IJPSR (2020), Volume 11, Issue 12 (Research Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 02 December 2019; received in revised form, 17 March 2020; accepted, 20 March 2020; published 01 December 2020

FORMULATION, NUTRITIONAL, SENSORY, ANTIOXIDANT ACTIVITY AND SHELF LIFE STUDIES OF INSTANT SOUP MIX

Priti and Kandra Prameela *

Department of Biotechnology, GITAM Institute of Technology, GITAM University, Visakhapatnam - 530045, Andhra Pradesh, India.

Keywords:

Formulation, Instant soup, Nutritional, Antioxidant, Shelf life

Correspondence to Author:
Kandra Prameela

Assistant Professor,
Department of Biotechnology,
GITAM Institute of Technology,
GITAM University, Visakhapatnam - 530045, Andhra Pradesh, India.

E-mail: chprameela5@gmail.com

ABSTRACT: In today's modern lifestyle, there is an increase in the development of various instant food products. To meet consumer requirements, the food choice will depend on several factors. The present study was aimed with the objective to formulate a value-added instant soup mix with nutritional and sensory characteristics. Further, the prepared instant soup mix was subjected to antioxidant and shelf life studies. Three different combinations (A-I, P-I and N-I) were prepared. The coefficient of friction (COF) was minimum for glass surface and maximum for plywood surface for all three products. The results of the moisture ranged from (6.82-7.99%), had different levels of ash content ranged from (7.40-12.49). The concentration of protein of sample NI (28.62%) was having the highest compared to PI (21%) and AI (19.36%). The carbohydrate content was found to be high in A1 (55.06%) compared to NI (46.55) and PI (44.98). The crude fiber, fat and saturated fat, and mineral contents are comparable with the three combinations. High mineral content was observed in NI sample compared to AI and PI. The product PI is rich in total phenolic and flavonoid contents and has shown high antioxidant activity. Further, the instant soup mix can be stored for a period of 90 days without any chemical preservative. Hence, the developed instant soup mix is a nutritional and value-added product with shelf life.

INTRODUCTION: The lifestyle of the population is drastically changing, especially the population living in urban areas. Urbanization is driving fast-paced and practical things almost in all aspects, including processing and preparation of the food. The emerging modern society loves instant food products such as food that are ready to cook and ready to eat. Hence, instant functional soup is one of the potential products that can be developed into an instant food for fulfilling the social demand of the rising population. Moreover, according to the data of WHO, 45% of death among children under the age of 5 years are connected to undernutrition.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.11(12).6114-23

The article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.11(12).6114-23

In addition, supplementation of nutritive legumes and vegetables together in food can fulfill the energy requirement of women of reproductive age and undernourished children. Hence, there is a wide demand for nutritive dry soup mixes in the global market [1]. Mixing grains and legumes provide a "complete" protein. Therefore, the formulation of the instant soup mix was done with grains and legumes with the addition of vegetables in it. Hence, our Lab developed soup is a form of a balanced diet.

Soups can be defined as a heterogeneous liquid that can be prepared from vegetables, fish, or meat with water, juice or stock, and some thickening agents. Usually, soups are categorized into two different types, namely thick soup and clear soup. Thick soups are prepared by mixing powder of cereal or pulses flour, cream, and eggs [2]. In contrast, clear soups are made from the clear extract of plant parts and edible animal parts.

The development of instant soup mix formulations has gained much attention with locally available ingredients with desired health benefits and without compromising on taste, odorants, and their sensorial properties.

Amaranth is rich in manganese, phosphorus exceeding your daily nutrient needs in just one serving. Manganese is especially important for brain function and is believed to protect against certain neurological conditions. High antioxidant-amaranth is especially high in phenolic acids, which are plant compounds that act as antioxidants [3]. The mung beans are alternatively known as the green gram, maash, or moong. Green gram contains high antioxidant Levels after germination, and it's a rich source of protein and minerals [4]. Thus, mung bean is of particular interest in developing a nutrient-rich soup. Additionally, pumpkin fruits are sweet when fully mature with yellow or orange flesh rich in carotene. Pumpkin also has a huge concentration of β-Carotene, which protect against certain cancers, and cataract is a powerful ally against the degeneration aspect of aging. Carotenoids are important for the prophylactic treatment of xeropthalmia [5]. They are said to have a variety of accessions which are related to the decreased risk of some degenerative diseases and also act as antioxidant [6]. Thus, help in preventing infections [7].

Navy bean is also known as haricot, pearl haricot bean, boston bean. It features in various soups such as senate bean soup and is even used in making pies. The green bean plants that produce navy beans may be either of the bush type or vining type, depending on which cultivar they are *Phaseolus vulgaris* L. are bioactive staple foods for colorectal cancer (CRC) chemoprevention [8-9]. Navy beans also contain vitamins B and minerals, such as iron, calcium, copper, zinc, phosphorous, potassium, and magnesium [10]. The sweet potato has a nutritional value of 50% higher than the potato [11]. Sweet potato's tubers have anti-diabetic, anti-oxidant, and anti-proliferative properties due to the presence of valuable nutritional and mineral components [12-13]. Furthermore, the basil seeds that are used for eating are the seeds from the sweet basil plant, *Ocimum basilicum*. They are also called Thai basil seeds, falooda, sabja, subza, selasih or tukmaria [14]. As soon as water touches the seeds, the swelling begins, and the seeds develop a whitish translucent coat on them while growing double their size too and it act as an efficient antimicrobial agent.

Ixora coccinea (also known as jungle geranium, the flame of wood or jungle flame) is a species of flowering plant in the Rubiaceae family. The ixora flowers help to smooth the mensuration flow and prevent cramps during the mensuration cycle.

Dehydrated food especially dry soup, mixes with all nutri ingredients, has major advantages such as protection from oxidative spoilage, has flavor stability for longer periods up to 1 year at room temperature, and a rich protein source, and has good nutritive value and they have longer life without refrigeration. Due to lesser weight they are easy to ship and can be readily available around the clock in a year. Functional soup can become an alternative food for breakfast because it could fulfill the adequacy of energy and nutrient required by the body. Thus, the purpose of the study was to formulate a value added healthy instant soup mix to maintain nutritional, sensory properties, antioxidant activity and shelf-life studies for long term usage.

MATERIALS AND METHODS:

Materials: In the present study, the following vegetables were used: Pumpkin, Spinach, amaranth leaves, Carrot, Onion, Chili, Ginger, Garlic, Curry leaves, and sweet- potato procured from SC India local vegetable market. Amaranth, Chickpea, Navy beans, Green gram, Basil seeds, and salt were purchased from the supermarket. Ixora petals were procured from Naval girls hostel garden, Visakhapatnam, India.

Formulation of Instant Soup Mix: A soup was prepared according to the standard formula and procedure are given in the literature [15]. Fresh vegetables were selected and manually sorted based on quality and physical appearance. They were washed carefully for 2 to 3 times under running water to remove dirt, soil, dust, pesticide residue, contaminants on the surface, followed by wiping with muslin cloth. carrot, onion and other vegetables were cut into small pieces.

Blanching was done for 2-3 minutes to soften the tissue and to control enzymatic browning. Dehydration of vegetables and major ingredients (amaranth seeds, chick-pea, and green gram) was

done in microwave for 15-20 min. As per formulation, vegetable and pulses soup was prepared and stored at ambient room temperature.

Physical Characterization of Instant Soup Mix:

Frictional Characteristics: A plastic cylinder of 50 mm diameter and 60 mm height was placed on an adjustable tilting flat plate faced with the test surface and filled with nearly 100 g sample.

The cylinder was raised slightly to avoid touching the surface. The structural surface with the material filled cylinder on it was inclined gradually until the cylinder just started to slide, and angle of repose (AOR) was determined [16].

Determination of pH: Weigh 2 g of the sample accurately and macerate with distilled water in a mortar and pestle. Transfer the contents into a beaker and makeup to 100 mL with distilled water. Determine the pH using the pH meter by first adjusting it with pH 4.0 buffer and base with pH 9.0 buffer. After adjusting, take the sample and note down the readings displayed [17].

Estimation of Moisture and Ash Content: The moisture content was measured by taking 5 gm of the sample in a crucible and kept in an oven in a predetermined time [18]. To estimate ash content, the moisture determined sample was transferred to the crucible into the muffle furnace at 550 ºC ± 25 ºC for3hrs. Take off the crucible from the muffle furnace and cool it in a desiccator for 15-30 min and measured the weight of the sample before and after ignition [19].

Determination of Total Soluble Solids: Brix refract meter determine sugar concentration in the fresh or processed food or solution. Weigh 2 g of the sample accurately. Macerate with 5 mL of distilled water. Place a drop of prepared sample on the prism of the refractometer and cover. Note down the reading, which indicates the percentage of soluble solids.

Nutritional Analysis:

Determination of Total Carbohydrate and Protein Content: Weigh 100 mg of the sample into a boiling tube. Hydrolyze, neutralize the sample to room temperature, and make up the volume to 100ml and centrifuge. Collect the supernatant and take 0.5 and 1 mL aliquots for analysis [20]. The total nitrogen content was measured by the Microkjeldahl method, and total protein content was measured by using below formula [21].

$$\text{Potein (\%)} = [6.25 \times \% \text{ Nitrogen}]$$

Estimation of Fat: Weigh 5 g of grounded and dried sample and place it in the thimble and the sample was placed in the Soxhlet extractor.

The flask of 90 ml petroleum ether and continue the extraction process for several hours, almost 6 hours, then removed the condensing unit from extraction and dried in an oven and the percentage of crude fat was calculated.

$$\text{Crude fat \%} = (w_2\text{-}w_1) / p \times 100$$

Where, Empty thimble = w_1, Thimble with sample = w_2, Weight of sample= p

Estimation of Crude Fibre: To estimate crude fibre 2 g of sample was taken into the round bottomed conical flask, with predetermines volume of H_2SO_4. The mixture was heated for 30 to 35 min and filtered with Whatman no.1 filter paper. The residue is washed with hot water twice or thrice to remove the acidity.

The obtained residue was treated with sodium hydroxide and made up to 200 mL with distilled water, and boiled for 30 to 35 min. After cooling, the residue was kept in a muffle furnace at 550 ºC for 1 h and was weighed for calculations.

(%) Crude fiber = Initial wt – Final wt / Weight of sample × 100

Estimation of Dietary Fiber: The defatted fiber samples were extracted with 25 ml of cold, slightly alkaline water (pH 7.0-7.5) for 2 h at 20 °C. The samples were then centrifuged at 1500 g or 3000 rpm for 10 min. The supernatants were removed and collected, and the procedure was repeated twice. Residues were extracted with 0.01 M EDTA solution for 2 h to bind cations and solubilize the more pectic substances. The mixtures were filtered. The washed residue was washed with ethanol and was freeze-dried, and kept for further analysis.

Estimation of Mineral Content using Atomic Absorption Spectroscopy: Standard solutions of 100 ppm, 10 ppm, 0.1 ppm, 0.01 ppm were

prepared using distilled water. 5 g of ash sample in a silica crucible. Ignited the material and transferred the crucible into the muffle furnace at 55 ˚C ± 25 ºC for 3 h and estimated mineral content 22.

Determination of Beta–carotene: The sample was mixed with acetone: hexane in the ratio of 4:6. The mixture was homogenized for 5 min and filtered through Whatman no.1 filter paper. Then, absorbance of the sample was measured at 453, 505, and 663 nm [23].

Sensory Evaluation: The product developed was subjected to sensory evaluation with the untrained panel members. Nine-point hedonic scale was chosen to test the acceptability, where the judge expresses their evaluation according to the scores given for each sensory attribute on the scorecard provided. The sensory evaluation attributes are color, appearance, texture, taste, and flavor. It is analyzed by a hedonic 9 point rating scale. The attributes are scored out of 9 Sensory evaluation Score: 9 like extremely, 8-like very much, 7-like moderately, 6-like slightly, 5-neither like nor dislike, 4-Dislike slightly, 3-dislike moderately, 2-dislike very much, 1-dislike very much. The above hedonic 9 point rating scale is one test which is commonly practiced in the food industry for sensory evaluation, and one who does the sensory evaluation has to rate the product between this score from like extremely.

Estimation of total phenols: 1 g of sample was weighed and extracted with methanol in a boiling water bath at 60 ºC. The volume was readjusted to 20 mL and filtered through Whatman no.1 filter paper. 1 mL of filtered sample was taken in the test tube, 0.5 mL 10% Folin Ciocalteris (FC) reagent was added. It was allowed to stand for 5 min, then add 2 mL Na_2CO_3 and kept in the dark for 1 h at ambient temperature. The absorbance was measured at 760 nm. Phenolic concentration was measured using Gallic acid as a standard curve and was expressed as µg/g [24].

Total phenols = Volume made × concentration in µg / Sample weight × aliquot taken forestimation (µg/g)

Estimation of Total Flavonoids: 1 mL aliquot of the digested sample was taken in the test tube. Add 10% of aluminum chloride and 0.3 mL of sodium nitrite was added. It was incubated for 6 min, then add 1 mL of 1N NaOH to the test tubes. The mixture was centrifuged and placed in the darkness for 15 min. Then absorbance was measured at 510 nm. Flavonoid concentration was measured using Quercetin as a standard curve [25].

Flavonoids = volume made × concentration in µg / Sample weight × aliquot taken for estimation (µg/g)

Antioxidant Activity:

Determination of radical 1, 1- diphenyl-2-picrylhydrazyl (DPPH) Scavenging Activity: Weigh 2 g of sample, Extract the sample under stirring with methanol at 60 ºC for 60 min. 500 µL of aliquot was added to the test tube then added DPPH solution. The mixture was made up to 4 mL with the extracting solvent. Then, absorbance was determined at 515 nm after 30 min [26].

$$(\%)\ \text{Inhibition} = A_{control} - A_{sample} / A_{control} \times 100$$

Estimation of Thiobarbituric Acid Test: Aliquot of 1 mL was added in the test tube with 2 ml of 20% trichloroacetic acid and 1 mL of 0.67% TBA to the mixture. Above test tube mixture was kept in a boiling water bath for 10 min. After cooling centrifuged at 3000 rpm for 10 min, absorbance of the sample was recorded at 532 nm [27].

$$(\%)\ \text{Inhibition} = A_{control} - A_{sample} / A_{control} \times 100$$

Shelf Life Studies: Different combination of prepared instant soup mix was kept at room temperature. Physicochemical, nutritive, bioactive compounds, sensory evaluation, and antioxidant activity were measured after 90 days of storage. The microbiological analysis was conducted to identify yeasts, filamentous fungi, and Salmonella sp at room temperatures.

Determination of Aflatoxins: Aflatoxins were extracted, purified, and separated by liquid chromatography (liquid chromatography model no. ABSCIEX 4000) and detected by fluorescence as per AOAC (2000) procedure. The sample is extracted with a methanol solution. The extract is diluted and injected into a column. Aflatoxin is eluted with acetonitrile and dried with a nitrogen stream. The aflatoxins (B1, B2, G1, and G2) are derivatized with acid to form fluorescent compounds. These are read through a fluorescence detector and compared to standards of known concentration.

RESULTS AND DISCUSSION: In recent year's awareness of making and consuming nutritious and healthy foods has increased dramatically. To reach the demand of the people, many food industries are producing traditional instant mixes for ready to consume. The development of value-added instant soup mix is an interesting and easy to consume and immediately produces energy to maintain proper health. In the preparation of soup, dehydration is one of the important preservation techniques which impart the nutritional quality to the end-user with varied health benefits. Most ingredient products are pre-treated before drying to shorten the drying time, improve taste, to conserve the flavors, and to maintain the nutrition of the food.

Preparation of Value-Added Soup: The study was conducted to develop a value-added soup with a combination of pseudo cereal, different pulses, and vegetables. The results were presented in **Table 1**. In sample-1 (A-1) the pulses, amaranth was maximized with a low concentration of other ingredients (vegetables and spices). The sample-2 (P-I) was prepared without pulses, and sample-3 (N-1) was prepared by taking all ingredients in the required proportions. Several combinations were tried for formulating instant soup mix, but the obtained 3 combinations have shown better results. Similarly, research work was conducted on instant herbal mix soup from various vegetable like potato, carrot, tomatoes, garlic and others and found that leguminous elements increase sensory significantly with increasing nutritional advantages [28].

TABLE 1: PREPARATION OF VALUE-ADDED PULSES AND VEGETABLE SOUP (AS PER 100G)

Ingredients (g)	A-I	P-I	N-I
Amaranth	26	-	-
Chick pea	20	-	-
Green gram	20	-	10
Navy beans	-	-	40
Pumpkin	-	30	10
Leaves(Spinach + Amaranth)	10	30	10
Spices	8	8	10
Salt	8	8	8
Sweet potato	-	4	8
Basil seeds	4	-	-
Jungle geranium	4	4	4

AI - Amaranth Ixora, PI – Pumpkin Ixora, NI- Navy beans Ixora

In another study, various ingredients like *Moringa oleifera, Centella asiatica* and *Solanum trilobatum* were used. The dried leaves of these species were used, and cornflour was applied a good thickening agent. Several combinations were tried by different researchers, and flavours were increased by adding different spices. Pre-treatment reduces the initial water content and modifies the tissue of the food ingredient, which helps to fasten the drying rate [29]. The influence of blanching was studied [30] and was applied on peeled and sliced vegetables, and pulses were blanched for 4 min in hot water 70-80 °C. The drying rate and rehydration properties of the blanched sample were found to be improved as compared with the unbalanced sample.

This method not only reduces the drying time but also produced a desirable end product due to inhibition of enzymatic browning [31]. Microwave heating is beneficial as it requires lesser amounts of time and temperature to remove the moisture content in foods [32]. Scorching is a problem in microwave heating because of the low availability of water content towards the end of the drying process. The major advantage of using a microwave is its ability to be combined with other methods of drying, such as vacuum drying [33]. They observed that microwave drying takes 70 to 90% shorter drying time retains better rehydrating properties as compared to the convective air-drying method. Infra-red heating is another method of removal of moisture from foods. Infrared has a wavelength range of 0.75 and 1000 μm [34].

Exposure of food to infra-red led to charge build-up in the electronic state as well as in the vibration and rotational state at the atomic and molecular levels. This caused the food to heat up without any changes in the temperature of the air surrounding the food. Infra-red drying has been used to dry various soup commodities, including paste (carrot, onion, tomato/tamarind, garlic, and chilli) pulses, leafy vegetables, and sweet potato paste.

Physical Analysis of Value-Added Instant Soup Mix:

Angle of Repose: The results of the experimental value of angle of repose (AOR) were given in **Tables 2** and **3**.

TABLE 2: RESULTS OF ANGLE OF REPOSE

Sample	Angle of repose (glass)	Angle of repose (cardboard)
AI	38.645	39.043
PI	46.33	48.21
NI	33.690	34.342

AI - Amaranth Ixora, PI-Pumpkin Ixora, NI-Navy Ixora

The coefficient of friction (COF) was minimum for glass surface and maximum for plywood surface. The differences in the values may be because of the roughness of the material used in determining the coefficient of friction.

TABLE 3: CLASSIFICATION OF FLOW ABILITY OF POWDER BASED ON REPOSE ANGLE

Description of repose angle	
Very free flowing	<30º
Free flowing	30-38º
Fair to passable flow	38-45º
Cohesive	45-55º
Very cohesive	>55º

Different physical parameters of value-added soups AI, PI and NI were analysed and the results of the end products were shown in **Table 3**. The results of the moisture ranged from (6.82-7.99%). These results were compared with the findings of (Fahima *et al.,* 2009). All the samples of the soup had different levels of ash content ranged from (7.40-12.49).

When the concentration of protein was compared, sample NI (28.62%) was having the highest compared to PI (21%) and AI (19.36%). The carbohydrate content found high in A1 (55.06%) compared to NI (46.55) and PI (44.98). The crude fiber, fat and saturated fat and mineral contents are comparable with the three combinations. High mineral content was observed in NI sample compared to AI and PI.

TABLE 4: PHYSICAL PROPERTIES OF VALUE-ADDED INSTANT SOUP MIX

Description	AI	PI	NI	Control
pH	9.37	9.76	10.08	8.99
TSS (ºBx)	32.4 º	36º	32º	34.2º
Moisture	7.45	6.82	7.99	13.01
Ash	7.40	9.13	12.49	6.41

AI - Amaranth Ixora, PI - Pumpkin Ixora, NI - Navy Ixora

TABLE 5: NUTRITIONAL ANALYSIS OF VALUE-ADDED INSTANT SOUP MIX

Description	AI	PI	NI	Control
Carbohydrate	55.06	44.98	46.55	69.3
Protein	19.36	21	28.62	5.4
Fat	3.24	6.06	0.88	5.7
Saturated fat	1.43	3.25	0.31	-
Trans fat	<0.001	<0.001	<0.001	-
Dietary fibre	15.42	15.56	13.59	4.63
Crude fibre	6.23	8.43	6.21	2.31
β- carotene (mg/ml)	0.0023	0.0 34	0.0041	-

AI-Amaranth Ixora, PI-Pumpkin Ixora, NI-Navy Ixora

Mineral Analysis of Value-Added Instant Soup Mix: Results of different value-added instant soup mix have shown in **Table 6**. The highest iron content was found in sample PI (16.94%) followed by sample AI (0.31%). The differences among the iron content of samples were due to the high availability of pumpkin and spinach in sample PI. Whereas, significant amounts of sodium were found in all the three samples *i.e.* PI (6.76%) followed by NI (5.81%) and AI (5.01%). Moreover, calcium content was highest in PI-0.57% than AI-(0.31%), & NI- (0.28%), phosphorous (PI- 2.51%, AI- 0.21% & 0.91%) and potassium (NI-1.63%, AI-0.94% and PI- 0.18%) was also available in the product which helps in building strong bones and muscles, most of the vegetable soups available in the market have low levels of mineral content which is not to meet the adequate intake of iron for adults [35]. Hence, our lab formulated value-added instant soup mix is comparatively nutritious than commercial soups.

TABLE 6: MINERAL CONTENT OF DIFFERENT VALUE-ADDED INSTANT SOUP MIX

Mineral (%)	AI	PI	NI
Calcium	0.31	0.57	0.28
Iron	8.83	16.94	9.10
Phosphorous	0.21	2.15	0.19
Potassium	0.94	0.18	1.63
Sodium	5.01	6.75	5.81

AI - Amaranth Ixora, PI - Pumpkin Ixora, NI- Navy beans Ixora

Sensory Evaluation of Soup: The sensory evaluation of the value-added instant soup mix samples were considered as per instructions regarding the evaluation procedure in the verbal form before quoting their judgments [36]. The sensory attributes considered in the evaluation were Appearance, taste, aroma, texture, and overall acceptability [15]. The average and the mean values of the scores for each of the attributes were computed and analyzed statistically. The result of sensory evaluation was presented in **Fig. 1**. The results concluded that evaluation scores of overall acceptability for a different formulation of instant soup mix *i.e.* AI, PI and NI is almost the same. The overall acceptability (8) of NI was better than PI (7) and AI (7), the texture of all the three samples rated 7 on hedonic scale whereas aroma (8), taste (8) and Appearance (8) of NI rated highest among PI and NI.

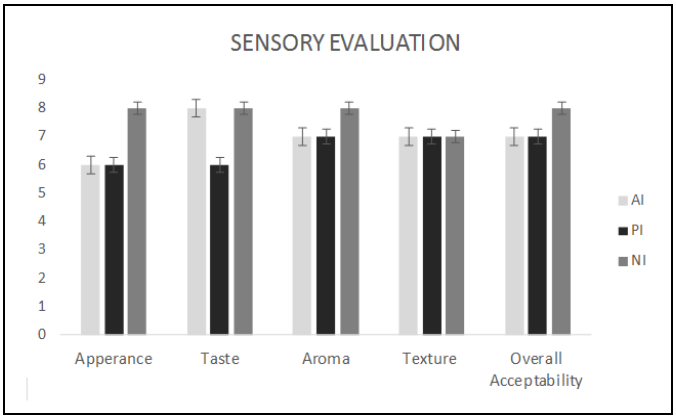

FIG. 1: SENSORY EVALUATION OF VALUE- ADDED INSTANT SOUP MIX AI - Amaranth Ixora, PI - Pumpkin Ixora, NI- Navy beans Ixora

Phenolic and Flavonoid Content of Value - Added Instant Soup Mix: The results of and total phenolic and flavonoid content of value- added instant soup mix were illustrated in **Fig. 2**. Addition of pumpkin and amaranth leaves powder has drastically improved the total phenolic content of sample PI (20.04 ug/gm). From the figure it shows the total phenolic content was higher in sample PI and lowest in control sample (0.97 ug/gm).

Moreover, *Phaseolus vulgaris* was used as a major ingredient in sample PI because of its notable flavonoid and phenolic acids content [37] and hence, contributed high flavonoid in sample PI (25.61 ug/gm). Phenolic and flavonoid content of control is extremely low because it gets highly processed in industries and losses all-natural compound from raw material.

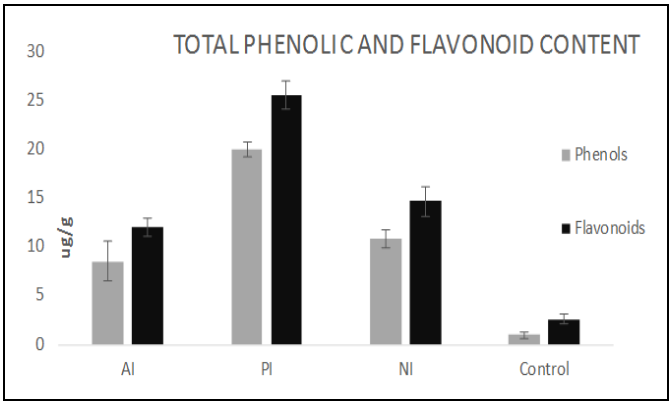

FIG. 2: TOTAL PHENOLIC AND FLAVONOID CONTENT OF VALUE – ADDED INSTANT SOUP MIX AI - Amaranth Ixora, PI - Pumpkin Ixora, NI - Navy beans Ixora

Antioxidant Activity of Value-Added Instant Soup Mix: To the end product, radical scavenging and antioxidant activities were measured using DPPH and TBA. Results of DPPH and TBA showed in **Fig. 3A, B** indicates stronger antioxidant activity in PI, NI than compared with AI while less in Control soup, but in the case of TBA, AI showed more antioxidant activity than NI and Control soup. Thus, the levels of such activity were higher in soups when it compared with highly processed market soups.

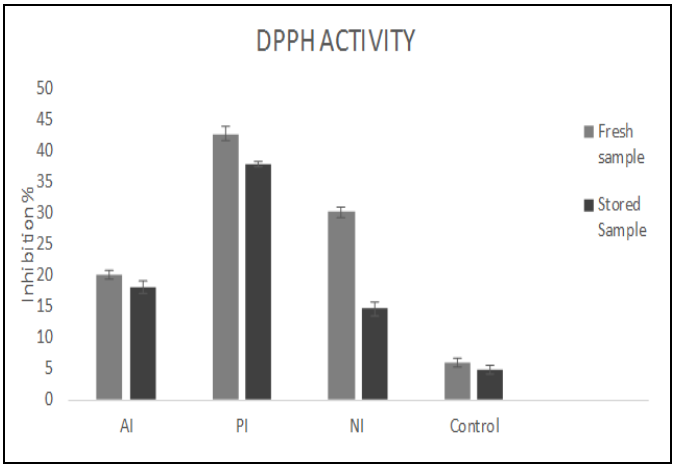

FIG. 3A: RADICAL 1, 1- DIPHENYL 2-PICRYLHYDRAZYL (DPPH) SCAVENGING ACTIVITY OF VALUE ADDED SOUP MIX AI - Amaranth Ixora, PI - Pumpkin Ixora, NI - Navy beans Ixora

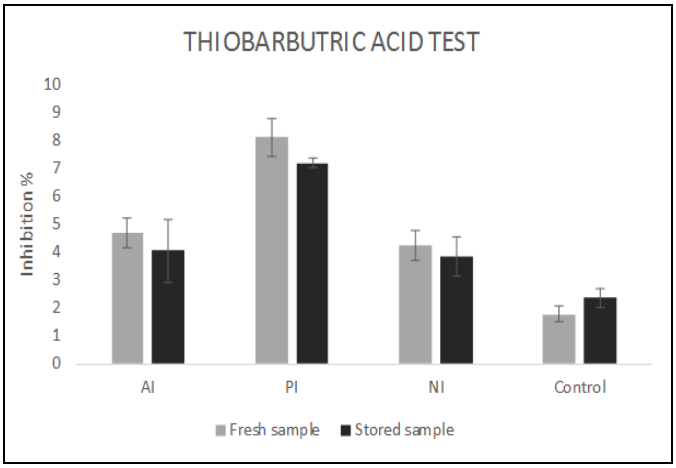

FIG. 3B: THIOBARBITURIC ACID TEST OF VALUE-ADDED INSTANT SOUP MIX AI -Amaranth Ixora, PI - Pumpkin Ixora, NI - Navy beans Ixora

Shelf Life Study of Value-Added Instant Soup Mix: The shelf life of the instant soup mix was evaluated through conducting sensory analysis at the interval of 45 days and 90 days. The number of responses is illustrated on the Nine-point Hedonic scale. After 45 days of storage, no major changes were observed in sensory characteristics.

But, after 90 days gradual decrease in appearance, taste, aroma, texture, and overall acceptability was

seen when it was compared with sensory analysis of the fresh sample. Overall acceptability of AI, PI, and NI got decreased to 6, 6, and 7, respectively; hence, the acceptability of sensory parameter is decreasing with increased storage period.

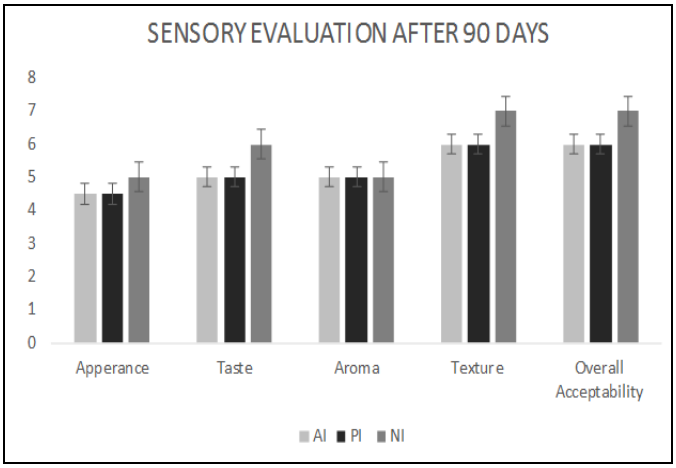

FIG. 4: SENSORY EVALUATION OF VALUE-ADDED INSTANT SOUP MIX AFTER 90 DAYS AI - Amaranth Ixora, PI - Pumpkin Ixora, NI- Navy beans Ixora

Study of Physiochemical Characteristics for 90 Days of Value–Added Instant Soup Mix: LDPE and MET- PET are two different packaging material used to study the shelf life of value-added instant soup mix. The moisture content of the product is the predominant parameter for defining the stability of products during storage. Higher moisture content usually is associated with the detrimental changes in physicochemical properties of the food product. The effect of the storage period and packaging material on the moisture content of stored instant soup mixes is illustrated in **Fig. 5** and **6**.

Moisture content (%) of instant soup mixes did not show much variation in MET PET packaging material of three different samples, but with progressive storage, there was an increase in the moisture content of instant soup mixes in LDPE and MET PET packaging materials. The increase in moisture content was within the safe limit (< 14%). The mean moisture content of the AI sample prepared from amaranth powder and basil seeds at 0 months was 7.16%, which increased to 7.50% in MET PET packaging whereas, LDPE packaging material was recorded with the highest moisture content 10.57 %. Similarly, the moisture content of PI and NI was high in LDPE *i.e.* 7.71 and 10.49 when compared with fresh sample and MET Packed Sample that was 6.97 and 9.06 respectively after 3 months of storage. Hence, the increase in moisture was found to be higher in LDPE packed samples than MET PET. An increase in moisture content during a storage period of 45 days was affected due to storage treatments and packaging conditions, which the authors explained was due to hygroscopic properties of the flour [38]. Hence, further storage period does not seem likely to influence the changes in the moisture content of soup mixes, noticeably.

Similarly, we can see the gradual decrease in other nutritional parameters of the sample with increased storage time. The effect of the storage period is comparatively low on MET-PET samples than samples stored in LDPE.

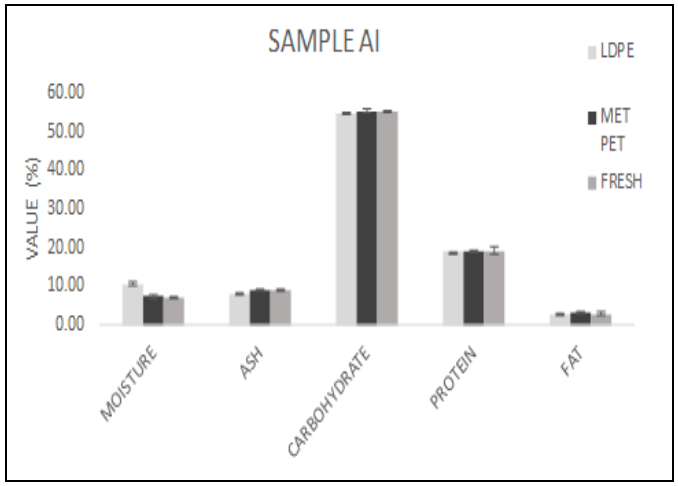

FIG. 5: PHYSIOCHEMICAL CHARACTERISTICS OF SAMPLE AI AFTER 90 DAYS AI- Amaranth Ixora, PI - Pumpkin Ixora, NI- Navy beans Ixora

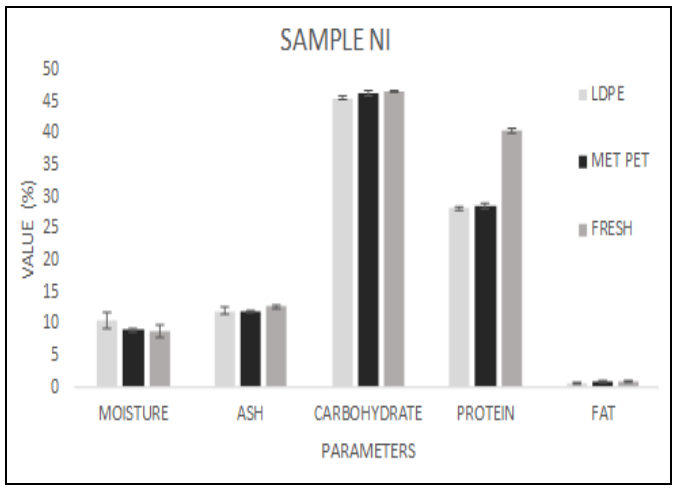

FIG. 6: PHYSIOCHEMICAL CHARACTERISTICS OF SAMPLE NI AFTER 90 DAYS AI - Amaranth Ixora, PI - Pumpkin Ixora, NI - Navy beans Ixora

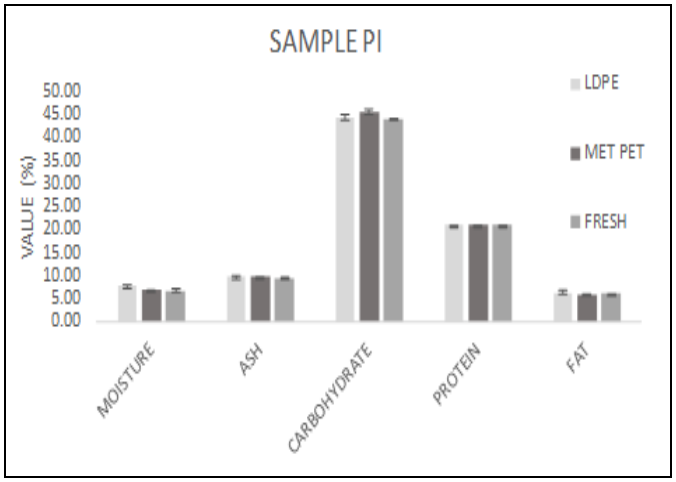

FIG. 7: PHYSIOCHEMICAL CHARACTERISTICS OF SAMPLE PI AFTER 90 DAYS AI - Amaranth Ixora, PI - Pumpkin Ixora, NI - Navy beans Ixora

TABLE 7: AFLATOXIN LEVEL IN VALUE-ADDED INSTANT SOUP MIX AFTER 90 DAYS

Aflotoxin (µg/kg)	AI	PI	NI
B1	<0.5	<0.5	<0.5
B2	6.13	5.41	3.96
G1	<0.5	<0.5	<0.5
G2	<0.5	<0.5	<0.5

AI- Amaranth Ixora, PI - Pumpkin Ixora, NI - Navy beans Ixora

According to the world health organization, aflatoxins B1, B2, G1 and G2 are particularly dangerous to humans and animals as they have been found in all major food crops but, most human exposure comes from contaminated nuts, grains, and their derived products.

Codex standards have set the maximum levels for contaminants levels for aflatoxins in various nuts, grains, dried figs, and milk are in the range of 0.5 to 15 µg/kg; from results of **Table 7,** the aflatoxin level is under the permissible limit, and the product is safe for consumption.

CONCLUSION: The proposed present study for the development of value-added instant soup mix proved to be rich in all nutrients. The product was optimized with different combinations and attained good sensory evaluation. The product PI is rich in total phenolic and flavonoid contents and has shown high antioxidant activity.

Further, the instant soup mix can be stored for a period of 90 days without any chemical preservative. Hence the developed instant soup mix is a nutritional and value-added product with economic benefits.

ACKNOWLEDGEMENT: The authors are thankful to the Management of GITAM (Deemed to be a University) for their constant support.

CONFLICTS OF INTEREST: The authors have declared no conflict of interest.

REFERENCES:

1. Wanying Li and Geoffrey PS: Oxalate content of the herb good-king-henry, blitum bonus-henricus 2015; 4(2): 140-47.
2. Radha C, Ogunsina BS and Hebina Babu KT: Some quality and micro-structural characteristics of soup enriched with debittered *moringa oleifera* seeds flour. American Journal of Food Science and Technology 2015; 3: 145-49.
3. Klimczak I, Małecka M and Pachołek B: Antioxidant activity of ethanolic extracts of amaranth seeds: Food / Nahrung 2002; 46(3): 184-6.
4. Madar IM, Asangani AH, Srinivasan S, Tayubi IA and Ogu GI: Nutritional and biochemical alterations in *Vigna radiata* (Mung Bean) seeds by germination: International Journal of Current Microbiology and Applied Sciences 2017; 6(9): 3307-13.
5. Ross DA: Recommendation for vitamin- A supplementation: The journal of Nutrition 2002; 132(9): 2902S-2906S.
6. Dang C: Effect of pumpkin distillable subject on lipid peroxidation and the activity of antioxidative enzyme induced by Plumbum in mouse (article in Chinese): Chin JClin Rehabil 2004; 8: 4378-79.
7. Yadav M, Jain S, Tomar R and Prasad GBKS: Medicinal and biological potential of pumpkin: an updated review: Nutrition Research Reviews 2010; 23(2): 184-90.
8. Willan and Anne: La Varenne Pratique: Part 3, Vegetables, Pasta & Grains 1989; 205.
9. Xu B and Chang SK: Comparative study on anti-proliferation properties and cellular antioxidant activities of commonly consumed food legumes against nine human cancer cell lines. Food Chem 2012; 134(3): 1287-96.
10. Bobe G, Barrett KG, Mentor-Marcel RA, Saffiotti U, Young MR, Colburn NH, Albert PS, Bennink MR and Lanza E: Dietary cooked navy beans and their fractions attenuate colon carcinogenesis in azoxymethane-induced ob/ob mice. Nutr Cancer 2008; 60(3): 373-81.
11. Ofori G, Oduro I, Elis and HK Dapaah: Assessment of vitamin A content and sensory attributes of new sweet potato (*Ipomoea batatas*) genotypes in Ghana: African Journal of Food Science 2005; 3: 184-92.
12. Jaarsveld PJ, Faber M, Tanumihardjo SA, Nestel P, Lombard CJ and Benadé SJ: Beta-Carotene rich orange-fleshed sweet potato improves the vitamin A status of primary school children assessed with the modified-relative-dose-response test: American Journal of Clinical Nutrition 2005; 81: 1080-87.
13. Abubakar HN, Olayiwola IO, Sanni SA and Idowu MA: Chemical composition of sweet potato (Ipomoea batatas Lam) dishes as consumed in Kwara state, Nigeria: International Food Research Journal; 2005; 17: 411-16.
14. Kumar A, Shukla R, Singh P and Dubey N: Chemical composition, antifungal and aflatoxigenic activities of *Ocimum sanctum* L. essential oil and its safety assessment as plant- based antimicrobial. Food Chem Toxicol 2010; 48: 539Y543.

15. Sudarsan SM, Santhanam SG and Visalachi V: Development and formulation of instant soup mix from sprouted horse gram and radish leaves: International Journal of Home Science 2017; 3(1): 346-49.
16. Mistry R, Dalal C and Soni T: Determination of angle of repose of pharmaceutical materials based on image processing using lab view: International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering 2017; 6(3): 1125-31.
17. Ranganna S: Handbook of analysis and quality control for fruit and vegetable products; ed 2nd Tata McGraw Hill Publishing Company Ltd, New Delhi. 12; 1986.
18. AOAC: Official Methods of Analysis of AOAC International, ed 18th. 2nd revision. AOAC International, Maryland, USA 2008.
19. AOAC: Association of official analytical chemistry. Washington DC: Author 2000; 6: 12-14.
20. Sadasivan S and Manickam A: Biochemical Methods: New age International PVT. Limited, New Delhi 2008.
21. AOAC: Official Methods of Analysis of AOAC International, 18th ed. AOAC International, Maryland, USA 2005.
22. Sindumathi G and Amutha S: Processing and quality evaluation of coconut-based jam: IOSR-JESTFT 2014; 8: 10-14.
23. Barros L, Ferreira MJ, Queiros B, Ferreira ICFR and Baptista P: Total phenols, ascorbic acid, β-carotene and lycopene in Portuguese wild edible mushrooms and their antioxidant activities: Food Chem 2007; 103: 413-19.
24. Sulaeman A, Keeler L, Giraud DW, Taylor SL, Wehling RL and Driskell JA: Carotenoids content and physic-chemical and sensory characteristics of carrot chips deep fried in different oils at several temperatures: Journal of Food Science 2001; 66: 1257-64.
25. Zhishen J, Mengcheng T and Jianming W: The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals: Food Chem 1999; 64: 555-59.
26. Matthaus B: Antioxidant activity of extracts obtained from residues of different oil seeds: J Agric Food Chem 2002; 50: 3444-52.
27. Stankovi MS: Total phenolic content, flavonoid concentration and antioxidant activity of *Marrubium peregrinum* L Extracts: Kragujevac J Sci 2011; 33: 63-72.
28. Upadhyay S, Tiwari R, Kumar S and Kohli D: Production and evaluation of instant herbal mix soup: International Journal of Agricultural Science and Research; 2017; 7:37-42.
29. Bai J, Sun D and Xaio H: Novel high humidity hot air impingement blanching (HHAIB) pretreatment enhances drying kinetics and colour attribute of seedless grapes. Innovative Food Science and Emerging Technologies 2013; 20: 230-37.
30. Doymaz I: Drying kinetics, rehydration and color characteristics of convective hot air drying of carrot slices: Heat and Mass Transfer 2014; 53(1): 25-35.
31. Romero CA, Byron J, Yepez V: Ultrasound as pre-treatment to convective drying of Andean blackberry: Ultrasonics Sonochemistry 2015; 22: 205-10
32. Kahyaoglu LN, Sahin S and Sumnu G: Spouted bed and microwave assisted spouted bed drying of parboiled wheat: Food and Bio products Processing 2012; 90: 301-08.
33. Borquez R, Melo D and Saavedra C: Microwave–vacuum drying of strawberries with automatic temperature control: Food and Bioprocess Technology 2014; 8: 266-76.
34. Askari GR, Emam-DZ and Mousavi SM: Heat and mass transfer in apple cubes in a microwave assisted fluidized bed dryer: Food and Bioproducts Pessing 2013; 91: 207-15.
35. Jayasinghe PS, Pahalawattaarachchi V and Ranaweera KKDS: Formulation of nutritionally superior and low-cost seaweed-based soup mix powder: Journal of Food Processing and Technology 2016; 7: 571.
36. Imaeda N, Tokudome Y, Ikeda M, kumi K, Nakako F and Shinkan T: Foods contributing to absolute intake and variance in intake of selected vitamins, minerals and dietary fiber in middle-aged Japanese. Journal of Nutri Sci Vitaminol 1999; 45 (5): 519-32.
37. García-LA, Moro C, Manchón N, Gonzalo-RA, Villares A, Guillamón E, Rostagno M and Mateo VL: *In-vitro* anti-inflammatory activity of phenolic rich extracts from white and red common beans: Food Chemistry 2014; 161: 216-23.
38. Gandhi N, Singh B and Sharma S: Storage stability and quality assessment of instant vegetable Soup Mixes prepared by Extrusion Processing: Bull Env Pharmacol Life Sci 2017; 73-82.

How to cite this article:
Priti and Prameela K: Formulation, nutritional, sensory, antioxidant activity and shelf life studies of instant soup mix. Int J Pharm Sci & Res 2020; 11(12): 6114-23. doi: 10.13040/IJPSR.0975-8232.11(12).6114-23.