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## **Formulation and Sensory Evaluation of Food Products Developed by Incorporating Germinated Garden Cress Seeds (*Lepidium sativum* L.)**

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### **Abstract**

Garden cress has been considered as an important medicinal plant since Vedic era. Garden cress seeds (*Lepidium sativum*) are excellent sources of iron, protein, and  $\beta$ -vitamin. In human quest for relieving the masses from the scourge of low nutritional status through non-conventional scarcely explored foodstuffs. Keeping this in view, the present study was undertaken with the objective to develop commonly consumed food preparations by incorporating germinated garden cress seeds by applying different cooking methods. Levels of incorporation of germinated garden cress seeds added in different preparations at range of 7-30 per cent. Organoleptic evaluation of all food preparations were conducted by a panel of ten judges using Hedonic nine point scale. The interpretation of data was done by analysis of variance (ANOVA). Nutrient content of all the food preparations was calculated using nutritive value of Indian foods. In germinated garden cress seeds incorporated food preparations, maximum and best acceptable level was 25 per cent in *Bhujia* and minimum (10) in *raita and sandwich*. Among all germinated garden cress seeds incorporated food preparations soup scored highest ( $8.18 \pm 0.40$ ) and *raita* scored minimum ( $7.5 \pm 0.70$ ) for overall acceptability. *Bhujia*, sandwich and salad showed significant difference ( $p \leq 0.05$ ) for overall acceptability. With incorporation of garden cress seeds, iron and protein content increased significantly ( $p \leq 0.05$ ) in all most acceptable food preparations.

**Keywords:** garden cress seeds; iron; protein; *bhujia*; *raita*; overall acceptability

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## 1. Introduction

Most of the plants possess nutritional as well as medicinal activities. And varieties of plants are used for the same purpose. Recently, Garden cress seeds (*Lepidium sativum* L.)

a member of Brassicaceae has gained more interest from consumer and producers and can be a good choice to incorporate in food products to enrich them with macro and micronutrients like protein, calcium and iron

Garden cress seeds, since ancient times, have been used in local traditional medicine of India. Garden cress seeds are bitter, thermogenic, depurative, rubefacient, galactagogue, tonic, aphrodisiac, ophthalmic, antiscorbutic, antihistaminic and diuretic. They are useful in the treatment of asthma, coughs with expectoration, poultices for sprains [14], leprosy, skin disease, dysentery, diarrhoea, splenomegaly, dyspepsia, lumbago, leucorrhoea, scurvy and seminal weakness. Seeds have been shown to reduce the symptoms of asthma and improve lung function in asthmatics [12]. The seeds have been reported as possessing a hypoglycemic property and the seed mucilage is used as a substitute for gum Arabic and tragacanth.

Scientists thought that if the seeds are so medicinal in their contents, the sprouts from the seeds should be a still better source of all the medicinal properties mentioned above, this led to development of cultivation practices for the plants on a large scale in Europe. Several studies on the effect of germination found that germination can increase protein content and dietary fiber, reduce tannin and phytic acid content and increase mineral bioavailability. [1,2,3,4] found that germination improves calcium, copper, manganese, zinc, riboflavin, niacin and ascorbic acid content. Garden cress seeds are richest source of protein (25-39 per cent) and minerals (6.4 percent) like calcium, iron and phosphorous. Germinated garden cress seeds can be cheap and more effective in improving anemia in anemic adolescent girls. Therefore, some food products were developed by incorporating germinated seeds of *L. sativum*.

## 2. Material and Methods

### 2.1 Collection of material

Seeds of *Lepidium sativum* (garden cress) were collected in bulk from local market of Panipat city Haryana. Seeds were obtained during summer season (April – May).

### 2.2 Processing of samples

Garden cress seeds were sorted and cleaned to remove impurities and stored in an air tight plastic container. Garden cress seeds were spread on damp muslin cloth and was kept at room temperature (32- 35 C) for 48 hours till seeds germinated. Germinated seeds were kept in closed containers at refrigerated temperature for only one day. These fresh germinated seeds were then incorporated in different food products.

### **2.3 Development of Food Preparation**

Commonly consumed food preparations-sandwich, raita, soup, salad and bhujia were prepared by incorporating germinated garden cress seeds using the basic food preparation (2002)[5]. Germinated garden cress seeds were incorporated in commonly consumed (salty) food preparations at different levels. Level of incorporation of germinated garden cress seeds in different food preparation ranged from 7-30 per cent.

### **2.4 Sensory evaluation**

All the developed food preparations were presented to a panel of ten judges comprising of both trained judges (3 lecturers of home science department, Kurukshetra university, Kurukshetra), five semi-trained judges (final year post graduate students home science department, Kurukshetra) and two untrained consumers, who evaluated organoleptically food preparations using Hedonic nine point scale. Nutrient content in food preparations were calculated using nutritive value of Indian foods [6].

### **2.5 Statistical Analysis**

The data obtained was analyzed statistically using SPSS for window version 12 (SPSS Inc, Chicago). Mean and standard deviation of mean were calculated for each studied variable. The interpretation of data so obtained was done by analysis of variance (ANOVA) test. Level of significance was accepted at  $p \leq 0.05$ .

## **3. Result**

### **3.1 Sensory Evaluation:**

The sensory evaluation of the food preparations made by the incorporation of germinated garden cress seeds revealed that all the food products developed were organoleptically acceptable. However, the acceptable level of incorporation of germinated garden cress seeds varied in different food preparations. It has also been noticed that when the level of incorporation of germinated garden cress seeds increased beyond the accepted levels in any preparations, the mean scores for the organoleptic evaluation for appearance, color, texture, taste, flavor and overall acceptability decreased.

The results of sensory evaluation by panelist is presented in Tables 1. The data shows moderate likeness of the food preparations with respect to color, appearance, taste, aroma and overall acceptability.

#### **3.1.1. Appearance**

Appearance is an important attribute in food choice and acceptance. Among all the food preparations appearance of sandwich scored the highest at 10 per cent level of incorporation and its mean score was  $8.7 \pm 0.48$ . Soup, salad, *bhujia*, *raita* were moderately like products and were given  $7.4 \pm 0.52$ ,  $7.5 \pm 0.5$  and  $7.3 \pm 0.48$ ,  $7.0 \pm 0.66$  scored by panelists respectively. None of the preparations scored below average, thus indicating that most of the preparations were on moderately appealing to panelists (Tables 1).

### 3.1.2. Aroma

Aroma is an integral part of taste and general acceptance of the food before it is put in the mouth. It is therefore an important parameter when testing acceptability of prepared foods. Results of sensory evaluation indicated that aroma of two samples (sandwich and *bhujia*) varied significantly ( $P < 0.05$ ). It was also noticed that *bhujia* and soup scored significantly higher ( $8.3 \pm 0.67$  and  $8.1 \pm 0.53$ ) ( $P < 0.05$ ) in terms of aroma than the rest of the food preparations at 25 and 15 per cent level of incorporation of germinated garden cress seeds respectively, by panelists. However, panelists rated higher to salad and sandwich than *raita* as moderately liked products. The most acceptable scores of salad, sandwich and *raita* at 10 and 15 level of incorporation of germinated garden cress seeds were  $7.4 \pm 0.48$ ,  $7.7 \pm 0.67$  and  $7.3 \pm 0.82$  respectively.

**Table 1:** Sensory evaluation of different food preparations incorporated with Germinated garden cress seeds (G.C.S)

| Food preparation | % level of incorporation | Color                              | Appearance                         | Texture                            | Taste                              | Aroma                              | Overall Acceptability              |
|------------------|--------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Sandwich         | 7                        | $6.3 \pm 0.67^*$                   | $7.6 \pm 0.52^*$                   | $6.7 \pm 0.67^*$                   | $6.9 \pm 0.56^*$                   | $6.6 \pm 0.52^*$                   | $7.3 \pm 0.48^*$                   |
|                  | <b>10</b>                | <b><math>8.8 \pm 0.42^*</math></b> | <b><math>8.7 \pm 0.48^*</math></b> | <b><math>7.4 \pm 0.52^*</math></b> | <b><math>8.1 \pm 0.74^*</math></b> | <b><math>7.7 \pm 0.67^*</math></b> | <b><math>7.5 \pm 0.53^*</math></b> |
|                  | 12                       | $7.4 \pm 0.52^*$                   | $7.9 \pm 0.57^*$                   | $6.6 \pm 0.52^*$                   | $6.0 \pm 0.82^*$                   | $7.4 \pm 0.52^*$                   | $5.8 \pm 0.79^*$                   |
| Raita            | 8                        | $7 \pm 1.23^*$                     | $6.5 \pm 0.27$                     | $6.2 \pm 1.45$                     | $6.3 \pm 0.79^*$                   | $6.2 \pm 1.03$                     | $6.7 \pm 1.4$                      |
|                  | <b>10</b>                | <b><math>7.6 \pm 0.51^*</math></b> | <b><math>7 \pm 0.66</math></b>     | <b><math>7.2 \pm 0.91</math></b>   | <b><math>6.5 \pm 0.97^*</math></b> | <b><math>7.3 \pm 0.82</math></b>   | <b><math>7.5 \pm 0.70</math></b>   |
|                  | 12                       | $6.3 \pm 0.59^*$                   | $6.1 \pm 0.16$                     | $6.5 \pm 0.59$                     | $5.8 \pm 1.02^*$                   | $5.4 \pm 0.89$                     | $6.3 \pm 0.80$                     |
| Soup             | 12                       | $7.3 \pm 1.02$                     | $7.1 \pm 0.25$                     | $7.9 \pm 1.45$                     | $6.3 \pm 0.98$                     | $6.1 \pm 1.28$                     | $7.2 \pm 1.47$                     |
|                  | <b>15</b>                | <b><math>8 \pm 0.51</math></b>     | <b><math>7.4 \pm 0.52</math></b>   | <b><math>8.09 \pm 0.5</math></b>   | <b><math>8.1 \pm 0.4</math></b>    | <b><math>8.1 \pm 0.53</math></b>   | <b><math>8.18 \pm 0.4</math></b>   |
|                  | 18                       | $7.5 \pm 0.69$                     | $6.9 \pm 0.75$                     | $5.5 \pm 1.23$                     | $6.5 \pm 1.02$                     | $6.9 \pm 0.95$                     | $7.5 \pm 0.72$                     |
| Salad            | 17                       | $7.3 \pm 0.9$                      | $7.1 \pm 1.1^*$                    | $7.2 \pm 1.2$                      | $7.3 \pm 1.09$                     | $7.1 \pm 0.09$                     | $7.5 \pm 0.75^*$                   |
|                  | <b>20</b>                | <b><math>8 \pm 0.52</math></b>     | <b><math>7.5 \pm 0.05^*</math></b> | <b><math>8 \pm 0.48</math></b>     | <b><math>7.7 \pm 0.51</math></b>   | <b><math>7.4 \pm 0.48</math></b>   | <b><math>7.7 \pm 0.4^*</math></b>  |
|                  | 22                       | $6.9 \pm 1.2$                      | $6.3 \pm 0.2^*$                    | $7.4 \pm 0.58$                     | $6.9 \pm 0.48$                     | $6.5 \pm 1.23$                     | $6.2 \pm 1.09^*$                   |
| Bhujia           | 20                       | $6.5 \pm 0.71^*$                   | $6.5 \pm 0.71$                     | $6.4 \pm 0.52^*$                   | $6.7 \pm 0.48^*$                   | $6.8 \pm 0.42^*$                   | $6.1 \pm 0.99^*$                   |
|                  | <b>25</b>                | <b><math>7.3 \pm 0.48^*</math></b> | <b><math>7.3 \pm 0.48</math></b>   | <b><math>7.7 \pm 0.48^*</math></b> | <b><math>8.0 \pm 0.66^*</math></b> | <b><math>8.3 \pm 0.67^*</math></b> | <b><math>8.0 \pm 0.66^*</math></b> |
|                  | 30                       | $5.5 \pm 0.53^*$                   | $5.5 \pm 1.08$                     | $6 \pm 0.66^*$                     | $6.2 \pm 0.63^*$                   | $5.9 \pm 0.99^*$                   | $6.0 \pm 1.05^*$                   |

# mean  $\pm$  S.D.

\* significance ( $p \leq 0.05$ )

### 3.1.3. Texture

The results revealed that no significant differences ( $P > 0.05$ ) were observed by panelist between salad and *raita* in terms of texture. but salad was highly liked as indicated by its higher scores of  $8.0 \pm 0.48$  than *raita*  $7.2 \pm 0.91$ . Likewise, soup was also liked very much and was ranked  $8.09 \pm 0.5$  by panelists, its differences was significant ( $P > 0.05$ ) at 15 per cent level of incorporation of germinated garden cress seeds. However, mean scored for texture for sandwich and *bhujia* were little lower  $7.4 \pm 0.52$  and  $7.7 \pm 0.48$  but significant difference were also

observed in their scores.

### 3.1.4. Taste

Further, this study aimed at assessing taste of the developed food products. In present study, panelists showed higher preference for food products-soup, sandwich and *bhujia* (mean score above 8) compared to the rest of the food preparations with germinated garden cress seeds. Salad was liked moderately whereas *raita* was liked slightly by the panelists. Further analysis revealed that significant differences were observed in scores of taste for sandwich, *raita* and *bhujia*.

### 3.1.5. Overall acceptability

Overall acceptability of soup and *bhujia* were liked very much by both groups of panelist with mean scores  $8.18 \pm 0.4$  and  $8.0 \pm 0.66$  respectively. Overall acceptability of all the food preparations were significantly different ( $P < 0.05$ ) except *raita*. Salad, *raita* and sandwich were moderately liked products and their scores were  $7.7 \pm 0.4$ ,  $7.5 \pm 0.70$  and  $7.5 \pm 0.53$  respectively and their level of incorporation varied from 10-20 per cent.

### 3.2. Nutrient content

As shown in the table 2 the energy content of the developed products was highest of *bhujia* 300.5 Kcal per 100 gm and lowest in *raita* 99.4 Kcal per 100 gm. Protein content varied from 5.29gm per 100 gm(*raita*) to 8 gm per 100 gm(*bhujia* ). Fat content ranged between 5.02 g in salad to 16.2gm per 100gm in *bhujia*. Carbohydrate content of germinated garden cress seeds incorporated food preparations varied from 6 g of *raita* to 36.1 g per 100g of sandwich. The highest iron content was found in salad (26.6 g/100g) and minimum in *raita* (10.18 g/100g).

**Table 2:** Nutrient contents (per 100gm) of the most acceptable food preparations

| Food Preparations | Control | Sandwich (GCS) | Control | Raita (GCS) | Control | Soup (GCS) | Control | Salad (GCS) | Control | Bhujia (GCS) |
|-------------------|---------|----------------|---------|-------------|---------|------------|---------|-------------|---------|--------------|
| Energy (Kcal)     | 231     | 276            | 60      | 99.4        | 163     | 230.3      | 32      | 114.8       | 187     | 300.5        |
| Protein (gm)      | 5.2     | 7.7            | 3.1     | 5.29        | 1.7     | 5.4        | 1.1     | 5.8         | 1.6     | 8            |
| Fat (gm)          | 8.6     | 11             | 4       | 6.05        | 9.2     | 13.7       | 0.2     | 5.02        | 10.1    | 16.2         |
| Carbs(gm)         | 33.1    | 36.1           | 3       | 6           | 7.5     | 21.48      | 6.27    | 11.43       | 21.1    | 29.3         |
| Ash (mg)          | 0.8     | 1.4            | 0.8     | 1.3         | 0.54    | 1.41       | 0.52    | 1.6         | 0.6     | 2.4          |
| Iron (mg)         | 1       | 11             | 0.2     | 10.18       | 0.5     | 15.52      | 9.1     | 26.6        | 0.4     | 25.4         |
| Calcium (mg)      | 28      | 65.7           | 149     | 145.2       | 23      | 33.74      | 37.1    | 93.3        | 11      | 105.2        |

#### **4. Discussion**

One of the most important things that was kept in mind was the consumer acceptability of the final product. The product should aid in filling up the deficiencies of the iron status in the anemic consumers. Thus the product should have minimum quantity to carry out the desired functions. Development of all the products are done by keeping in mind those products should provide at least one third of iron requirements in Indian adolescent girls could be fulfilled. Further germinated products are rich in vitamin B and ascorbic acid which help in absorption of iron.

Sensory evaluation is easy in its principle but its implementation in the field is often complicated because of lack of knowledge of sensory evaluation, it difficult for them to understand some sensory testing methods. The present study therefore used both semi-trained panelist from Department of Food Science, Kurukshetra University and consumers (un-trained).

The organoleptic evaluation of the different food preparations prepared using different amount of germinated garden cress seeds was done .The assessment was done by studying the characteristics like color , appearance, texture, taste , aroma and overall acceptability. The organoleptic evaluations showed that the sample prepared with supplementation of garden cress seeds at 10-15% were most acceptable.

Germination improves the consistency, mouth feel and taste of the product [7,8]. In the present study, germinated garden cress seeds were used. Several studies have shown that germination improves the nutritive value and sensory attribute of cereals and legumes. Germination has also been found to decrease the levels of antinutritional factors present in cereals and maximizes the levels of some of the utilizable nutrients [10]. Reference [9] reported that sensory panelists highly rated formulations from germinated grains for all the sensory parameters investigated. In present study, overall acceptability of all the food preparations was high(more than 8 score) for bhujia and soup.

#### **5. Conclusion**

It can be concluded that the sensory evaluation done on all the recipes revealed that germination of the seeds significantly improved their organoleptic quality and contributed to their high acceptance. The fact that these recipes are inexpensive, locally available and nutritious makes them potentially effective in solving anemic problem in adolescents.

#### **6. Recommendation**

Plant world is replete with an array of food stuffs many of which stood relegated to the margins for a long time owing to their low pallet appeal. This study unveils the nourishing potential of garden cress seeds(*Lepidium Sativum* ) through incorporation of germinated seeds in various commonly consumed Indian recipes. Germination of seeds has also increased its acceptability and its incorporation in various recipe was found to be organoleptically acceptable. Germinated garden cress seeds incorporated food products are more nutritious than

control and has a potential to act as a nourishing and therapeutic agent. But it is yet to come to margins and become a main dietary ingredient. So the need of the hour is to throw light on its unexplored potential to cure malnutrition in developing countries like India.

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#### **APPENDIX: MEANING OF DIFFERENT INDIAN FOOD PREPARATIONS**

Sandwich – Sandwich made with white bread(70g) , mayonnaise(10g), germinated garden cress seeds(15g)

Raita- A curd(75g) of buffalo's milk mixed with germinated garden cress seeds(10gm) and seasoned with salt, black paper and cumin powder.

Vegetable Soup - Stew made with a variety of vegetables(200ml) (onion, carrot, beans, cabbage) and germinated garden cress seeds(15g) are added in stew and seasoned with salt pepper and soya sauce.

Salad - A salad prepared with variety of vegetables onion (20g), cucumber(35g), tomato(20g), germinated garden cress seeds (20g)and lemon juice(5ml).

Bhujia – An Indian vegetable prepared using germinated garden cress seeds (30g)and potato(50g).