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Dr. A Sharma

Scientist, JNKVV, KVK,
 Shahdol, Madhya Pradesh, India

Dr. N Vishwakarma

Scientist JNKVV, KVK,
 Jabalpur, Madhya Pradesh,
 India

Dr. A Singh

Scientist JNKVV, KVK, Sidhi,
 Madhya Pradesh, India

Dr. M Singh

Pr. Scientist JNKVV, KVK,
 Shahdol, Madhya Pradesh, India

Study of low cost nutritious halwa instant mixes on sensory, proximate and shelf life parameters

Dr. A Sharma, Dr. N Vishwakarma, Dr. A Singh and Dr. M Singh

Abstract

Halwa is a traditional Indian food which is solely prepared from wheat grits. Four different types of halwa mixes were prepared by incorporating different kinds of roasted legume dal flour *viz.*, chickpea, green gram, soybean and fieldpea in different proportions. The mixes were evaluated on sensory, nutritional and storability parameters. Based upon the sensory evaluation, the optimized level of supplementation was found to be 20% supplementation of roasted legume dal flour in roasted wheat flour. Soybean blended mix showed better nutritional quality in comparison to other mixes. Fortification of mixes with 10% skimmed milk powder further enriched the products with higher contents of protein, calcium and phosphorus content. The prepared halwa mix was monitored for changes in moisture content, free fatty acids as well as sensory quality during storage and was found stable for 6 months at ambient conditions in polyethylene bags. The cost analysis of Halwa mixes showed that the cheapest products were based on soybean and fieldpea which had lower values in comparison to other products based on green gram and chickpea.

Keywords: Traditional, sensory, nutritional, storability, sensory evaluation, instant mixes

Introduction

In developing nations, cereal grains will remain the main component of adults and infants fundamental meals; hence, efforts should be directed at enhancing the food items nutritional status (Sanni *et al.*, 1998) [12]. Cereal-based gruels, aside from their bulkiness, which has been suggested as a potential contributing factor to the etiology of malnutrition (WHO, 2001a) [16], are typically low in protein and deficient in certain key amino acids, especially tryptophan and lysine. By complementing each other's particular amino acids, locally grown legumes that are high in protein and lysine can be added to cereals to boost their protein content and quality. However, this can often limit the amount of sulfur amino acids in the mixes. FAO/WHO/UNICEF (1971) [6] highlighted the use of locally produced foods that are prepared at home using the following guidelines: (i). (Dewey and Brown, 2003; Pelto *et al.*, 2003) [5, 10] Among these are (i) good nutritional value to support breastfeeding, (ii) acceptance, (iii) cheap cost, and (iv) utilization of locally produced food items. A readily available mix may be introduced into a product that is a part of the typical diet, using cereal-pulse mixtures for human consumption is thought to be one of the greatest possibilities to boost the nutritional status of the population (Hernandez and Sotelo, 1984) [7].

The classic wheat-based traditional dishes such as panjiri, halwa, laddo, lapsi, mathri, pua, gulgula, and missi-roti are widely consumed and play a significant role in everyone's diets, especially on festive and religious occasions. These product exhibits unique sensory qualities, in terms of color and appearance, flavor and taste, texture, and overall acceptability. They are made with traditional, low-cost processing methods like grinding and roasting. Halwa is one of the many foods made from wheat that is frequently consumed. This is a classic dessert made by roasting cereal flour, usually wheat, in ghee or vegetable oil, and then sweetening it with sugar. It is typically liked by every family member, regardless of age or gender. It has a light brown color, a granular texture, a good flavor, and a high nutritional content.

Although halwa is a widely used and well-liked traditional foodstuff, very little scientific data regarding its composition, sensory qualities, and nutritional value is currently accessible. It is crucial that its nutritional and sensory characteristics are determined using scientific methods. Standardizing the instant halwa mix requires combining high-quality components, recipes, and manufacturing processes. The development of an appropriate production and packaging system to enable the preparation of commercial mixes will be facilitated by the scientific investigation.

Corresponding Author:

Dr. A Sharma

Scientist, JNKVV, KVK,
 Shahdol, Madhya Pradesh, India

The present investigation was planned with an objective to incorporate low cost available flour at different levels to standardized the instant halwa mixes and study its effect on nutritional, sensory and shelf life characteristics of developed mixes and food products.

Materials and Methods

Procurement of raw materials

The various kinds of food stuffs viz., wheat, rice, chickpea, green gram, soybean, fieldpea black gram, sugar, jaggery, skimmed milk powder, oil, salt, essential spices and polythene bags etc. were purchased from JNKVV farm and local market. The foodstuffs and polythene bags were purchased from local market.

Processing of wheat grains

Wheat grains were cleaned to remove the dust and foreign materials. The grains were ground in an electric grinder to make flour and sieved by 80-100 mesh sieves. The obtained flours were stored in air-tight container for further use.

Processing of chickpea / green gram/ fieldpea/ black gram grains

Grains of different kinds of pulses individually were cleaned to remove the dust and foreign materials, moistened with water for 4-6 hrs and then dried for 3-4 days in sunlight till the material was completely dried to 6-8% moisture content. The dried grains were pearled in a hand operated chakki for removal of husk. Then, the obtained dal grains were ground in an electric grinder to make flour and sieved by 80-100 mesh

sieves. The obtained flours were stored in air-tight container for further use.

Processing of soybean grains

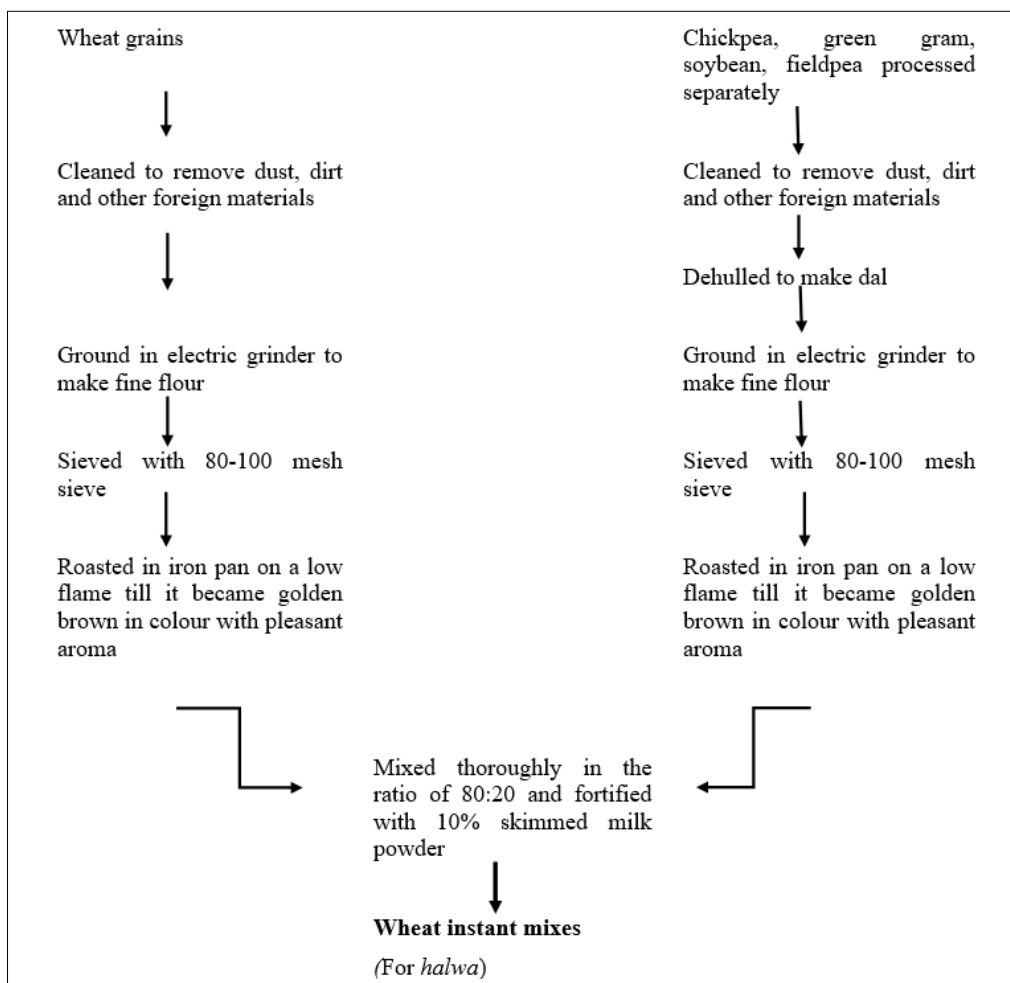
Soybean grains were thoroughly cleaned to remove the dust and foreign materials. The cleaned grains were soaked in water for 4-6 hrs and then autoclaved for 5-10 minutes in a pressure cooker. They were then removed and dried in sunlight for 3-4 days till the material was completely dried to 6-8% moisture content. The obtained grains were then ground in an electric grinder to make fine flour and sieved by 80-100 mesh sieves. The obtained flour were stored in air-tight container before use.

Roasting of different kinds of flours

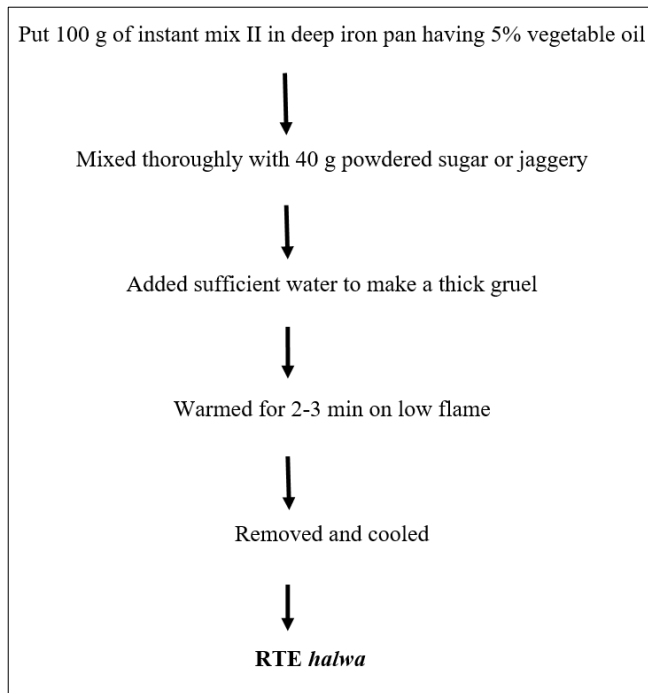
Roasting of different kinds of individual flours were carried in deep iron pan on a low flame till it become brownish in colour and then used for the development of instant mixes.

Formulation and development of instant halwa mixes

Various kinds of wheat based instant mixes were used to prepare halwa. They were made from roasted wheat flour in combination with different kinds of roasted legume dal flours viz., chickpea, green gram, soybean and fieldpea in various proportions i.e. 90:10, 85:15, 80:20, 75:25 and 70:30 and designated the mixes as I to V. Roasted wheat flour was used as control. The detailed procedure for preparation instant mixes and its products halwa have been presented in Flow sheet No. 1 and 2.



Flow sheet 1: Preparation of wheat based instant mixes (for halwa)



Flow sheet 2: Preparation of *halwa* from wheat based instant mixes

Analysis

Sensory evaluation of RTE halwa revealed that the instant mixes based on wheat flour for development of halwa were formulated and developed in the rates of 80:20. The mixes developed were used to prepare the RTE products by using 40% table sugar and 5% vegetable oil and subjected to sensory evaluation. The proximate analysis of instant mixes and RTE products were also carried out by the standard procedure. The moisture, fat, ash content were evaluated as described in AOAC (1980) [2], protein content by using conventional micro- kjeldahl digestion and distillation procedure as given in AOAC (2000) [4], total carbohydrates by difference system, total calorific value by Swaminathan (1986), crude fiber by as described in AOAC (1992) [3], iron content was determined colorimetrically as described in "A Manual of Laboratory ways (1983)", calcium in the

acid condensation was determined by the verse Nate titration system as described in "A Manual of Laboratory ways (1983)", phosphorus content in the triacid condensation by vanadomolybdate system as described by Koenig and Johnson (1942) [8]. The sensory evaluation of halwa developed from instant mixes were made by hedonic rating for quality attributes and overall adequacy using expert panelists according to the system as described by Amerine *et al.* (1965) [1] on a 9 points hedonic scale. The experimental data were collected by taken mean values from all the three replications and the analysis of variance as outlined by Panse and Sukhatme (1978) [9]. The storability of instant mixes were conducted in polyethylene bags for the period of 12 months at ambient conditions on parameters such as moisture content, free fatty acid content and sensory scores of the products made from stored composites.

Results and Discussion

Sensory analysis of RTE halwa

Halwa developed from chickpea blended instant mixes

Halwa is a traditional Indian food which is solely prepared from wheat grits. In the present investigations, *halwa* instant mixes were developed using roasted wheat flour and roasted chickpea dal flour in various ratios (90:10, 85:15, 80:20, 75:25 and 70:30) and labeled the items as I to V. As control, (100%) roasted wheat flour was taken. Instant Mixes were evaluated after making *halwa* with 40% table sugar and 5% vegetable oil.

The sensory quality attributes of the products varied significantly as shown in Table 1. The sensory scores for *halwa* made from various kinds of instant mixes ranged in between 6.8 to 8.7. The products IV and V scored lower values ranging in between 6.8 to 7.2 for flavour and 7.2 to 7.8 for taste resulted in decrease of overall acceptability (6.9 to 7.4). It revealed that the products prepared using roasted chickpea dal flour upto 20% level was good and liked by the panelists. The sensory scores of the products I to III ranged from 8.2 to 8.7 without any significant differences. Thus, roasted chickpea dal flour could be blended for making *halwa* instant mixes upto the extent of 20% showing no unfavorable impact on the sensory quality attributes of the developed food.

Table 1: Sensory evaluation of *halwa* made from different types of wheat based instant mixes II (roasted wheat flour and roasted chickpea dal flour) (Results are average of 10 individuals)

Sensory attributes	Control	Product-I	Product-II	Product-III	Product-IV	Product-V	Av. Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
Colour & Appearance	8.6	8.7	8.4	8.3	8.5	8.2	8.5	0.033	0.096	10.5	3.11	S
Taste	8.5	8.4	8.5	8.3	7.8	7.2	8.1	0.019	0.056	242.7	3.11	S
Flavour	8.2	8.4	8.5	8.4	7.2	6.8	8.0	0.051	0.147	68.1	3.11	S
Texture	8.3	8.2	8.2	8.6	8.1	8.0	8.0	0.058	0.167	4.27	3.11	S
Overall Acceptability	8.4	8.4	8.7	8.6	6.9	7.4	8.1	0.027	0.079	244.2	3.11	S
Av. Mean	8.4	8.4	8.5	8.4	7.7	7.5						

- **Control:** 100% roasted wheat flour
- **Products (I to V):** Different ratio of roasted wheat flour with roasted chickpea dal flour (90:10, 85:15, 80:20, 75:25 and 70:30)

Instant halwa mixes based on green gram dal

The results revealed that all the sensory attributes of the products varied significantly as shown in Table 2. The sensory scores of *halwa* made from various kinds of instant mixes ranged in between 6.5 to 8.8. The products IV and V scored lower values ranging in between 6.5 to 7.3 for taste and 7.0 to 7.7 for flavour resulted in decrease of overall acceptability (6.9 to 7.6). It revealed that the products

prepared using roasted green gram dal flour upto the level of 20 per cent was good and liked by the panelists. The sensory scores of the products I to III ranged from 8.3 to 8.8 without any significant differences. Thus, roasted green gram dal flour could be blended for making *halwa* instant mixes up to the extent of 20% showing no unfavorable impact on the sensory quality attributes of the developed food.

Table 2: Sensory evaluation of *halwa* made from different types of wheat based instant mixes II (roasted wheat flour and roasted green gram dal flour) (Results are average of 10 individuals)

Sensory attributes	Control	Product-I	Product-II	Product-III	Product-IV	Product-V	Av. Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
Colour & Appearance	8.6	8.5	8.4	8.5	8.6	8.4	8.5	0.047	0.136	1.2	3.11	NS
Taste	8.5	8.6	8.7	8.5	7.3	6.5	8.0	0.064	0.045	133.8	3.11	S
Flavour	8.7	8.6	8.3	8.6	7.7	7.0	8.2	0.038	0.111	102.87	3.11	S
Texture	8.4	8.7	8.6	8.2	8.1	8.2	8.4	0.057	0.164	6.16	3.11	S
Overall Acceptability	8.7	8.8	8.6	8.5	7.6	6.9	8.2	0.027	0.079	261.75	3.11	S
Av. Mean	8.6	8.6	8.5	8.5	7.9	7.4						

- **Control:** 100% roasted wheat flour
- **Products (I to V):** Different ratio of roasted wheat flour with roasted green gram dal flour (90:10, 85:15, 80:20, 75:25 and 70:30)

Instant *halwa* mixes based on soybean dal

The results showed that all the sensory attributes varied of the products significantly as shown in Table 3. The sensory scores of *halwa* made from various kinds of instant mixes ranged in between 6.5 to 8.8. The products IV to V scored lower values ranging in between 6.5 to 7.3 for taste and 7.0 to 7.7 for flavour resulted in decrease of overall acceptability (6.9 to 7.6). It revealed that the products prepared using

roasted soybean dal flour upto the level of 20 per cent was good and liked by the panelist. The sensory scores of the products I to III ranged in between 8.1 to 8.8 without any significant differences. Thus, roasted soybean dal could be blended for making *halwa* instant mixes upto the extent of 20% showing no unfavorable impact on the sensory quality attributes of the developed food.

Table 3: Sensory evaluation of *halwa* made from different types of wheat based instant mixes II (roasted wheat flour and roasted soybean dal flour) (Results are average of 10 individuals)

Sensory attributes	Control	Product-I	Product-II	Product-III	Product-IV	Product-V	Av. Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
Colour & Appearance	8.6	8.5	8.4	8.5	8.3	8.3	8.4	0.033	0.096	4.4	3.11	S
Taste	8.4	8.6	8.8	8.5	7.3	6.5	8.0	0.053	0.152	99.56	3.11	S
Flavour	8.7	8.6	8.2	8.6	7.7	7.0	8.2	0.054	0.157	50.25	3.11	S
Texture	8.8	8.7	8.0	8.4	8.2	7.9	8.3	0.057	0.164	14.65	3.11	S
Overall Acceptability	8.4	8.6	8.8	8.5	7.6	6.9	8.2	0.057	0.165	56.17	3.11	S
Av. Mean	8.6	8.6	8.4	8.5	7.8	7.3						

- **Control:** 100% roasted wheat flour
- **Products (I to V):** Different ratio of roasted wheat flour with roasted soybean dal flour (90:10, 85:15, 80:20, 75:25 and 70:30)

Instant *halwa* mixes based on fieldpea dal

The results showed that all the sensory attributes of the products varied significantly as mentioned in Table 4. The sensory scores of *halwa* made from various kinds of mixes ranged in between 6.5 to 8.8. The products IV and V scored lower values ranging in between 6.6 to 7.4 for taste and 7.0 to 7.5 for flavour resulted in decrease of overall acceptability (6.5 to 7.1). It revealed that the products prepared using

roasted fieldpea dal flour upto the level of 20 per cent was good and liked by the panelist. The sensory scores of the products I and III ranged from 8.3 to 8.8 without any significant differences. Thus, roasted fieldpea dal could be blended for making *halwa* instant mixes upto the extent of 20% showing no unfavorable impact on the sensory quality attributes of the developed food.

Table 4: Sensory evaluation of *halwa* made from different types of wheat based instant mixes II (roasted wheat flour and roasted fieldpea dal flour) (Results are average of 10 individuals)

Sensory attributes	Control	Product-I	Product-II	Product-III	Product-IV	Product-V	Av. Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
Colour & Appearance	8.8	8.6	8.4	8.5	8.4	8.6	8.6	0.051	0.149	3.0	3.11	NS
Taste	8.5	8.7	8.4	8.6	7.4	6.6	8.0	0.027	0.019	643.2	3.11	S
Flavour	8.6	8.7	8.3	8.3	7.5	7.0	8.1	0.065	0.188	35.27	3.11	S
Texture	8.7	8.6	8.8	8.6	8.0	8.1	8.5	0.058	0.168	11.19	3.11	S
Overall Acceptability	8.4	8.5	8.4	8.4	7.1	6.5	7.9	0.020	0.057	640.32	3.11	S
Av. Mean	8.6	8.6	8.5	8.5	7.7	7.4						

- **Control:** 100% roasted wheat flour
- **Products (I to V):** Different ratio of roasted wheat flour with roasted fieldpea dal flour (90:10, 85:15, 80:20, 75:25 and 70:30)

Fortification of instant *halwa* mixes by skimmed milk powder

In the present investigations, instant *halwa* mixes developed from combination of flours in the ratio of 80:20 (roasted wheat flour: roasted different legume dal flour) were further improved by the addition of 10 per cent skimmed milk powder for nutritional improvements. All these mixes were

evaluated for various sensory quality attributes after addition of 40% table sugar and 5% vegetable oil. The results showed that all the sensory attributes of the products varied from 8.3 to 8.7 with an average value of 8.5 as mentioned in Table 5. This indicates that all the products were good and liked by the panelist without any significant differences irrespective to fortification of various kinds of legume dal flours.

Table 5: Sensory evaluation of *halwa* made from various kinds of wheat based instant mixes II fortified with 10 per cent skimmed milk powder (Results are average of 10 individuals)

Sensory attributes	Kinds of instant <i>halwa</i> mixes				Av. Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
	Chickpea blended	Green gram blended	Soybean blended	Fieldpea blended						
Colour & Appearance	8.5	8.7	8.6	8.5	8.6	0.033	0.097	2.73	4.07	NS
Taste	8.8	8.5	8.3	8.4	8.5	0.019	0.056	42	4.07	S
Flavour	8.4	8.3	8.6	8.4	8.5	0.019	0.054	14.75	4.07	S
Texture	8.6	8.5	8.4	8.5	8.5	0.056	0.162	0.97	4.07	NS
Overall Acceptability	8.6	8.5	8.7	8.6	8.6	0.020	0.057	5.64	4.07	S
Av. Mean	8.6	8.5	8.5	8.5						

1. Proximate composition of various kinds of instant *halwa* mixes

Proximate composition of different instant mixes developed

from roasted wheat flour in combination with 20 per cent legume dal flours have been presented in Table 6 with respect to various nutrients.

Table 6: Proximate composition of different types of wheat based instant mixes II (roasted wheat flour and roasted legume dal flour) Results are average of three replications)

Nutrients (g/100 g)	Kinds of wheat based instant mixes II					Average Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
	Control	Chickpea blended	Green gram blended	Soybean blended	Fieldpea blended						
Crude protein	11.75	15.15	15.68	18.68	15.58	15.37	0.0103	0.030	18944.59	3.48	S
Crude fat	1.72	1.50	1.61	5.53	1.49	2.37	0.0162	0.047	3977.86	3.48	S
Total carbohydrates	75.26	74.15	73.56	65.28	71.88	72.03	0.042	0.120	302955	3.48	S
Total ash content	1.71	1.88	2.11	2.38	2.06	2.03	0.008	0.024	298.45	3.48	S
Total crude fibre	1.48	1.33	1.28	1.87	1.43	1.48	0.009	0.025	232.59	3.48	S
Calcium (mg)	46	48	52	93	52	58.2	0.650	1.876	304.11	3.48	S
Phosphorus (mg)	340	342	366	427	366	368.2	0.843	2.435	579.94	3.48	S
Iron (mg)	6.05	6.87	5.71	7.10	5.48	6.24	0.031	0.088	14049.37	3.48	S

- **Control:** 100% roasted wheat flour only
- **Instant Mixes:** Developed from roasted wheat flour in combination with 20% roasted legume dal flours

Crude protein: Crude protein content of various kinds of instant mixes varied from 15.15 to 18.68%. Soybean blended mix showed maximum protein content and lowest in chickpea blended mix showed minimum protein content. In control, the crude protein was found to be 11.75% which was significantly lower than other developed instant mixes.

Crude Fat: Crude fat content of various kinds of instant mixes varied from 1.50 to 5.53%. Soybean blended mix showed maximum crude fat content and chickpea blended mix showed minimum crude fat content. In control, the crude fat was found to be 1.72%.

Total ash content: Total ash content of various kinds of instant mixes varied from 1.88 to 2.38%. Soybean blended mix showed maximum total ash content and chickpea blended mix showed minimum total ash content. In control, total ash content was observed to be 1.71%.

Total crude fibre: Total crude fibre of various kinds of instant mixes varied from 1.28 to 1.87%. Soybean blended mix showed maximum total crude fibre content and green gram blended mix showed minimum total crude fibre content. Control observed to have total crude fibre of 1.48%.

Calcium: Calcium content of various kinds of instant mixes

varied from 48 to 93 mg/100 g. Soybean blended mix showed maximum calcium content and chickpea blended mix showed minimum calcium content. In control, calcium content was found to be 46 mg/100 g. This showed that all instant mixes developed contained higher amount of calcium than control.

Phosphorus: Phosphorus content of various kinds of instant mixes varied from 342 to 427 mg/100 g. Soybean blended mix showed maximum phosphorus content and chickpea blended mix showed minimum phosphorus content. In control, phosphorus content was found to be 340 mg/100 g. This showed that phosphorus content was also present in higher quantities in all the developed mixes.

Iron: Iron content of various kinds of instant mixes varied from 5.48 to 7.10 mg/100 g. Chickpea blended mix showed maximum iron content and green gram blended mix showed minimum iron content. In control, iron content was found to be 6.05 mg/100 g.

Fortification of instant mixes (*halwa*) by skimmed milk powder

The amount of important nutrients *viz.* protein, ash content, calcium, phosphorus and iron in instant mixes fortified with 10 per cent skimmed milk powder have been presented in Table 7.

Table 7: Important available nutrients in various kinds of wheat based instant mixes fortified with 10 per cent skimmed milk powder (Results are average of three replications)

Nutrients (g/100 g)	Kinds of wheat based instant mixes II					Average Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
	Control	Chickpea blended	Green gram blended	Soybean blended	Fieldpea blended						
Protein	11.42	17.22	17.89	20.43	17.70	16.93	0.016	0.047	14049.37	3.48	S
Ash content	1.83	2.32	2.53	2.78	2.49	2.39	0.007	0.019	937.88	3.48	S
Calcium (mg)	48	168	172	209	172	153.8	0.931	2.688	1452.39	3.48	S
Phosphorus (mg)	345	402	423	479	423	414.4	0.943	2.723	871.05	3.48	S
Iron (mg)	6.14	6.37	5.32	6.58	5.12	5.91	0.006	0.019	3326.68	3.48	S

▪ **Control:** 100% roasted wheat flour

▪ **Instant Mixes:** Developed from roasted wheat flour in combination with 20% roasted legume dal flours

Protein: Protein content of various kinds of instant mixes ranged in between 11.42% to 20.43%. Soybean blended mix showed maximum protein content and chickpea blended mix showed minimum protein content. The protein content was found to be 11.42% in control which was significantly lower than other developed instant mixes.

Ash content: The highest ash content was observed in soybean blended mix (2.78%) and lowest ash content was observed in chickpea blended mix (2.32%). Ash content ranged in between 2.32% to 2.78 of various kinds of instant. In control, total ash content was observed to be 1.83%. All the developed instant mixes contained higher amount of ash as compared to control.

Calcium: Calcium content of various kinds of instant mixes varied from 48 to 209 mg/100 g. Soybean blended mix showed maximum calcium content (209 mg/100 g) whereas chickpea blended mix showed minimum calcium content (48 mg/100 g). In control, calcium content was found to be 48 mg/100 g. All the developed instant mixes contained higher amount of calcium.

Phosphorus: Phosphorus content in various kinds of instant mixes ranged in between 345 to 479 mg/100 g. Soybean blended mix showed maximum phosphorus content (479 mg/100 g) whereas chickpea blended mix showed minimum phosphorus content (345 mg/100 g). In control, phosphorus content was found to be 345 mg/100 g. Similarly, phosphorus content in all the developed instant mixes was higher than control.

Iron: Iron content of various kinds of instant mixes ranged in between 5.12 to 6.58 mg/100 g. Soybean blended mix showed highest iron content (6.58 mg/100 g) and fieldpea blended mix showed minimum iron content (5.12 mg/100 g). Iron content in control was found to be 6.14 mg/100 g.

Important available nutrients in ready-to-eat halwa

Table 8 showed the amount of important nutrients viz. protein, ash content, calcium, phosphorus, iron and total energy in the products developed from combination of flours in the ratio of 80: 20 (roasted wheat flour: roasted different legume dal flour) with 40 per cent table sugar and 5 per cent vegetable oil.

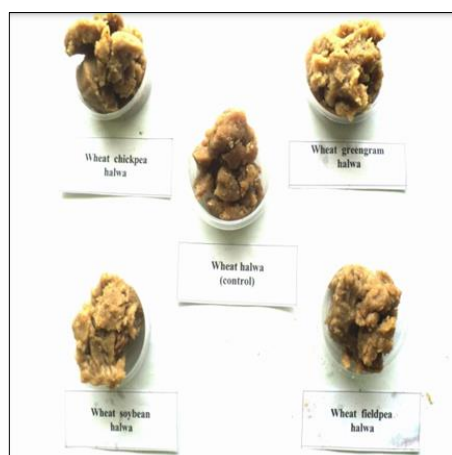
Table 8: Important available nutrients in RTE halwa developed from various kinds of wheat based instant mixes II (Results are average of three replications)

Nutrients (g/100 g)	Kinds of RTE halwa					Av. Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
	Control	Chickpea blended	Green gram blended	Soybean blended	Fieldpea blended						
Crude protein	5.43	7.00	7.26	8.65	7.20	7.11	0.022	0.062	939.60	3.48	S
Total ash content	0.79	0.86	0.97	1.10	0.95	0.93	0.015	0.046	19.39	3.48	S
Calcium (mg)	22	22	24	43	24	27	0.494	1.428	110.45	3.48	S
Phosphorus (mg)	157	158	170	198	170	170.6	0.650	1.876	216.16	3.48	S
Iron (mg)	2.80	3.18	2.64	3.29	2.54	2.89	0.016	0.047	138.94	3.48	S
Total energy (kcal)	284	291	283	294	283	287	0.775	2.237	14.72	3.48	S

▪ **Control:** 100% roasted wheat flour

▪ **Instant mixes:** Prepared using combination of flours in the ratio of 80: 20 (roasted wheat flour: roasted different legume dal flour)

▪ All products made from instant mixes having 40% table sugar and 5% vegetable oil

**Plate 2:** RTE halwa developed from various kinds of wheat based instant mixes II

Protein: Protein content of various kinds of RTE halwa varied from 5.43% to 8.65%. Soybean blended halwa showed maximum protein content of 8.65% whereas chickpea blended halwa showed minimum protein content of 5.43%. Protein content was found to be 5.43% in control. This revealed that all the legume blended halwa contained higher amount of protein contents.

Ash content: Ash content of various RTE halwa varied in between 0.86 to 1.10%. Soybean blended halwa showed highest ash content of 1.10% whereas chickpea blended halwa showed lowest ash content of 0.86%. The entire legume blended halwa contained higher amount of ash contents.

Calcium: Calcium content of various kinds of RTE halwa varied from 22 to 43 (mg/100 g). Soybean blended halwa

showed maximum calcium content of 43 mg/100 g whereas chickpea blended *halwa* showed minimum calcium content of 22 mg/100 g. In control, calcium content was found to be 22 mg/100 g.

Phosphorus: Phosphorus content of various kinds of RTE *halwa* ranged in between 158 to 198 mg/100 g. The maximum amount of phosphorus was recorded in soybean blended *halwa* and minimum in chickpea blended *halwa*. In control, phosphorus content was found to be 157 mg/100 g.

Iron: Iron content of various kinds of RTE *halwa* ranged in between 2.54 to 3.29 mg/100 g. The maximum amount of iron content was observed in soybean blended *halwa* and minimum in fieldpea blended *halwa*. Iron content in control was found to be 2.80 mg/100 g.

Total energy: The total energy content of various kinds of *halwa* varied 283 to 294 kcal/100 g. Soybean blended *halwa* showed the maximum and field pea blended *halwa* the minimum. In control, it was found to be 284 kcal/100 g. This showed that there was a little variation in the energy contents of the products.

Table 9: Important available nutrients in RTE *halwa* made from various kinds of wheat based instant mixes II fortified with 10 per cent skimmed milk powder (Results are average of three replications)

Nutrients (g/100 g)	Fortified RTE <i>halwa</i>					Av. Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
	Control	Chickpea blended	Green gram blended	Soybean blended	Fieldpea blended						
Protein	5.43	7.94	8.28	9.46	8.18	7.86	0.007	0.020	14914.91	3.48	S
Ash content	0.79	1.07	1.16	1.28	1.15	1.09	0.006	0.016	5372.18	3.48	S
Calcium (mg)	22	77	79	97	79	70.8	0.989	0.699	55241	3.48	S
Phosphorus (mg)	157	186	196	221	196	191.2	0.494	1.428	726.41	3.48	S
Iron (mg)	2.80	2.94	2.46	3.04	2.32	2.71	0.030	0.087	35.00	3.48	S
Total calories (kcal)	284	286	279	288	280	283.4	0.775	2.237	8.22	3.48	S

- **Control:** 100% roasted wheat flour
- **Instant Mixes:** Developed from roasted wheat flour in combination with roasted legume dal flours in the ratio 80:20 fortified with 10% skimmed milk powder
- All products made from instant mixes having 40% table sugar and 10% vegetable oil

Calcium: Calcium content of various kinds of RTE *halwa* varied in the range of 77 to 97 mg/100 g. The highest amount of calcium content was observed in soybean blended *halwa* and lowest in chickpea blended *halwa*. In control, calcium content was found to be 22 mg/100 g. All the developed products contained higher amount of calcium as observed in the fortified instant mixes.

Phosphorus

Phosphorus content of various kinds of RTE *halwa* varied in the range of 186 to 221 (mg/100 g). Soybean blended *halwa* showed highest phosphorus content of 221 mg/100 g and chickpea blended *halwa* showed lowest phosphorus content of 186 mg/100 g. In control, phosphorus content was found to be 157 mg/100 g. Phosphorus content was also significantly higher in all the RTE *halwa* as observed in fortified instant mixes

Important available nutrients in RTE *halwa* made from skimmed milk fortified instant mixes

The results depicted in Table 9 revealed that the amount of important available nutrients viz. protein, ash, calcium, phosphorus, iron and total energy content in RTE *halwa* made from various kinds of instant mixes prepared using combination of flours in the ratio of 80:20 (roasted wheat flour: roasted different legume dal flour) fortified with 10 per cent skimmed milk powder. The RTE *halwa* were made with 40% table sugar and 10 per cent vegetable oil.

Protein: Protein content of various kinds of RTE *halwa* ranged in between 7.97 to 9.46%. Soybean blended *halwa* observed the maximum protein content of 9.46% and chickpea dal blended *halwa* observed the minimum protein content of 7.97%. In control, the protein content was found to be 5.43%.

Ash content: Ash content of various kinds of RTE *halwa* varied from 1.07 to 1.28%. Soybean blended *halwa* observed the maximum ash content of 1.28% and chickpea dal blended *halwa* observed the minimum ash content of 1.07%. In control, total ash content was recorded to be 0.79%.

Iron: Iron content of various kinds of RTE *halwa* ranged in between 2.32 to 3.04 mg/100 g. The maximum iron content was recorded in soybean blended *halwa* and minimum in fieldpea blended *halwa*. Iron content in control was found to be 2.80 mg/100 g.

Total energy: The total energy contents of various kinds of RTE *halwa* ranged in between 279 to 288 kcal/100 g. There were little variations in the energy contents of the developed products along with control.

2. Shelf-life studies of instant mixes

(a) Changes in moisture content

Table 10 showed the changes in moisture content of various kinds of wheat based instant mixes. It varied from 6.34 to 8.15%. During storage, the moisture content was observed to increase from 0.49 to 10.20% in different kinds of mixes.

Table 10: Changes in moisture content of various kinds of wheat based instant mixes during storage (Results are average of three replications)

Kinds of instant mixes	Storage Period (months)			Average Mean	SEM±	CD at 5%	F Cal	F Tab	S/NS
	0	6	12						
Control	7.15	7.21	7.23	7.20	0.006	0.017	17.33	5.14	S
Chickpea blended mix	6.34	6.85	7.02	6.74	0.007	0.022	751.4	5.14	S
Green gram blended mix	8.11	8.10	8.15	8.12	0.019	0.056	0.63	5.14	NS
Soybean blended mix	7.35	7.95	8.10	7.79	0.062	0.179	12.85	5.14	S
Fieldpea blended mix	6.78	6.85	6.88	6.84	0.003	0.010	79.00	5.14	S

- Values expressed in g/100 g instant mix
- **Control:** Roasted wheat flour only
- **Instant mixes:** Developed from roasted wheat flour with roasted legume dal flours in the ratio of 80:20

(b) Changes in free fatty acid acidity

The free fatty acid acidity of different kinds of instant mixes ranged from 0.113 to 0.242 mg KOH/100 g of instant mixes during storage as shown in Table 11. The enhancement of free

fatty acid acidity was observed to increase from 7.07 to 21.00%. The maximum increase was observed to be in soybean and chickpea blended mixes and minimum in green gram and fieldpea blended mixes.

Table 11: Changes in free fatty acid acidity in various kinds of wheat based instant mixes II during storage (Results are average of three replications)

Kinds of instant mixes	Storage Period (months)			Average Mean	SEM±	CD at 5%	F Cal	F Tab	S/ NS
	0	6	12						
Control	0.113	0.115	0.121	0.116	0.001	0.003	5.78	5.14	S
Chickpea blended mix	0.183	0.165	0.215	0.190	0.0003	0.001	1924	5.14	S
Green gram blended mix	0.139	0.138	0.148	0.142	0.003	0.007	1.52	5.14	NS
Soybean blended mix	0.200	0.215	0.242	0.219	0.002	0.006	39.97	5.14	S
Fieldpea blended mix	0.161	0.160	0.173	0.165	0.002	0.006	4.36	5.14	NS

- Values expressed in mg KOH/100 g instant mix
- Control: Roasted wheat flour only
- Instant mixes: Developed from roasted wheat flour with roasted legume dal flours in the ratio of 80:20

3. Sensory evaluation of products developed from stored instant mixes

Table 12. showed the sensory quality characteristics viz., taste, flavour and overall acceptability of different kinds of

instant mixes. The results showed that all the products developed from 6 month stored mixes were good and accepted by the panelists. However, due to lower values in taste and flavour, the products developed from 12 months stored materials were not accepted by the panelists. Therefore, it was concluded that instant mixes could be used up to the period of 6 months without any deterioration of the quality of products.

Table 12: Average values of sensory attributes of different kinds of products developed from stored instant mixes

S. No.	Kinds of instant mixes	Products developed	Period of storage	Sensory attributes of RTE products			Average Mean	SEM±	CD at 5%	F Cal	F Tab	S/ NS
				Taste	Flavour	Overall acceptability						
(A) Wheat based instant mixes												
1.	Instant mixes for halwa	Halwa	6	8.5	8.4	8.5	8.47	0.047	0.137	0.50	5.14	NS
			12	7.1	6.2	6.2	6.5	0.047	0.137	40.03	5.14	S

Cost of the instant mixes

Based on the market price of the raw materials used in the formulation and development of various kinds of instant mixes, the cost of the instant mixes worked out to be in the range of 35 to 50 rupees per Kg including home scale processing and packaging charges.

Conclusion

The instant mix (for *halwa*) consisting of combination of roasted flours (wheat flour and different legume dal flours) were subjected to sensory and nutritional evaluation. The sensory attributes of the products revealed that roasted wheat flour and roasted legume dal flours could be successively incorporated in the blends in the ratio of 80: 20. Further increase in the level of legume flour, the developed products showed a lower sensory value probably due to more beany flavour causing reduction in the taste.

The nutritional composition of instant mixes revealed that soybean blended mix in the ratio of 80:20 contained highest amount of protein, fat, ash, crude fibre, calcium, phosphorus and iron contents i.e. 18.68%, 5.53%, 2.38%, 1.87%, 93 mg/100 g, 427 mg/100 g and 7.10 mg/100 g respectively. Thus soybean blended mix was more nutritious as compare to other mixes. All the developed instant mixes were found superior to control. Further, fortification of mixes with 10% skimmed milk powder enhanced the quality of protein, calcium and phosphorus levels.

The nutritional composition of RTE *halwa* revealed that the products contained protein in the range of 7.00 to 8.65%, ash 0.86 to 1.10%, calcium 22 to 43 mg/100 g, phosphorus 158 to 198 mg/100 g and iron 2.54 to 3.29 mg/100 g. On fortification of 10% skimmed milk powder calcium and phosphorus

increased significantly without any change in the level of iron and total energy. These results were found in conformity with the results of Sadana *et. al.* (2008) ^[17] reported energy content of 532 Kcal/ 100 g of halwa prepared from combinations of germinated wheat, soybean and carrot powder.

Nutritional and sensory analysis of wheat based instant mixes revealed that incorporation of soybean dal flour in wheat flour up to the level of 20 per cent for halwa improves the nutritional quality of products in terms of proteins, phosphorus and iron without any adverse effect on the sensory quality characteristics of the product. Supplementation of 10% skimmed milk powder further increased the amount of calcium, phosphorus and proteins. Sharma *et al.* (2018) ^[13] also reported that fortification of panjiri mixes with 10% skimmed milk powder enriched the nutritional content of the product.

The storage stability of various kinds of wheat based instant mixes in polyethylene bags at ambient conditions showed that maximum amount of moisture and free fatty acid acidity was observed after storage of 6 months and good sensory quality RTE products could be made from them up to 6 months storage. Sharma *et.al.* (2022) ^[14] also reported that chakli mixes could be safely stored for 6 months at room temperature in polyethylene bags at ambient conditions. Hence, based on the above it could be concluded that low cost nutritious instant halwa mixes could be developed at home scale and or cottage level from the available local food commodities which may help in reducing the malnutrition problem of the society.

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