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Development and Standardization of Enriched Moringa (*Moringa oleifera* Lam) Based Soup Mixes (ESM)

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Abstract
The study was carried out with the objective to develop and standardize moringa based enriched soup mixes (ESM). Two processing techniques *viz* drying – blending and pulping- dehydration were adopted for the development of soup mixes. In drying- blending method the moringa fruit pulp, moringa leaves, tomato and onion were dried separately at 70 ^{0}C for 4-8 h, powdered, blended together with other ingredients such as soya flour, milk solid and corn flour in different proportions. In pulping- dehydration method the moringa fruit pulp, moringa leaves, tomato and onion were made into pulp using a mixer grinder and dehydrated in the dryer at 70 ^{0}C for 7-8 h. The dried pulp was powdered, sieved and blended with other ingredients. The base materials (moringa pulp and moringa leaves) were added to the soup mixes with different proportions (30, 35 and 40). Four combinations of ESM were developed by using organoleptic and preference score from three combinations of four treatments.

Keywords: Moringa, Enriched soup mixes, Dehydration, Organoleptic score

1. Introduction
The plant food can be health promoting beyond its traditional nutritional value and is gaining acceptance among consumers and health professionals (Tewari, 2007) [18]. *Moringa oleifera* is an inexpensive yet nutritious tree vegetable. These plants have always been vital for mankind irrespective all over the globe since the beginning of life. *Moringa oleifera* Lam (Moringaceae) is one of the 14 species of family Moringaceae. This ‘’Miracle Tree” is believed to have originated from sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan (Anwar *et al*., 2007) [2]. *Moringa oleifera* has very high nutritional values; this positions the plant high in the table of healthy edible plants and vegetable as an important source of vitamins and minerals.

The fresh *Moringa oleifera* leaves contain seven times more vitamin C than orange, four times more calcium than in milk, three times more iron than in spinach, three times more potassium than in banana, four times more vitamin A than in carrot and proteins form as much as in egg (Gruangchock *et al*., 2010) [5]. *Moringa oleifera* is rich in various phytochemicals (Antioxidants) like carotenoids, vitamins, minerals, amino acids, sterols, glycosides, alkaloids, flavonoids, moringine, moringinine, phytoestrogens, caffeoylquinic acids and phenolics in flowers, leaves, roots, fruits and seeds (Anwar *et al*., 2007) [2]. The extract of the pods of *M. oleifera* is a good source of compounds with antioxidant properties, free radical scavenging activity and reducing power activity (Sharma *et al*., 2011) [15].

Vegetables and green leaves are highly perishable food items and require special processing treatments to prevent post-harvest losses. Convenience foods or processed foods are foods which are designed to save consumer time in the kitchen, reduces costs due to spoilage scale up (Liaqat *et al*., 2009) [7]. The trend in consumption of ready to eat food products is increasing due to increase in the number of working women population concomitant with the increase in per capita income, urbanization, scarcity of household labour, lack of time and hectic schedules, compelling the consumer to look for foods of convenience, easy commercial availability, culturally acceptable, nutritive and minimally processed with longer shelf-life. Taking into consideration of all nutrition and food safety concerns, food scientist and nutritionist agree that any form of commercial soup is significantly nutritious,

with higher nutrient content leading to higher nutritional value (Fahima *et al*., 2007) [4]. The soups are generally consumed for health as well as nutritive benefits particularly in patients whose intake of solids is poor due to several obstructive or pathological reasons. Under those circumstances, soups are the best source to supply health protective compounds and to circumvent the nutritive deficiency (Rekha *et al*., 2010) [12].

Despite its nutritional, economic and medicinal importance, the moringa still reminds neglected and not much work has been done to develop moringa based processed foods. In this context, the present investigation, "Development and standardization of enriched moringa (*Moringa oleifera*) based soup mixes (ESM)" was carried out.

2. Materials and Methods

Selection of base materials

Moringa fruit pulp and moringa leaves were selected as base materials for the development of enriched soup mixes. The moringa fruits were collected from the local markets while leaves were collected from homestead gardens.

Selection of other ingredients

Ingredients used for the formulation of the soup mixes were soya flour, tomato powder, onion powder, milk solids and corn flour.

Preliminary processing of ingredients

The base materials such as moringa fruits (pods) and leaves were washed and cleaned to remove dirt and dust. Cut the fruit into pieces and slit open into two halves. The half cut pieces were then scrapped off in order to get the pulp of moringa fruit leaving the peal. The pulp was dried at 70^0 C for 7-8 h. This was powdered and sieved. Moringa leaves were separated from stem and care was also taken to remove the small stems from the leaves. The leaves were spread in the steel trays and then dried at 70 ^{0}C for 4-5 h. This was powdered and sieved. The soya chunks were directly powdered and the other ingredients such as tomato and onion were cleaned, washed and cut in to small pieces, dried at 70^0C for 6-8 h.

Formulation of enriched soup mixes

Drying-blending

In this processing technique, the powdered dry ingredients along with the base materials were blended with soya flour, milk solid, and corn flour in different proportions. Sensory quality and nutritional value were the major criteria to detect the proportion.

Pulping-dehydration

In this method, the moringa fruit pulp, moringa leaves, tomato and onion were made into pulp using a mixer grinder and then dehydrated in the dryer at 70^0 C for 7-8 hours. The dried pulp was then powdered, sieved and blended with other ingredients.

Standardization of ESM

In the standardization procedure, two types of combinations were carried out for developing soup mixes. The first one (C_1) was moringa fruit pulp with soya flour and other ingredients (onion, tomato, corn flour, milk solid etc.). The second one (C_2) was moringa pulp combined with moringa leaves and soya flour with other ingredients. Each of these combinations was carried out through two processing techniques such as drying-blending (P_1) and pulping-dehydration (P_2). Various combinations were tried out through trial and error method. Based on the proportions, altogether twelve combinations were worked out. The acceptability and preference of the.

Twelve soups mixes were also observed by analyzing the sensory attributes and hedonic rating using a panel of ten judges. According to these aspects best soup mixes from each treatment were identified.

Standardization of moringa based soup (MS) from ESM.

Moringa soup was prepared by taking 10-15g of ESM and mixed with 200ml of water briskly to avoid lump formation. Boiled for 10-15 minutes. Added salt and pepper as per preference by stirring continuously. Simmer for 5-6 minutes and served hot.

3. Result and Discussion

Standardization of ESM

The overall acceptability score covering all the five sensory characteristics have been computed by taking the average overall score values of the individual sensory qualities *viz* appearance, colour, flavour, texture and taste.

The results of overall score of combinations of ESM are depicted in table (1).

Table 1: Organoleptic evaluation of ESM combinations.

Treatments	Combination I	Combination II	Combination III	Mean
$P_1 C_1$	6.7	7.1	8.2	7.3
$P_1 C_2$	7.1	7.4	8.0	7.5
$P_2 C_1$	6.8	6.7	8.2	7.2
$P_2 C_2$	8.4	7.7	7.1	7.7
	CD value		F value	
$P_1 C_1$	0.30		12.87 **	
$P_1 C_2$	0.30		4.48 *	
$P_2 C_1$	0.30		15.01 **	
$P_2 C_2$	0.30		9.03 **	

P_1 C_1 -Moringa pulp alone (Drying and blending). P_1 C_2 - Moringa pulp with leaf (Drying and blending). P_2 C_1 -Moringa pulp alone (Pulping and dehydration).P_2 C_2 - Moringa pulp with leaf (Pulping and dehydration).

Hedonic rating was also adopted for screening the best combination in each treatment. Results revealed that the hedonic data of the experimental samples showed that the different combinations of PC treatments were found to be statistically significant. The details of the hedonic rating are depicted in the Table 2

With regard to the P_1 C_1 treatment, the highest value was obtained in the third combination (8.2) and the least for the first combination (6.7). Similarly, in the second treatment (P_1 C_2) and the third treatment (P_2 C_1), the third combination recorded the highest value of 8.0 and 8.2, respectively. In the fourth treatment (P_2 C_2) the highest hedonic score was recorded in the first combination (8.4) and the least value for the third combination (7.1).

Table 2: Preference of the ESM combinations (Hedonic scale)

Treatments	Combination I	Combination II	Combination III	Mean
$P_1 C_1$	3.6	4.1	4.2	3.9
$P_1 C_2$	2.9	3.8	3.5	3.4
$P_2 C_1$	3.5	3.3	4.0	3.6
$P_2 C_2$	4.1	3.8	3.5	3.8

CD – 0.68 F – 2.48

P_1 C_1 -Moringa pulp alone (Drying and blending). P_1C_2- Moringa pulp with leaf (Drying and blending). P_2 C_1 -Moringa pulp alone (Pulping and dehydration). P_2 C_2 Moringa pulp with leaf (Pulping and dehydration). *- Significant at five per cent level. **- Significant at one per cent level

Moringa oleifera is considered as the 'Nature's Medicine Chest' and hence, considerable effort is required to process this food in to convenient forms in order to promote its consumption and to obtain maximum health benefits (Anwar *et al*., 2007) [3]. In the present investigation moringa fruit pulp and leaves were selected as base materials for the development of enriched soup mixes (ESM) because the base materials are available at low cost and very rich in all the micronutrients (Joshi and Mehta, 2010) [6]. Pai (2007) [9] reported that there is a need to make new products from indigenous raw materials having nutritional value which open up new channels for domestic and export market. Hence, research in this field should be focused to develop nutrient packed food supplements from locally available resources.

Finally the best ESM combinations from each treatment were standardized (Table 3).

Table 3: Standard combinations of ESM

Treatments	Ingredients	Proportions (%)
1. Drying-blending		
$P_1 C_1$	Moringa fruit pulp+ soya+ tomato+ onion+ milk solid+ maida	30+ 7+ 10+ 8+ 25+ 20
$P_1 C_2$	Moringa fruit pulp+ moringa leaf+ soya+ tomato+ onion+ milk solid+ corn flour+ maida.	30+ 10+ 5+ 10+ 5+ 23+ 10 +7
2. Pulping-dehydration		
$P_2 C_1$	Moringa pulp+ soya+ tomato+ onion+ milk solid+ corn flour	40+ 5+ 10+ 4+ 21+ 20
$P_2 C_2$	Moringa pulp+ moringa leaves+ soya+ tomato+ onion+ milk solid+ corn flour	35+ 10+ 6+ 10+ 4+ 20+ 15

Saha and Dunkwal (2009) [13] opined that instant food means simple, fast and convenient food which is easy and fast to prepare. In this context prepared enriched soup mixes are in a convenient form. As reported by Abate and Peterson (2008), soup is a favorite comfort food and is relished by people of all age groups. Soup mixes supply the nutrients needed for overall good health and are consumed by both healthy and sick people. According to Rekha *et al*. (2010) [12] soups are consumed for nutritive benefits and also by patients whose intake of solids is considerably reduced due to several pathological reasons. Since soups mixes are prepared as a mixture of vegetables as reported by Sen and Mogra (2011) [14], in the present study also soya flour, tomato powder, onion powder, milk solids and corn flour were used along with base materials in different proportions for the development of enriched soup mixes. The incorporation of antioxidant rich ingredients in the soups will further boost the product market as the present trend is focused on marketing of processed food products providing health benefits (Moreno *et al*., 2004) [8].

In this study instant soup mixes were developed using two different processing techniques such as drying-blending and pulping-dehydration. According to Singh *et al*. (2003) [16] dry soup mixes are prepared by blending dried ingredients. Somogyi and Luh (1988) [17] reported that dried or dehydrated vegetables can be produced by a variety of process. The processes differ primarily by the type of drying method used, which depends on the type of food and the type of characteristics of the final product. Ratti (2001) [11] found that freeze drying protect the food commodities against chemical decomposition, easy rehydration, retention of heat sensitive and active ingredients in food and excellent shape retention. In the present study two types of combinations were carried out for developing soup mixes. The first one was moringa fruit pulp with soya flour and other ingredients (onion, tomato, corn flour, milk solid *etc*.). The second one was moringa pulp combines with moringa leaves and soya flour with other ingredients.

Standardization of ESM

Standardization plays a key role in product development which facilitates the growth of food industries. According to Poduval (2002) [10], one of the foremost purpose of standardization is to facilitate the movement of materials and products through all stages of production in any industrial activity, starting from the raw material to the finished products, than to the dealer and finally to the retailers and consumers. Liaqat *et al.* (2009) [7] found that recipe standardization is important to achieve optimal accuracy in determining the nutrient estimation. In the present experiment the standardization procedure for the development of ESM was done by considering the overall score and hedonic rating of four treatments with three combinations each. The overall acceptability score covering the average value of the individual sensory qualities *viz* appearance, colour, flavour, texture and taste. Liaqat *et al.* (2009) [7] reported that sensory evaluation is a useful tool to achieve consumer acceptability for recipe standardization. The overall acceptability of three combinations of each treatment was equally acceptable to the judges. Considering the results of hedonic rating of ESM samples, it was revealed that the third combinations of first three treatments showed highest preference and in the fourth treatment, the first combination was found high most preferred one. The three combinations in the four treatments vary with the proportions of the ingredients in each treatment.

4. Conclusion

It can be concluded from the study that enriched moringa based soup mixes prepared by drying-blending and pulping-dehydration could be adopted for the development of soup mixes. Four combinations of ESM were standardized by

considering the organoleptic and preference score from three combinations of the four treatments *viz.*, i) P_1 C_1 - Moringa pulp alone incorporated (Drying and blending); ii) P_1 C_2 - Moringa pulp with leaf incorporated (Drying and blending); iii) P_2 C_1 - Moringa pulp alone incorporated (Pulping and dehydration) and P_2 C_2- Moringa pulp with leaf incorporated combination (Pulping and dehydration).

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