixes can be used as an alternate morning food [4].

According to [5], soup mix reinforced dehydrated veggies should be rehydrated and cooked within a short amount of time to produce a product that is both nutritious and appetizing.

Objective: In view Proposed experimental nutrition investigation aimed at designing instant soup mix using millets, dehydrated vegetables with determining nutritional quality & stability aspects

Materials and Methods

A. Collection of samples

All ingredients procured from the local market, was processed and stored till further use. Suitable pre- treatment was carried out. The product formulated was subjected to analysis.

B. Processing techniques

i) Preparation of amaranth seeds powder

Amaranth and foxtail was dry roasted and ground using blender and mixed in the ratio 75:25, 25:75 respectively further the studies were carried on 75:25 blend

Preparation of dried vegetables

Vegetables like carrot, beans, mango ginger was oven dried at 90 degree C

Preparation of soup with soup millet

30g of the soup mix is added to 250ml of boiling water seasoned with salt and pepper and served hot.

C. Proximate analysis

The product was analyzed for proximate and mineral composition such as moisture, ash, protein, carbohydrates, and Iron zinc respectively. using standard AOAC protocol.

D. Physical properties of instant soup mix

Determination of Bulk Density: The method described by Oladele and Aina was used for the determination of bulk density. 25g of the samples was put into 100ml measuring cylinder. The measuring cylinder was then tapped continuously until constant volume was obtained.

BD(g/ml) - weight of the sample/ Volume of the sample.

Determination of oil absorption capacity:

The oil absorption capacity (OAC) of sample was evaluated according to Eke and Akobundu15 method. One gram (1 g) of sample was mixed with 10 ml of refined oil. The slurry was agitated on a Vortex mixer for 2 min and allowed to stand at 28°C for 30 min. After 30 min standing, the suspension was centrifuged at 300rpm for 25 min. Volume of free oil was measured. Oil absorption capacity was expressed as the amount of oil (in ml) absorbed by a gram of sample.

$$\text{OAC \%} = \frac{\text{Sample taken} - \text{oil obtained}}{100} \times 1000$$

Determination of water absorption capacity:

The water absorption capacity of the sample was evaluated according to Anderson et al. 16 method. One gram (1 g) of samples was weighed into a centrifuge tube and 10 ml distilled water added. The content of the centrifuge tube was shaken for 30 min in a KS 10 agitator. The mixture is centrifuged at 5000 rpm for 15 min.

$$\text{WAC \%} = \frac{\text{Sample taken} - \text{water obtained}}{100} \times 100$$

E. Microbial analysis

TAMC and TYMC was determined by pouring plate method

F. Sensory analysis

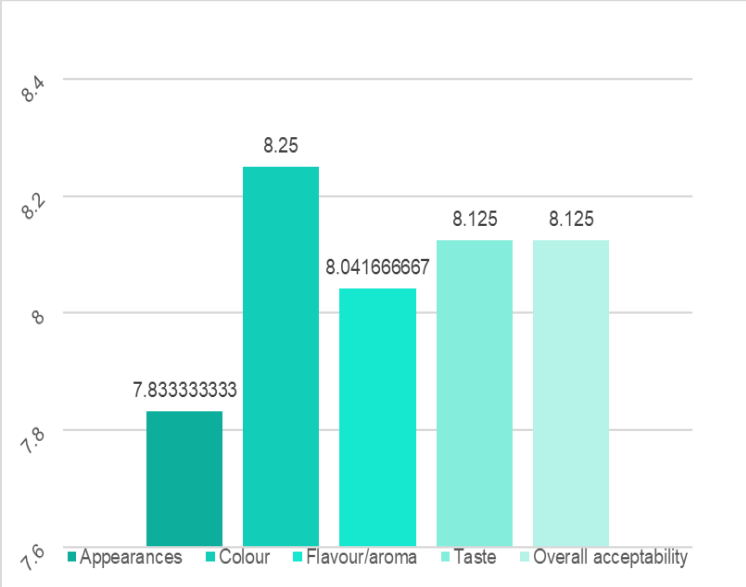
Nine-point hedonic scale was used for sensory evaluation, it was carried out by 25 semi-trained panel members

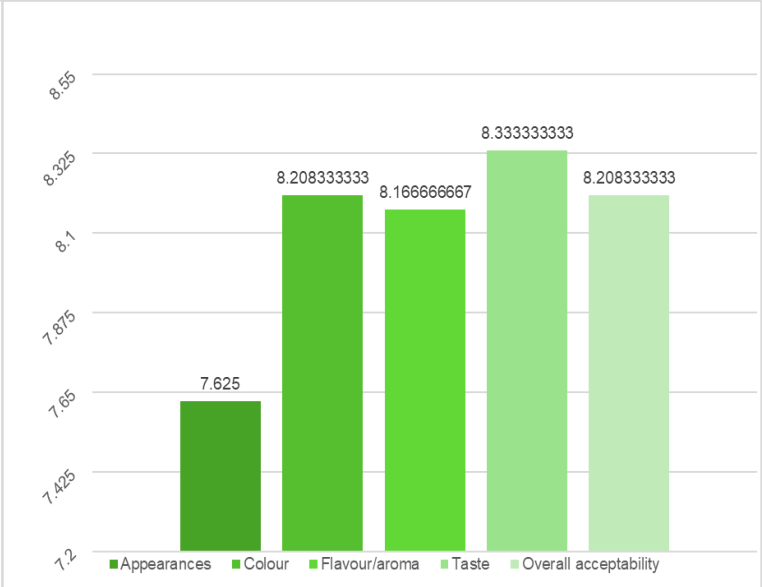
Experimental findings:

PHASE 1: FORMULATION, STANDARDIZATION & ORGANOLEPTIC STUDIES.

- Formulation: The processed flour is blended in the ratio 75:25g (Amaranth: Foxtail) along with ingredients and Dehydrated vegetables to form soup mix
- Standardization: 30g of the soup mix is added to 250ml of boiling water seasoned with salt and pepper and served hot.
- In reference to the results of the sensory evaluation of 2 variations namely Variation 1 & Variation 2. The acceptability of Variation 2 was higher than Variation 1, hence Variation 2 was subjected for further analysis.

Figure 1: Sensory Evaluation





variation-1
75% amaranth
25% foxtail without dehydrated vegetables.

variation-2
75% amaranth
25% foxtail with dehydrated vegetables.

PHASE 2: PHYSICO-CHEMICAL & ANALYTICAL STUDIES

TABLE 1: PROXIMATE PRINCIPLES AND DIETARY FIBER (FOXTAIL)

Parameter	Value
Moisture	9.05%
Protein	11.65 g
Ash	98.0%
Fat	3.48 g
Dietary Fiber	10.2 g
Carbohydrate	64 g
Energy	379 kcal

TABLE 2: PROXIMATE PRINCIPLES AND DIETARY FIBER (AMARANTH)

Parameter	Value
Moisture	6.56%
Protein	13.27 g
Ash	97.6%
Fat	5.5 g
Dietary Fiber	7.47 g
Carbohydrate	61.46 g
Energy	489 kcal

TABLE 3: PROXIMATE PRINCIPLES AND DIETARY FIBER(PRODUCT)

Parameter	Value
Moisture	2.39%
Protein	14g
Ash	97%
Fat	5.3g
Dietary Fiber	16.8 g
Carbohydrate	68.59 g
Energy	104.1 kcal

Moisture content is as low as 2.93%, this increases their self-life of the product, 14 g of protein caters to 5% of RDA, 29.5 MCG of folate renders 9% of folate RDA, the product is said to be low calorie high fiber

TABLE 4: MINERAL AND VITAMIN ESTIMATION OF THE PRODUCT

Mineral / Vitamin	Values
Iron	6 mg /100 g
Zinc	2.84 mg
Folate	29.5 mcg

Mineral analysis was carried out using standard AOAC protocols and the result is tabulated as mentioned above.

TABLE 5: PHYSICO-CHEMICAL STUDIES OF THE PRODUCT

Parameter	Values
Bulk density	0.62g/ml
Water absorption capacity	12%
Oil absorption capacity	20%

Physico-Chemical Studies was carried out using standard AOAC protocols and the result is tabulated as mentioned above.

Phase 3: Microbial analysis

TABLE 6: MICROBIAL ANALYSIS OF THE PRODUCT

Test	Results
TAMC	4500cfu/g
TYMC	80cfu/g
Pathogens	Nil
Coliforms	<10cfu/g
E. coli	Nil
Streptococcus aureginosa	Nil
Pseudomonas aeruginosa	Nil
Salmonella Sp	Nil
Enterobacteriacca	Nil

Microbial analysis was carried out using pouring plate method, the sample is formulated in non-sterile method of handling, the limit of TAM, C and TYMCn complies with the result.

PHASE 4: TABLE 7: NUTRITIVE VALUE PER SERVING AND COST-EFFECTIVE STUDY OF THE PRODUCT

Nutrient	Value /30g
Energy	31kcal
Protein	4.2G
Carbohydrates	20 g
Dietary Fibre	5g
Fat	1.59g
Iron	1.8mg
Zinc	0.85mg
Folate	8.8mcg

The serving size of the product is said to be 30 g, nutritive, value and costing is as follow

Product can be priced anywhere between 15 to 20 INR for 30 g

Conclusion: The proposed experimental based investigation has emphasized the significance of millets as a functional ingredient in RTC soup mix formulation. It contributes specific vital micro molecules in correcting burden of disease manifestation. The formulation has shown to exhibit high shelf, sensory quality aspects & cost effective. Notably the formulation could be a functional meal substituent required for health development.

Future line of directions: Gut which is a 2nd brain in the human body, essentially important in maintaining homeostasis, biological process and holistic health development. Traditionally millets are the micro grains known to be a pre-biotics supporting vital health system. Recently convenient food formulation has gained a significant impact on health care management. Established instant formulation could be a value based therapeutic regime in uplifting health vulnerabilities.

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