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Formulation and development of instant soup mix using *Moringa oleifera* leaf powder

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Abstract
Aimed to prepare (RTR) ready to reconstitute instant soup mix and other ingredient to get acceptable soup for desired health benefits this research work had been carried out. Instant soup mix is a popular energetic snack, consumed and liked by everyone. Instant soup prepared with more than 24% (MLP4) taste Moringa leaf powder along with other ingredients was found acceptable in terms of overall acceptability with the hedonic score 8.04 as compared to control 8.63 respectively. The results indicated that supplementation with Moringa leaf powder significantly enhanced the nutritional characteristics and had a reasonable amount of required nutrients. The developed soup is formed high in protein 13.67%, ash 9.79%, fibre 5.99% and low in fat 3.04% and carbohydrates 54.88% which make the developed soup as an appropriate choice for the fulfillment of nutritional demand of people. Therefore the value added instant soup mix can also play a great role in attaining the nutritional security in the country.

Keywords: Instant soup mix, physicochemical, vitamins and Organoleptic.

Introduction

Moringa oleifera is being cultivated in poverty stricken nations as a primary source of food. The leaves being the most nutritious part of the plant is a significant source of protein, fat, calcium, iron, copper, zinc, manganese and have high levels of vitamins B, C, K and beta-carotene. *Moringa oleifera* is one of the best examples, which contains all essential nutrients, enzymes, omega oils, minerals, antioxidants and phyto-chemical compounds. (Morton, 1991, Gilani *et al.* 1994) [9, 5]. Various parts of this plant such as the leaves, roots, seed, bark, fruit, flowers and immature pods used since ancient times. It used as extremely rich in vital nutrients and medicinal value, known to heal and ease many diseases: from various inflammations to parasitic diseases, diabetes, cardiac, circulatory stimulants, antipyretic, antitumor, anti-inflammatory, antiepileptic, diuretic, antiulcer, antispasmodic antihypertensive, cholesterol lowering, antidiabetic, antioxidant, antibacterial, hepatoprotective, antifertility, antifungal activities and cancer else (Shah *et al.* 2016) [15].

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. *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) [3]. 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) [16].

Soup is one of the traditional foods which can be classified as an appetizer, warm food during cold and sick. In the modern world commercially prepared instant soup has replaced homemade soup as preparing a soup is a time consuming process (Niththiya *et al.* 2014) [10]. Soup is generally made by combining ingredients such as vegetables green leaves with juice, water, or other liquid. Hot soups are additionally characterized by boiling solid ingredients in liquids in a pot until the flavors are extracted, forming a broth. Ingredients commonly used to

thicken soups and broths include rice, lentils, flour, and grains.

Dried soup powders have an advantage of protection from enzymatic and oxidative spoilage and flavor stability at room temperature over long periods of time (6–12 months). In addition, they are ready for reconstitution in a short time for working families, hotels, hospitals, restaurants, and institutional use as well as to military rations. Moreover, they exert light weight for shipping and availability at all time of the year (Rekha, 2010) [14].

Materials and Methods

Moringa leaves powder preparation:- Good quality of Moringa leaves, were collected from the University Campus, leaves and parts were cleaned properly by removing the insect damaged and deteriorated, stem and the good quality parts were selected for drying.

Dehydration of Moringa parts, spices and vegetables: - The cleaned parts were blanched by steam for 3 minutes. Leaves were shade dried in room temperature while flowers and pods dried in hot air oven at 55 °C for 16 hours (Parvathi *et al.*, 2015) [13]. The fresh spices and vegetables were cleaned, chopped into small pieces and dried in hot air oven at 65 °C for 5-6 hours.

Preparation of instant soup mix: - A proportion of ingredients, sample combinations, cooking and accordingly percentage of supplementation was established through sensory evaluation. Several compositions of raw materials and main ingredients were tried to arrive at the desired formulation with optimum percentage as recommended by acceptability studies. All experimental samples were prepared using the method of Amal *et al.*, (2014) [1] with slight modification various acceptability parameters such as consistency, colour, appearance, flavour, taste, after taste and overall acceptability were considered as deciding factors by using the method described by Amerine *et al.*, (1965) [2].

Table 1: Treatment combinations

S. No.	Formulations	Control	MLP %	MLP %	MLP %	MLP %
01	Citric acid	0.25	0.25	0.25	0.25	0.25
02	Sodium benzoate	0.30	0.30	0.30	0.30	0.30
03	Sugar	4	4	4	4	4
04	Corn starch	8	8	8	8	8
05	Cumin	0.3	0.3	0.3	0.3	0.3
06	Black pepper	0.5	0.5	0.5	0.5	0.5
07	Salt	4	4	4	4	4
08	Green pea	4	4	4	4	4
09	Cabbage	0.3	0.3	0.3	0.3	0.3
10	Carrot	4	4	4	4	4
11	Coriander	0.35	0.35	0.35	0.35	0.35
12	Garlic	1.30	1.30	1.30	1.30	1.30
13	Onion	2	2	2	2	2
14	Tomato	10	10	10	11	11
15	Lentil	35	19	17	15	13
16	Sanwa millet	25	25	25	24	24
17	*MLP	0	18	20	22	24
	Total	100	100	100	100	100

*MLP Moringa leaves powder

Physical properties: - *Reconstitution Index (RI)* - The reconstitution index of the samples was determined according to method described by Onwuka (2005) [11]. *Water absorption capacity (WAC)* - The gain in mass was the water absorption capacity of the soup sample. The volume difference gave the volume of water absorbed by 1g of the test sample. Absorption capacity is expressed in grams of water absorbed per gram of sample (Onwuka, 2005) [11]. *Bulk density (BD) determination*- A graduated cylinder (10 ml) was gently filled with the flour sample. The bottom of the cylinder was then tapped gently on a laboratory bench several times. This continues until no further diminution of the test flour in the cylinder after filling to mark, was observed (Onwuka, 2005) [11]. *Rehydration Ratio (RR)* - Rehydration ratio was defined as the ratio of weight of rehydrated samples to the dry weight of the sample (Krokida and Marinos-Kouris, 2003) [7]. *Swelling index (SI)* - The method as described by Ukpabi and Ndimele (1990) [17] was used in the determination of the swelling index. *Hunter Colour Measurement*- Colour measurement of different instant soup mixes was done by using a Hunter colour measuring system and expressed in terms of L*, a*, b*, according to the CIE method (1976).

Chemical properties:- All the experiments were carried out in duplicate and mean values have been reported. The instruments used were properly calibrated and standardized procedures were followed for the valid and reliable analysis. *Proximate composition of instant soup mix*- The nutritional evaluation of instant soup mix with respect to various constituents was carried out by the following procedures. *Determination of Moisture content*- The moisture content of the sample was determined by using moisture meter. *Determination of Protein content*- The protein content in sample was determined by using conventional Micro-Kjeldhal digestion and distillation procedure as given in AOAC (1992) [4] using Pelican's Kel Plus digestion and distillation assembly. *Determination of Fat content*- The fat content of the sample was determined by the procedure as described in AOAC (1992) [4] using Pelican's Socks plus automatic fat analysis system. *Determination of Ash content*- The ash content present in the sample was determined according to the procedure given in AOAC (1992) [4] using Muffle furnace. *Determination of Crude fibre*- The crude fibre was determined by the method as described in AOAC (1992) [4] using automatic fibre analysis system- Fibra Plus (Make-Pelican). *Determination of Total Carbohydrates*- Total carbohydrate was estimated by subtracting the sum of moisture, protein, fat, ash and crude fibre from 100 (Merrill and Watt, 1973) [8].

Sensory analyses- The sensory quality characteristics were evaluated by Amerine *et al.* (1965) [2].

Statistical analysis- A complete randomized design was adopted for statistical analysis of data by following the procedure as described by Panse and Sukhatme (1985) [12].

Results and Discussion

The investigations were carried out to test the suitability of *Moringa oleifera* leaves with other ingredients in the preparation of instant soup mix. The results obtained during the course of investigation have been described in the form of tables and figures.

A number of trials were conducted by taking varying Moringa oleifera parts sugar, corn starch, cumin, black pepper, salt, green pea, cabbage, carrot, coriander, garlic, onion, tomato, lentil, sanwa millet, citric acid and sodium benzoate. Accordingly soup was prepared using earlier mentioned basic

recipe for soup with 10 to 30% Moringa parts, 10- 38% lentil, 2 to 5% salt and sugar, 7 to 10% cornstarch. Finally soup were prepared using the optimum level of ingredients arrived at desired formulations from the earlier results of acceptability studies of soup formulations.

In the preliminary sensory evaluation test different soup were prepared from different formulations and were evaluated by panelists. The score for the product with 16 - 22% Moringa leaf sanwa millet, 13- 35% lentil powder, 10 -11% tomato powder were are acceptable in terms of all sensory attributes. Panelists suggested the 4g of salt and sugar,. 0. 5 g black pepper, 10 to 11% tomato powder for improving the taste and colour of modified instant soup mixes. They also suggested to take 8 g of corn starch for instant medicinal soup mix as the soup with 10% corn starch was too thick and 7 g of corn starch was too thin. They also suggested increasing the cooking time of instant soup mix up to 6 minutes. The use of green pea grits was recommended in place of whole seed in the formulations.

Sensory analysis - The results of sensory analysis are given in Table – 2.0 the control got highest value followed by MLP4 while MLP1 got the lowest value for all sensory attributes. The scores of control for colour and appearance, taste, flavour, consistency, after taste and overall acceptability are 8.67, 8.50, 8.66, 8.90, 8.76 and 8.63 respectively. Among the improved formulations the variation MLP4 scored highest scores than other variations for all the sensory characters viz., colour and appearance (8.01), taste (8.10), flavour (8.16), consistency (8.06), after taste (8.07) and overall acceptability (8.04). All the treatments differed significantly from each other.

Table 2: Sensory attributes of instant soup mixes with Moringa leaf powder

Formulations	Colour & appearance	Taste	Flavour	Consistency	After taste	Overall acceptability
CONT	8.67	8.50	8.66	8.90	8.76	8.63
MLP1	7.16	7.23	6.90	7.20	7.26	7.56
MLP2	7.30	7.86	7.16	7.46	7.13	7.93
MLP3	7.40	7.60	6.96	7.56	7.50	7.83
MLP4	8.01	8.10	8.16	8.06	8.07	8.04
SEM	0.180	0.209	0.197	0.215	0.079	0.175
CD at 5%	0.574	0.668	0.629	0.685	0.253	0.558

* Maximum score out of 9

Physical attributes of instant soup mixes: - *Reconstitution Index*- The observed Reconstitution Index with different combinations of instant soup mix varied from 14.30 to 16.33 (g/ml) in Moringa leaf powder. The Reconstitution Index was found to be highest in MLP4 (16.33 g/ml). *Water absorption capacity* - The highest value of WAC of instant soup mix from MLP attained by MLP4 (291 ml/100 g) followed by control (290 ml/100 g) and lowest by MLP2 (275ml/100 g). *Bulk Density*- The bulk density of instant mixes ranged from 0.72 to 0.80 g/ml in Moringa leaf powder whereas higher was observed in instant soup mixes from MLP. *Rehydration ratio*- The rehydration ratio with different combinations of instant soup mix of MLP varied from 2.5 to 4.8 and it was to be highest in MLP4 and lowest in control. *Swelling index*- The Swelling index with different combinations of instant soup mix (Table- 3.0) ranged from 1.33 to 1.66 and was found to be highest in MLP4 and lowest in MLP1.

Table 3: Physical attributes of instant soup mixes with Moringa leaf powder

Formulations	Reconstitution Index(g/ml)	Water absorption capacity(ml/100g)	Bulk density (g/ml)	Rehydration ratio	Swelling Index
CONT	14.3	290	0.72	2.5	1.33
MLP1	14.26	279	0.77	4.3	0.5
MLP2	14.36	276	0.78	4.5	0.83
MLP3	15.16	278	0.79	4.7	1.33
MLP4	16.33	290	0.80	4.8	1.66
SEM	0.364	0.577	0.027	0.163	0.241
CD at 5%	1.160	1.843	N/S	0.521	0.769

Hunter colour analysis: - *Hunter colour analysis of instant soup mixes with Moringa leaf powder*- Colour of the food is the first parameter of quality evaluated by consumers. Although there are many different colour, the most frequently used is the hunter L* a* b* colour, due to its uniform colour distribution and because its perception of colour is closest to the one human eye. In instant soup mix with MLP the highest value of lightness (75.12) was obtained from control followed by MLP1 (52.64), MLP2 (50.29), MLP4 (50.28) while the lowest value (49.52) was obtained from MLP3. The highest value of a* and b* (9.42, 15.69) was obtained from control and lowest by MLP2 and MLP4 respectively (Table-4.0).

Table 4: Hunter colour analysis of instant soup mixes with Moringa leaf powder

Formulations	L*	a*	b*
Control	75.12	9.42	15.69
MLP1	52.64	1.53	14.29
MLP2	50.29	1.32	14.29
MLP3	49.52	1.74	14.16
MLP4	50.28	1.63	13.71
SEM	0.687	0.537	0.537
C.D.	2.192	1.714	1.714

L* Represents the brightness from white (100) to black (0)
a* Represents the red to green colour.
b* Represents the yellow to blue colour.

Proximate Analysis: - The blending of *Moringa oleifera* leaves with other ingredients in different formulations of instant soup mix affected the proximate composition. The results for the different biochemical parameters are given in tables.

Moisture content varied from 8.41 to 9.55 percent as shown in (Table-5.0). MLP1 exhibited maximum moisture content followed by MLP4, MLP3, MLP2, and control formulation with minimum moisture content. It is clear from Table 5.0 that *protein* ranged from 9.76 to 13.67 percent in different formulations of instant soup mix. Formulation MLP4 (13.67) had significantly maximum protein content followed by MLP3, MLP1, and control with the minimum protein content. All formulations differed significantly from each other. The range of *fat content* was found to be 1.40 to 3.4 percent in various instant soup mix formulations. MLP4 exhibited maximum fat content as compared with other formulations and it was statistically superior to rest. The original instant soup mix (control) exhibited highest *Carbohydrate content* (61.52%) followed by MLP1, MLP2, MLP3, and MLP4 with lowest content. Control was statistically superior to other formulations. The *crude fibre content* of instant soup mix ranged from 4.13 to 5.99 percent in various formulations. MLP4 exhibits maximum fibre content compared to the rest; hence it is statistically superior to other formulations. The *ash content* in different blends of instant soup mix ranged from 8.69 to 9.79 percent. MLP4 was numerically superior to rest of the formulations.

Table 5: Proximate analysis of instant soup mixes with Moringa leaf powder in %.

Formulations	Moisture	Protein	Fat	Crude fibre	Carbohydrate	Ash
CONT	8.41	09.76	1.40	4.13	61.52	8.69
MLP 1	9.55	13.51	2.60	5.49	57.30	9.76
MLP2	8.71	13.48	2.75	5.66	56.78	9.77
MLP3	8.77	13.54	2.90	5.83	56.25	9.78
MLP4	8.85	13.67	3.04	5.99	54.88	9.79
SEM	0.075	0.210	0.146	0.284	0.465	0.054
CD at 5%	0.240	0.671	0.465	0.905	1.484	0.173

Conclusions

It can be concluded from the study that enriched Moringa based soup mixes prepared by drying could be adopted for the development of soup mixes and supplementing soup mix with Moringa leaf as a valuable food addition to enhance nutritional characteristics of the instant soup. Among the six combinations, the treatment MLP4 was found best in context of organoleptic and preference score. The cost of production also found in acceptable level. The developed soup mix is more convenient than traditional product and this will improve its popularity among the younger generation and is a novel one holds good commercialization potential.

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