ISSN:2319-2607 IISUniv.J.Sc.Tech. Vol.2(1),71-79 (2013)
RESEARCH ARTICLE

A Bengal gram dhal flour *ladoo* improvisation incorporating Red kidney beans (*Phaseolus vulgaris* L.) and Garden cress seeds (*Lepidium sativum* L.)

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Abstract

A ladoo is an energy dense sweetmeat, sparsely rich in micronutrients and antioxidants. Multiple micronutrient deficiencies are more common than single deficiencies in developing countries and the cause for their high prevalence is low dietary intake by populations and poor bioavailability of micronutrients. Proximate, mineral composition, antinutrients and antioxidants of raw & processed red kidney bean (RKB; botanical name: *Phaseolus vulgaris* L L.) and garden cress seeds (GCS; botanical name: Lepidium sativum L) were investigated on dry weight basis with a view to find alternative and cheaper sources of protein, calcium and iron to solve the problem of malnutrition due to inadequate protein, iron and calcium in nutrition which is a prevalent problem in developing world. Processing methods (hot water blanching [HWB], roasting and microwave processing [MP]) were adopted using the standard analytical techniques. GCS were roasted and microwave processed (130 °C for 18 minutes) while RKB were processed by HWB (at 95°C) and milled into flour by using grinder. Proximate principles showed that both were good sources of protein, RKB was rich in fiber, iron and calcium while GCS were rich sources of fat, iron, calcium and phosphorous. Evaluation of the antioxidant and anti-nutritional properties of the kidney bean flour (KBF) showed that blanching reduced phenol content from Whole (6.28± mg/g) to Blanched (4.05± mg/g) and total cyanogens from Whole (.007± mg/100g) to Blanched (0.005± mg/100g) respectively. On the other hand, roasting and MP of GCS caused an increase in phenol content (mg/100g) (Whole - 47.10±1.01; roasted - 50.23±0.25; MP - 53.11±1.01) and decrease in oxalic acid (Whole – 135.66±2.08; roasted - 65.33±1.52; MP - 54.33±1.52) and total cyanogens(mg/100g) (Whole - 5.50±0.10; roasted - 4.46±0.50; MP - 3.80±0.10).This finding suggests that processing methods - HWB, roasting and MP given to kidney beans and garden cress seeds could be more beneficial for enhancing the nutrient profiles and reducing the antinutrients for better absorption of nutrients. The processed forms of two foodstuffs were incorporated into ladoo as a source of macro and micro nutrients.

Keywords

Antioxidants, Antinutrients, Garden cress, *Ladoo*, Red kidney beans

Introduction:

Vegetarian diets are in for revisiting, re-exploring and reinventing for their potential due to their nutritive and health enhancing attributes. Besides, the pragmatism shown by food technologists and nutritionists for using non conventional food stuffs of vegetarian origin to realize their nutraceutical nature and developing their products of acceptable value is breaking the ice between the consumers and food stuffs. Consumers eat too many animal products (rich saturated fat) and not enough plant foods which causes side effects and demand supply gap. It is to this end that intensive efforts are being made to find alternative sources of protein from the underutilized leguminous plants in nutrition and in the formulation of new food products (Barker, 1996; Katharine, 2002). Acceptance of RKB and GCS seems to increase as they are power house of nutrients. Red Kidney Bean (*Phaseolus vulgaris* L.) is the most important economic variety of the genus *Phaseolus* (Common Beans) and also referred as *Rajmah, Bakla in Hindi; Garden bean, Field bean, Haricot bean in English, Haricot commun in French.* It is an economical source of macro as well as micronutrients and a variety of phytochemicals (Bible). It is estimated by Wang *et al* (2009) that red kidney beans have 21.5-27.1% protein, 1.1-1.2% fat, 61.7% carbohydrates (36.1% starch), 7.0%- 20% fiber, 3.0-4.4% ash lies in their composition. Due to high fiber content, they have hypocholesterolmic and hypoglycemic action and also reduce the risk of colon cancer (Anderson *et al*, 1990) comparable to Bengal gram (*Cicer arietinum*)

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and fenugreek seeds (*T. foenum graeaum*) (Sharma, 1986; Mathur *et al*, 1964). Sufficient intake of beans favorably affects the major health concerns of modern man. They have been associated with numerous other health benefits including reduction of heart (Anderson, 1984) and renal diseases risks (Anderson *et al*, 1999), cataracts, relieve constipation, improve gastrointestinal integrity (Bourdon, 2001), stabilize blood sugar (Geil and Anderson, 1994), brain and immune dysfunction (Ames *et al*, 1993). It has not gained widespread industrial, economic and nutritional importance because its acceptability and utilization have been limited. They are important sources of dietary proteins for both human and animals, but the presence of relatively high concentration of potentially toxic substances such as phytate, tannins and oxalate that can cause food poisoning referred to anti-nutritive factors affects the nutritional quality by interacting with intestinal tract and also reduce protein digestibility (Nowacki, 1980). According to Liener (1994) unless these substances are destroyed by rapid and thorough processing or other treatments (Giamin and Bakebain, 1992) such as- germination reduces trypsin inhibitors (El-Hag *et al*, 1978) dehulling and soaking reduces tannin content (Reddy *et al*, 1985); cooking decreases the phytic acid (Ur Rehman and Shah, 2005) which improves the nutritive value and biological availability of legumes and exert adverse physiological effects when ingested by man and animals.

Soaking to hydrate the beans prior to heating, therefore, is a very important step to effectively inactivate proteinaceous inhibitors such as trypsin inhibitors and lectins. Soaking and leaching are necessary to reduce some antinutrients, particularly in some varieties of bean and other legumes.

Garden cress (*Lepidium sativum* L., Fam: Cruciferae, Common names: Hindi-*chansur*, Tamil-*aliverai*, Bengali-*alevarie*, Marathi-*ahliva*, Punjabi-*shargundai*) is an annual erect herbaceous plant, cultivated all over India, North America and parts of Europe. Despite ubiquitous occurrence, people know very little about this nature's creation of a treasure trove of nutrients. It contains high amount of protein and iron. It has also found to have significant amount of calcium and folic acid in addition to vitamin A and C. Besides, it is also beneficial in treating and curing certain diseases. It has been an important medicinal plant since Vedic era.

The seeds of garden cress are aperient, diuretic and gently stimulant. These are demulcent, aphrodisiac, carminative, galactogogue and emmenagogue (Nadkarni, 1954). These are rubefacient and are applied as a poultice for hurts and sprains. The root is used in the treatment of secondary syphilis and tenesmus (Chopra *et al*, 1956). A preliminary pharmacological study on seeds of garden cress has suggested the presence of cardioactive substance and is shown to have probable action through adrenergic mechanisms (Vohora and Khan, 1977). Aqueous extract of garden cress seeds has been reported to exhibit a potent hypoglycemic activity in normal and streptozotocin induced diabetic rats (Eddouks *et al*, 2005).

Aqueous extract of garden cress is found to have antihypertensive and diuretic effect when studied both in normotensive and spontaneously hypertensive rats (Eddouks and Maghrani, 2008). The effectiveness of this plant in treatment of bronchial asthma, hiccups, cough with expectoration and bleeding piles has been reported (Chopra *et al*, 1956). Besides having all these therapeutic properties these seeds have some antinutrients which should be reduced before consumption.

These components can be reduced or inactivated through the application of a variety of processing techniques.

Soaking causes reductions in the levels of anti-nutritional factors. Abousamaha *et al* (1985) reported that soaking reduced the tannins, trypsin inhibitors, and haemagglutinins of lentil seeds. The trypsin inhibitor activity of winged beans was reduced by soaking in water, 2% sodium hydroxide, or potassium hydroxide solution (Sathe and Salunkhe, 1981).

Roasting is a common process applied for nuts and seeds, to enhance their sensorial properties and nutritional value. Roasting also has been shown to possibly reduce antinutrients such as trypsin inhibitors and phytic acid, and increase the content of catechins and polyphenols (Vidal-Valverde *et al*, 1993). It may significantly modify the antioxidant capacity of foodstuffs by degrading some heat-labile antioxidative constituents, or by forming through the Maillard reaction (MR), new compounds having antioxidant activity (Nicoli *et al*, 1999).

MP, if properly used, had the tendency towards greater retention of many micronutrients probably due to the shorter preparation time. Microwaving for 1.5 min increased antioxidant activity by 16.68%. Microwave cooking by different methods enhanced antioxidant activity in broccoli, spinach, green beans and pepper and caused no change to antioxidant activity in squash, peas and leek (Turkmen *et al*, 2005).

Therefore, the work was aimed to determine proximate, antinutrients and antioxidants of raw and processed RKB and GCS to make the use of these two treasure trove of nutrients in food product development.

Materials and Method

Collection and Preparation of Sample

In the present study, phaseolus species of RKB (*RSJ-178*) and GCS were selected on the basis of their wide cultivation and consumption in Rajasthan. RKB were procured from Rajasthan Seed Corporation, Jaipur, Rajasthan after their due certification. While *GCS* were procured from University of Agriculture Sciences, Banglore, Karnataka. After purchasing, preliminary preparation like- cleaning was done and the foreign material was carefully removed by hand sorting.

Preparation of RKB Samples

Raw sample: 100 g of the raw seeds were cleaned and dried in sunlight. After this, they were ground and converted into fine powder.

***Blanching and Soaking of seeds*:** RKB (100 g) were taken and soaked in boiled distilled water at 95°C at a ratio 1:5wt/vol. for ½ hour in beaker. Mixed with spoon for 2-3 times. After half an hour, the water was decanted and beans were washed with fresh water. Then, they were soaked in fresh water for 12 hrs at 24°C (Kon, 2006). After this, they were dehulled manually and dried in direct sunlight for 3-4 days for removal of beany flavor. After drying, blanched and raw forms of beans were ground to get fine flour and stored in air tight containers and used for analysis (Khatun *et al*, 2007).

Preparation of GCS Samples

***Whole garden cress seed flour*:** GCS were sun dried and hand sorted to remove wrinkled, moldy seeds and foreign material. Half amount of seeds was stored in an air tight container and rest amount was ground in a mixer equipped with stainless steel blade and stored in an airtight container.

***Roasted garden cress seed flour*:** GCS were roasted in a griddle. Half amount of seeds was stored in an air tight container and rest amount was ground in a mixer equipped with stainless steel blade and stored in an airtight container (Audu and Aremu, 2011).

***Microwave processed garden cress seed flour*:** Garden cress seeds (100g) were kept in a microwave oven at 130°C for 18 minutes. They were cooled. Half amount of seeds was stored in an air tight container and rest amount was and ground in a mixer equipped with stainless steel blade and stored in an airtight container (Howard *et al*, 1999).

Proximate Analysis

The proximate and nutritional parameters evaluated were moisture, crude protein, fat, crude fibre, ash, total carbohydrate, calcium, iron and phosphorous (Raghuramulu *et al*, 2003; AOAC, 1980; Sharma, 2007). All were analyzed in triplicate sets. Moisture content was determined by drying up the sample in air oven at 100-125°C. Crude protein was carried out using the Kjeldhal procedure with nitrogen to protein factor of 6.25. Fat was estimated through soxhlet extraction. Fibre was analyzed through resistant to the action of dilute mineral acid (Sulphuric acid) and alkali (Sodium hydroxide) and total carbohydrate was calculated by subtracting from 100, a sum of values (g/100g) for moisture, protein, fat, ash and crude fibre. Calcium, iron and phosphorous was estimated by dry ashing method.

Antioxidants

Determination of total phenolic contents: Extracts of all flours were prepared according to the method described by Oktay *et al*, 2003. Samples (10 g) were extracted overnight with 150 ml of methanol and the extracts were filtered through whatman No.1 paper.

Total phenolics were determined using Folin-Ciocalteu reagent. Samples (200 µl) were introduced into test tubes, and then 1.0 ml Folin-Ciocalteu's reagent and 0.8 ml sodium carbonate (7.5%) were added. The absorbance of all samples was measured at 760 nm after incubating at 30°C for 1.5 hrs. Results were expressed as milligram of gallic acid equivalent (GAE) per gram of fresh weight (Singleton and Slinkard, 1977).

Antinutrients

***Determination of oxalic acid*:** Weighed 2 g of sample in a 250 ml volumetric flask, added 190 ml of H_2O and 10 ml of 6N HCl and digested for 1 h on boiling water bath. The volume was made up after cooling and filtered the supernatatnt. Then 50 ml of filtrate was taken and added 20 ml of 6N HCl. The mixture was evaporated to half of its volume and filtered. The precipitate was washed several times to make volume about 125 ml. Thereafter 3-4 drops of methyl red were added followed by concentrated NH_3, till the solution turned faint yellow, heated to 90-100°C, allowed to cool at room temperature and filtered. Thereafter, the filtrate was boiled, added 10 ml of 5% $CaCl_2$, with constant stirring and allowed to stand overnight. Next day, it was filtered through whatman filter paper (no. 41) and the precipitate was washed several times with hot water to make it free of Ca ions. Precipitate was transferred to the original beaker by washing with distilled water. Then added H_2SO_4 solution (1:4) till the precipitate was completely dissolved. The contents were warmed and titrated with N/20 $KMnO_4$ to the near end point (Raghuramulu *et al*, 2003).

***Determination of total cyanogens*:** 1 g of sample was homogenized in 25 ml water with 3-4 drops of chloroform. This homogenate was placed in 500 ml conical flask. Filter paper strips were saturated with alkaline picrate solution. These saturated strips were placed in hanging position with the help of a cork stopper inside the conical flask. The mixture was incubated at room temperature (20°C) for 20-24 h. Sodium picrate present in the strips was reduced to reddish compound in proportion to the amount of hydrocyanic acid evolved. The color was eluted by placing the paper in a clear test tube containing 10 ml distilled water and compared it with standard hydrogen cyanide solution at 625 nm (Hogg and Ahlgren, 1942; Indira and Sinha, 1969).

Product Development

Conventional recipe namely- *Paustik ladoo* **(RKBP-10% + GCS-5%)** was developed by using the raw and processed form of beans and seeds. It was a blend preparation of roasted ingredients prepared by grinding and mixing. In the developed countries, *ladoo* are extensively used and prepared at household level for providing optimum nutrition. The following recipe was selected on the basis of popularity, provides optimum nutrition, and promotes health. Standard (S) of paustik *ladoo* was prepared using whole wheat flour, Bengal gram flour, jaggery only. Coconut powder and chopped almonds were used for garnishing. Cardamom powder was added to enhance the flavor. Test samples of recipe were prepared with incorporation of KBF and GCS in raw (A) and processed forms (B and C). Garden cress seeds were soaked in milk for 3 hours before product development. Composition of recipe is as per the given table 1.

Table 1. Incorporation of RKBF, GCS and other Ingredients in *Paustik ladoo*

Ingredients (g)	S	A	B	C
Whole wheat flour	30	15	15	15
Bengal gram flour	26.5	15	15	15
Jaggery	30	30	30	30
RKBP -	10 10 10			
GCS	-	5	5	5
Milk	-	11.5	11.5	11.5
Scrapped Coconut	10	10	10	10
Cardamom	1	1	1	1
Almonds	2.5	2.5	2.5	2.5
Total	100	100	100	100

Organoleptic Evaluation

First of all, triangle test was applied to select semi trained panel for performing sensory evaluation. Finally, the products prepared were evaluated for acceptability at a nine point hedonic method by 15 semi trained panel members. Hedonic rating relates to pleasurable and unpleasurable experiences and the acceptability is judged for the reactions of the panelists in terms of their depth of liking or disliking of the given product. All samples were served to the panelist members at one session. They were then asked to rate the acceptability of the product on a scale, usually of points, ranging from like extremely to 'dislike extremely'.

Statistical Analysis

Data obtained was subjected to the analysis of mean and standard deviation.

Results and Discussion

Nutrient Analysis: Table 2 illustrates the proximate principles of RKBF and GCSF.

Table 2. Mean values of proximate principles in RKBP and GCSF

Samples / Proximate Principles	WRKBF	BRKBF	WGCSF	RGCSF	MPGCSF
Moisture (g/100)	12.30 ±0.43	13.20 ±0.36	5.83±0.28	4.60±1.15	3.60±0.28
Ash (g/100)	3.60±0.36	3.20±0. 79	5.93±0.11	6.40±0.36	6.50±0.20
Protein (g/100)	23.63 ±1.18	21.70 ±1.50	25.09±0.51	24.26±1.20	23.79±1.39
Fat (g/100)	1.50±0.20	1.30 ±0.10	21.83±0.28	18.19±1.92	18.59±1.53
Fiber (g/100)	4.00±0.34	3.63 ±0.38	7.86±0.05	15.16±1.04	9.33±0.76
Total carbohydrate (g/100)	56.7 ±3.61	62.73 ±5.0	33.44±0.63	31.38±2.70	38.11±3.10

The result of nutrient analysis revealed that the moisture content of Blanched red kidney bean flour (BRKBF) was increased due to overnight soaking of sample in given treatment. The ash content was found to be higher in Whole red kidney bean flour (WRKBF) as compared to treated sample (BRKBF) due to leaching of macro and micro elements into the soaking water. The value of fat content was also found in good range in WRKBF than blanched sample due to high lipolytic enzyme activity which breakdown the triglyceride into simple forms during processing treatment. Soaking of seeds followed by dehulling decrease the fibre content of BRKBF sample than untreated sample. The protein content of WRKBF was decreased after blanching treatment due to the leaching of soluble proteins or hydrolysis of protein in simpler compounds during processing. The similar result found that the protein content of untreated seeds had higher than those of lupin seeds reported by Hassan *et al*, (2005). The carbohydrate content in BRKBF was increased. The value of carbohydrate showed that the seed could be a good supplement to scarce cereal grains.

The moisture content of WGCSF was recorded as 5.83±0.28 g/100g while both heat treatment (roasting and MP) caused a decrease in moisture content (Table 2). Roasting and MP increased the ash and fibre content of GCSF but a decrease was observed in protein, fat and fibre content of GCSF.

Accumulating evidence favors the view that increased intake of dietary fiber in an otherwise low-fiber diet, can have beneficial effects in humans (Cummings *et al*, 1976; Dukehart *et al*, 1989; Jenkin *et al* , 1977). Some claimed benefits of a high fiber diet are to prevent or alleviate maladies such as cardiovascular diseases, diabetes, diverticulosis and colon cancer.

Processing- HWB significantly affected the mineral content of the red kidney bean flour. Processed red kidney bean seed flour and garden cress seeds were found to be a good source of essential minerals. Due to leaching of macro and micro elements into the soaking water, calcium (261 mg/100gm), iron (6.1 mg/100gm) and phosphorus (419 mg/100gm) was increased in BRKB than untreated ones. Results revealed that *Paustik ladoo* fortified with 20% KBF and 5% GCS showed the possibility of incorporation of these both into food products at both household and commercial level.

Effect of Processing on Antioxidant and Antinutritional Factors

The results of processing treatments on antinutrient and antioxidant of unprocessed and processed kidney beans are depicted in Table 4.

Antioxidant

Phenol: The phenol content of WRKBF was 6.28mg/g and after dehulling they was significantly reduced in processed sample (4.05mg/g). Bean hulls contained large amount of phenolic compounds that exhibited strong antioxidant and antimutagenic activity. The total phenolic content of whole and dehulled beans ranged from 2.2-78.2 & 0.6-6.3 mg of catechin equivalent per g of sample respectively, which significantly decreased with all processing methods. During dehulling, 60-70% of polyphenols was decreased (Ma and Bliss, 1978). The phenol content was higher in dark colored beans as compared to light colored beans. Rehman and Shah (1996) reported a significant reduction in the polyphenol contents of different legumes with various soaking processes The physiological effects of dry bean consumption may be due to the presence of abundant phytochemicals includes polyphenolics, which possess both anti-carcinogenic (Aaby *et al*, 2004) and antioxidant properties (Dos Santos

Table 3. Mean values of selective minerals in RKBF and GCSF

Samples / Minerals	WRKBF	BRKBF	WGCSF	RGCSF	MPGCSF
Iron (mg/100g)	5.3±0.31	6.00 ±0.10	112.66±0.57	127.1±2.53	117.65±8.00
Calcium (mg/100g)	221±58.28	235.6±55.51	347.50±2.17	339.83±0.28	325.0±5.00
Phosphorus (mg/100g)	408 ±4.35	415±5.29	598.33±2.08	465.5±1.32	397.83±0.76

Table 4. Mean values of antioxidants and antinutrients in RKBF and GCSF

Antioxidants and Antinutrients	WRKBF	BRKBF	WGCSF	RGCSF	MPGCSF
Phenols (mg/100g)	5.19±1.12	4.12±0.87	47.10±1.01	50.23±0.25	53.11±1.01
Total Cyanogens (mg/100 g)	N	N	5.50±0.10	4.46±0.50	3.80±0.10
Oxalic acid (mg/100g)	N	N	135.66±2.08	65.33±1.52	54.33±1.52

WRKBF = *Whole red kidney bean flour,* BRKBF = *Blanched red kidney bean flour, WGCSF = Whole garden cress seed flour, RGCSF = Roasted garden cress seed flour, MPGCSF = Microwave processed garden cress seed flour, N = negligibly small*

et al, 2006; Parr and Bolwell, 2000) and anti-inflammatory properties which decrease the incidence of several degenerative diseases- coronary diseases and remove carcinogens from the body (Miller *et al*, 2000; Kris-Etherto *et al*, 2002).

Phenol content of GCSF is given in table 4. There was an increase in RGCSF (50.23±0.25 mg/100g) and MPGCSF (53.11±1.01mg/100g) in comparison to WGCSF depicting the fact that heat treatment caused an increase in phenol content. Similar finding was concluded by one author. In peanut roasting, soluble proteins and amino acids are changed as a result of moisture losses and form Maillard derivatives, including pyrroles and furans which may contribute to the increased in total phenolic compounds of roasted samples (Yanagimoto *et al*, 2002).

Cooking asparagus was found to increase total phenols by 23%. The results also indicate that the effect of cooking process was significant and more pronounced than the effect of cultivars. The study was in agreement with that by Lima *et al* (2009) in which the type of food did not have a profound effect on the phenolic content. Ascorbic acid of asparagus was greatly reduced by the cooking process (Fanasca *et al*, 2009). The vitamin contributes to the total phenols as it is capable of reducing the active reagent used in the analysis of phenols. Hence processes that affect ascorbic acid will ultimately reduce the total phenolic content. Epidemiological studies have indicated that regular consumption of foods rich in phenolic compounds such as fruits, vegetables, whole grain cereals, red wine and tea, is associated with reduced risk of cardiovascular diseases, neuro-degenerative diseases and certain cancers (Amin *et al*, 2006; Huang *et al*, 2007; Hunterand Fletcher, 2002;Nilsson *et al*, 2004; Parr and Bolwell, 2000).

Antinutrients

The level of total cyanogens in WRKBF was 0.007 mg/100g. After soaking treatment, the cyanide content was reduced in treated sample i.e. BRKBF (0.005mg/100g). Except for soaking in water, all processing techniques significantly reduced its contents. The highest reduction was achieved with cooking after soaking in sodium bicarbonate solution followed by germination whereas the least reduction was noted with water soaking only. Akindahunsi (2004) reported a value of 3.7mg/kg in raw African oil beans, which was reduced by soaking and cooking to 2.2mg/kg. Okafor *et al*, (2002) reported a range of 5.88 to 28.55mg/100g for the cyanogens contents of various legumes. Vijayakumari *et al* (1995) noted 87% loss in HCN contents of Indian tribal pulse only with autoclaving treatment, whereas reduction with other treatments like water and $NaHCO_3$ solution etc were much less.

Roasting and MP caused a slight reduction in total cyanogens (Table 4). While there was a great decrease observed in oxalic acid by heat treatment (RGCSF - 65.33±1.52mg/100g; MPGCSF- 54.33±1.52 mg/100g; WGCSF- 135.66±2.08mg/100g). Similar finding was also observed by other author. Microwave cooking reduced the phytate content by up to 62.35%. Roasting for 120 min also decreased the tannin content up to 75%. Roasting was also effective in reducing haemagglutinin content by 67.50% at 120 min. A significant loss of HCN content (62.5%) was observed in the vegetable cowpea (akidi) by roasting for 120 min. The heat treatment involved in the process must have caused the vaporization of the free cyanide (Udensi *et al*, 2007).

Organoleptic Analysis

The mean scores of sensory evaluation of ***Paustik ladoo*** are listed in Table-5. According to the results, standard stood out among all samples in all attributes. In terms of appearance, sample C showed highest score (7.33) and this was followed by sample A (7.26) and sample B (6.93). Sample C ranked higher in terms of color (7.13) after standard (7.40) in comparison to sample A (7.06) and sample B (7.00). Texture of sample C (7.20) was recorded the highest and trend remained the same as earlier (sample A- 7.00; sample B-6.86). Sample C got higher score in terms of taste (6.86) and then sample B took place (6.6) followed by sample A (6.53). Flavor of sample C was more liked (6.93) as compared to sample A (6.46) and B (6.40). After taste was recorded higher in sample C (7.00) then sample B (6.60) and sample A (6.40). Over all acceptability values stood in the following order. Sample C (7.06) > Sample B (6.66) > Sample A (6.60).

Table 5. Mean scores of organoleptic evaluation of *Paustik ladoo*

Attributes	S	A	B	C
Appearance	7.80±0.67	7.26±1.16	6.93±0.96	7.33±0.90
Color	7.40±0.82	7.06±0.96	7.00±1.13	7.13±1.06
Texture	7.26±0.88	7.00±1.00	6.86±0.91	7.20±1.01
Taste	7.73±1.10	6.53±1.18	6.60±1.40	6.86±1.06
Flavor	7.66±0.97	6.46±1.30	6.40±1.29	6.93±1.03
After taste	7.66±1.11	6.40±1.35	6.60±1.12	7.00±0.92
Overall Acceptability	8.00±1.13	6.60±1.29	6.66±1.29	7.00±0.96

S = Standard *ladoo*, A = RKBF + WGCSF, B= BRKBF + RGCSF, C= BRKBF + MPGCSF

A = Red kidney bean flour (10%) + Whole garden cress seed flour (5%)

B = Blanched red kidney bean flour (10%) + Roasted garden cress seed flour (5%)

C = Blanched red kidney bean flour (10%) + Microwave processed garden cress seed flour (5%)

Highly acceptable barnyard millet cookies were developed with nutraceutical ingredients such as linseed, soy, cocoa, chocolate, dry fruits nuts and garden cress seeds. Value added barnyard millet cookies were nutritionally superior to control cookies. Among the value added cookies garden cress seeds incorporated for iron enriched recorded higher iron (21.21%), dietary fibre (9.34%), energy (483 Kcal) and manganese (145.45 mg/100 g) content, besides exhibiting high sensory quality and excellent texture (3393.00 g force).Consumer acceptability tests of iron enriched barnyard millet cookies (incorporating barnyard millet flour at 60 per cent level, replacing refined flour) revealed acceptability by more than 90 per cent (Ballolli and Chimmad, 2010).

Conclusions

On the basis of results discussed as above, the inference goes home that Red Kidney Bean Flour (RKBF) and Garden Cress Seed flour (GCSF) are good sources of nutrients such as energy, protein, calcium, iron and phenol. Household processing methods like blanching, roasting and microwave processing become instrumental in reducing the antinutrients which act as stumbling block in nutrient absorption. *Paustik ladoo,* the recipe developed has been found to be a good source (per/100g) of energy (375.66 kcal), protein (9.83g), fat (10.8g), fibre (2.62g), iron (8.68mg) and calcium (177.55mg). The results of sensory evaluation revealed that sample C (7.00±0.96, prepared by incorporation of blanched red kidney bean flour and microwave processed garden cress seeds) has a better acceptability as compared to that of sample B (6.60±1.29, prepared by incorporation of Blanched red kidney bean flour and roasted garden cress seeds) and sample A (6.60±1.29, prepared by incorporation of raw red kidney bean flour and whole (unprocessed) garden cress seeds), *vis-à-vis* the standard (8.00±1.13, without incorporation of raw red kidney bean flour, blanched red kidney bean flour, whole (unprocessed) garden cress seeds, roasted garden cress seeds, microwave processed garden cress seeds). The study points towards the fact that this healthy improvisation of *Paustik ladoo* due to fortification of *red kidney bean flour* and *garden cress seed* could become helpful in curing the malnutrition related diseases due to its augmented nutritive value but also act health enhancing owing to its phytochemicals content. Such recipes can deliver two pronged benefits; to alleviate malnutrition by improving the nutritional status of teeming impoverished millions.

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