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ENRICHMENT OF TRADITIONAL INDIAN FOOD PREPARATIONS WITH GARDEN CRESS SEEDS

Tarvinderjeet Kaur* and Mamta Sharma

Department of Home Science, Kurukshetra University, Kurukshetra, Haryana, India

*Corresponding author: tarvinkuk7@yahoo.com/ r.kaushik82@gmail.com

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ABSTRACT

India has the highest prevalence of iron-deficiency anemia among women in the world. More than 60 per cent of adolescent girls are affected by nutritional anemia. Garden cress seeds (*Lepidium sativum*) are locally available inexpensive seeds which are excellent sources of iron, protein, and β -vitamin. Keeping this in view, the present study was undertaken with the objective to develop commonly consumed food preparations by incorporating roasted and soaked garden cress seeds by applying different cooking methods. 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). Amongst the roasted garden cress seeds incorporated food preparations, the mean scores for overall acceptability was highest for *atta besan laddoo* and minimum for *matrey*. The overall acceptability of soaked garden cress seeds was highest for sweet and sour vegetable and lowest for *salty lassi*. The per cent increased in iron content by incorporation of roasted garden cress seeds ranged from 79.3(*shakarpara*) to 311.6(*mathri and matrey*) per cent whereas by incorporation of soaked garden cress seeds iron content ranged from 37 per cent(*Sweet and salty lassi & cool cool drink*) to 500 per cent(*Kheer*).

Keywords: Garden Cress Seeds, Anemia, Organoleptic Evaluation, Best Acceptable

INTRODUCTION

Nutritional anemia is one of India's major public health problems. The prevalence of anemia among adolescent girls is more than 60 per cent (WHO, 2000). Iron deficiency anemia (IDA) resulting from inadequate intake of iron, low absorption, low bioavailability (1-6%) of dietary iron from plant food is the most common form of anemia in India (Vir 2000). Anemia in adolescent girls affects their physical work capacity and reproductive physiology. Further, in iron deficiency changes in brain iron content, distribution, and in neurotransmitter function may affect cognition which result in acute brain disfunctioning and long-lasting abnormalities. (Beard JL and Agarwal KN, 2001). This in turn may adversely affect learning and scholastic performance of the schoolgirls entering the adolescence. Iron deficiency in childbearing women increases maternal mortality, prenatal and perinatal infant loss and prematurity. Physical work capacity is reduced due to IDA. Decreased level of hemoglobin reduces the availability of oxygen to the tissues, which in turn affect cardiac output (Beaton et al., 1989). Morbidity from infectious disease is increased in iron deficient population, because of the adverse effect of iron deficiency on the immune system.

Strategies for improving anemia include supplementation, fortification and improvement in the diet. Therefore, it is essential that locally available materials

which are inexpensive but highly nutritious be used as a vehicle to improve the nutrition status for adolescent girls.

A garden cress seed (*Lepidium sativum*) belongs to family Cruciferae grown in India, North America and parts of Europe. It is also known as common cress, land cress and Haliv in India (Gokavi et al., 2004). The edible whole seed is known to have health promoting properties as it contains 25-39 per cent of protein. Thirty three percent carbohydrate, 2.4 per cent crude fat, 7.6% crude fiber and 6.4% minerals, iron (100%) (Gopalan et al., 2004). Therefore, these seed can serve as raw material for the enrichment of traditional Indian food products. Hence the present study has been done to develop food preparations by incorporating garden cress seed.

MATERIAL & METHODS

MATERIALS

Garden cress seeds were purchased in bulk from local market of Panipat city Haryana. Seeds were obtained during summer season (April – May).

PROCESSING OF SAMPLES

Garden cress seeds were sorted and cleaned to remove impurities and stored in an air tight plastic container. The garden cress seeds were then divided into two different portions

- One portion of G.C.S were roasted in a pan for one min on low flame and then cooled at room temperature. It was then powdered & stored in air tight containers.
- Second portion of Garden cress seeds were soaked over night & were stored in closed container for further use. Fresh soaked seeds were consumed within a day.

NUTRITIONAL EVALUATION

Nutrient content of the raw seed was determined using standard methods of AOAC (2012).

DEVELOPMENT OF FOOD PREPARATION

Commonly consumed food preparations were prepared by incorporating roasted and soaked garden cress seeds using the basic food preparation (Usha R. *et.al*, 2002) . The level of incorporation of roasted garden cress seeds in commonly consumed (salty/sweet) food preparations ranged from 8-20per cent .In soaked garden cress seeds food preparations the level of incorporation of garden cress seeds varied from 1-20 per cent.

SENSORY EVALUATION

All the developed food preparations were presented to a panel of ten judges comprising of trained judges (3 lectures of home science department, Kurukshetra University, Kurukshetra), semi-trained judges(five final year post graduate students of home science department ,Kurukshetra) and two untrained consumers. The panel of judges evaluated food preparations organoleptically using Hedonic nine point scale. Nutrient content in food preparations were calculated using nutritive value of Indian foods (Gopalan *et. al.*, 2004)

STATISTICAL ANALYSIS

The interpretation of data so obtained was done by analysis of variance (ANOVA) test. Level of significance was accepted at $p \leq 0.05$.

RESULT & DISCUSSION

SENSORY EVALUATION

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

ROASTED GARDEN CRESS SEEDS INCORPORATED FOOD PREPARATIONS

Five food preparations namely, *atta besan laddoo*, *shakarpara*, *chikki*, *mathri* and *matrey* were prepared by incorporation of roasted garden cress seeds (Table 1). In *Atta besan laddoo* the most acceptable level of incorporation of garden cress seed was 10 per cent and the

mean scores for overall acceptability was 7.4 ± 0.52 . In *atta besan laddoo*, within 8 ,10 and 12 per cent level of incorporation of roasted garden cress seeds significant difference($p < 0.05$) appeared in scores for color and taste. Garden cress seeds were incorporated in *shakarpara* at 10, 12 and 15 per cent level of incorporation. *Shakarpara* was most acceptable at 12 per cent and scores for all organoleptic characteristics(except appearance) of *shakarpara* within 10, 12 and 15 per cent level of incorporation were found significantly different($P < 0.05$). *Chikki* was best acceptable at 17 per cent level of incorporation of roasted garden cress seeds and its scores for overall acceptability awarded by the panel of judges were 5.5 ± 1.2 . Non-significant difference was noticed in scores for all organoleptic characteristics of *chikki* except for color within 15, 17 and 20 per cent level of incorporation of roasted garden cress seeds (Table 1). Subsequent analysis of the data indicated at 20 per cent level of incorporation of roasted garden cress seeds *mathri* and *matrey* was most acceptable and the respective scores for overall acceptability were 5.7 ± 1.42 and 5.5 ± 1.41 . Further, non- significant differences ($p < 0.05$) were found for all organoleptic characteristics of *mathri* and *matrey*.

SOAKED GARDEN CRESS SEEDS INCORPORATED FOOD PREPARATIONS

Soaked garden cress seeds were incorporated in various food preparations (*Lassi(sweet/salty)*, *coolcool drink*, custard, *kheer*, sweet and sour vegetable, shake, porridge and pudding) using different cooking method. The most acceptable level of incorporation of soaked garden cress seeds was 2 per cent for *sweet lassi*, *salty lassi* and *Cool cool* and the respective scores for overall acceptability ranged from 6.9 ± 0.32 (*salty lassi*) to 8.3 ± 0.48 (*cool cool*). Significant difference ($p < 0.05$) was found in the scores for all organoleptic characteristics. Custard was prepared at 3,5, 7 per cent level of incorporation of soaked garden cress seeds. Its overall acceptability scores (7.7 ± 0.65) was same as that of *lassi* (sweet). All organoleptic characteristics of custard, were found significantly different ($p < 0.05$) except for color. *Kheer* , shake and sweet & sour vegetable were best acceptable at 7 per cent level of incorporation of soaked garden cress seeds and their scores ranged from 8.2 0.92 to 8.7 0.48. The best scores for overall acceptability awarded by the panel of judges was 8.7 ± 0.48 to sweet and sour vegetable. Analysis of data revealed that significant difference ($p < 0.05$) appeared within color, taste and overall acceptability characteristics of *kheer* (Table 2). However, in shake, non-significant difference ($p < 0.05$) was obtained in scores for colour, appearance, texture, taste and overall acceptability. Significant difference ($p < 0.05$) was noticed for all organoleptic characteristics except appearance in sweet and sour vegetable.. Porridge was best acceptable at 10 per cent and the scores for overall acceptability were 7.8 ± 0.98 . Most acceptable level of incorporation of soaked garden cress seeds in pudding was 14 per cent and the score for overall acceptability was 7.3 ± 0.67 . Significant difference was noticed in scores for all organoleptic characteristics of pudding except color at 10, 14 and 18 per cent level of incorporation of soaked garden cress seeds.

The findings of the present study are in favour with the previous studies. Sood *et al.* (2002) who prepared a supplement food laddoo using locally available foods like jaggery, processed rice flakes, garden cress seeds and amaranth seeds (45 : 40 : 10 : 5) for school going children 7-9 years. Saravanan *et al.* (2012) also

developed beet root slush beverage mix by using garden cress seed soluble powder, beetroot powder, sugar powder and milk powder in ratio 3.4: 2: 3: 0.7. It was observed that 15 per cent garden cress seeds, along with date flakes and desiccated coconut powder, almonds were highly acceptable (Uma, 2010).

Table 1: Sensory evaluation of different food preparations incorporated with roasted garden cress seeds (g.c.s)

Food preparation	% level of incorporation	color	appearance	texture	taste	aroma	overall acceptability
Atta besan laddoo	8	6.2±1.2*	6.3±1.08	6.5±1.32	6.3±1.45*	7.2±1.27	6.8±1.38
	10	6.5±1.03*	6.9±0.83	7.3±0.50	6.5±0.68*	7.5±0.52	7.4±0.52
	12	5.8±1.48*	5.9±1.45	6.3±1.58	7±1.23*	6.9±1.47	7.1±1.36
Shakarparaa	10	6.1±1.56*	5.8±1.02	5.2±1.23*	5.4±1.45*	5.6±1.6*	5.5±1.41*
	12	6.5±1.18*	6.5±1.08	6.6±1.17*	6.3±1.15*	6.5±1.08*	6.7±0.94*
	15	5.6±1.23*	5.3±1.45	4.8±1.5*	5.2±1.4*	5.3±1.03*	5.2±1.1*
Chikki	15	5.7±1.2*	5.3±1.36	5.1±1.5	4.4±1.2	4.0±1.6	4.5±1.32
	17	5.8±1.16*	5.5±1.33	5±1.22	5±1.41	5.3±1.5	5.5±1.2
	20	4±1.52*	4.7±1.42	4.3±1.35	4±1.5	4.0±1.23	4.1±1.29
Mathri	15	5.8±1.2	5.7±1.5	6.1±1.42	5.2±1.53	5.1±1.24	5.2±1.36
	20	5.9±1.37	5.8±1.47	5.7±1.34	5.6±1.50	5.3±1.79	5.7±1.42
	25	4.8±1.39	4.9±1.56	5.1±1.24	4.4±1.35	4.3±1.45	4.2±1.37
Matrey	15	5.9±1.6	4.9±1.54	4.2±1.42	5.5±1.09	5.2±1.26	5.1±1.8
	20	6.2±1.55	5.5±1.64	5.4±1.84	5.5±1.18	5.4±1.83	5.5±1.84
	25	6.1±1.56	5.1±1.24	5.3±1.39	5.1±1.56	5.3±1.47	5.2±1.37

Value of mean ± S.D. *Significant p < 0.05

Table 2: Sensory evaluation of different food preparations incorporated with soaked Garden Cress Seeds (G.C.S.)

Food Preparation	% level of incorporation	Color	Appearance	Texture	Taste	Aroma	Overall Acceptability
Lassi (Sweet)	1	6.8±0.42*	6.6±0.52*	6.7±0.48*	7.3±0.48*	5.8±0.42*	6.7±0.48*
	2	6.7±0.48*	7.5±0.53*	7.9±0.32*	6.9±0.32*	7.8±0.42*	7.7±0.48*
	3	5.7±0.48*	5.9±0.57*	5.6±0.52*	5.4±0.69*	6.2±0.78*	4.6±0.52*
Lassi (Salty)	1	6.8±0.42*	6.6±0.52*	7.7±0.48*	6.9±0.57*	6.9±0.57*	5.7±0.48*
	2	7.7±0.48*	7.7±0.48*	5.8±0.42*	6.7±0.48*	6.6±0.52*	6.9±0.32*
	3	7.1±0.32*	6.6±0.52*	5.8±0.42*	6.2±0.42*	4.8±0.43*	6.1±0.32*
Cool Cool Drink	1	8.8±0.42*	8.8±0.42*	8.6±0.52*	8.6±0.52*	9±0*	8.6±0.52*
	2	8.6±0.52*	8.6±0.52*	7.8±0.42*	8.6±0.51*	8.8±0.42*	8.3±0.48*
	3	8.5±7.1*	8.5±0.71*	7.6±0.52*	8.2±0.63*	8.7±0.48*	8.1±0.73*
Custard	3	7.2±1.23	7.1±1.5*	7.4±1.36*	7.1±1.09*	7.8±1.42*	7.2±1.54*
	5	7.7±0.90	7.7±0.90*	7.6±0.92*	7.4±0.93*	8±0.63*	7.7±0.65*
	7	6.9±1.47	6.7±1.52*	6.3±1.23*	6.2±1.36*	6.4±1.50*	6.2±1.43*
Kheer	5	6.8±1.06*	7.5±1.42	7.9±1.09	7.4±1.28*	7.7±1.42	7.2±1.39*
	7	8.2±0.42*	8.4±0.84	8.1±0.56	8±0.94*	8.2±0.63	8.3±0.48*
	10	7.1±1.45*	7.8±1.29	7.5±1.74	7.6±1.52*	7.3±1.68	7.4±1.67*
Sweet and Sour Veg.	5	7.5±0.53*	7.5±0.53	6.4±0.69*	7.5±0.53*	7.5±0.53*	6.2±0.78*
	7	8.9±0.32*	8.7±0.48	8.4±0.52*	8.9±0.32*	8.5±0.53*	8.7±0.48*
	10	8.4±0.52*	7.5±0.53	7.6±0.52*	7.1±0.57*	6.8±0.42*	7.3±0.48*
Shake	5	8.1±1.56	6.9±1.25	7.3±1.7	8.2±1.5	7.3±1.68*	7.7±1.34
	7	8.4±0.17	7.9±0.28	7.6±1.5	8.5±1.06	7.9±0.82*	8.2±0.92
	10	7.9±1.03	7.2±1.1	7.5±1.85	8.1±1.74	7.4±1.56*	7.6±1.7
Porridge	8	7.5±1.59	7.2±1.09	7.6±1.1	7.2±1.58	7.3±1.05	7.4±1.90
	10	8±0.63	7.9±0.83	7.9±0.54	7.9±1.04	7.8±0.98	7.8±0.98
	12	7.8±1.45	7.5±1.36	7.3±1.48	6.9±1.40	6.8±1.25	7.6±1.08
Pudding	10	5.5±0.85	6.4±1.26*	5.3±0.95*	6.3±0.95*	7.5±0.53*	6.9±0.74*
	14	8.1±0.74	8.3±0.68*	7.5±0.53*	7.1±0.74*	7.7±0.48*	7.3±0.67*
	18	7.2±0.92	6.7±0.67*	5.5±0.53*	5.1±0.74*	7±0.82*	5.1±0.74*

Value of mean ± S.D. *Significant p < 0.05

NUTRIENT CONTENT

Energy content of the food preparations prepared by incorporating roasted garden cress seeds varied from 491.6 Kcal (*Atta besan laddoo*) to 319.2 Kcal (*mathri and matrey*) per 100gm (Table 3). In the present study per cent increased in the energy content of the respective food preparations was 10.47 and 41.23 by incorporation of garden cress seeds. Protein content was highest in *chikki* (9.2 g/ 100gm) and lowest in *shakarpara* (6.78 g/100gm). The incorporation of roasted garden cress seeds increased protein content that varied from 44.9 per cent to 176.29 per cent. Fat content ranged between 85.5 g (*chikki*) to 12.9 g (*shakarpara*) per 100gm and their per cent increased varied from 5.5 to 32.7 per cent by incorporation of roasted garden cress seeds. Carbohydrate content of roasted garden cress seeds incorporated food preparations varied from 18.6 g (*mathri and matrey*) to 83.2 g (*shakarpara*) per 100gm. Nearly 53.7 per cent of carbohydrate content increased in *mathri and matrey* and only 4.9 per cent increased in *shakarpara*. The highest ash content was found in *mathri and matrey* (3.36 g/100gm), its per cent increased was 46.08 percent and minimum in *shakarpara* (0.94 g/ 100gm), its per cent increased was 203.2 by incorporation of roasted garden cress seeds. Iron and calcium content of *shakarpara* and *chikki* was the highest respectively whereas *atta besan laddoo* had minimum iron and calcium content amongst all developed food preparations. With the incorporation of roasted garden cress seeds per cent increase in the respective

nutrient content ranged from 79.3 to 311.6 and 94.04 to 3000 per cent respectively.

Energy content of all the food preparation prepared by incorporating soaked garden cress seeds varied from 379.2 Kcal (pudding) to 39 Kcal (*salty lassi*) per 100gm. There was 32.13 per cent increased in energy content of pudding after incorporation of soaked garden cress seeds. Protein content was highest in pudding (14.5gm/100g) and lowest in *cool-cool drink* (0.7gm/100gm) whereas fat content ranged between 0.7 gm (*cool-cool drink*) to 31.8 gm per 100 gm of sweet and sour vegetable. The highest per cent increased in protein and fat content was observed in cool cool drink (133.3%). Pudding had the highest carbohydrate (40.3 gm/100gm) content. The per cent increased by incorporation of soaked garden cress seed was 12.74 and lowest was in *lassi* (*salty*) i.e 2.1gm/100gm. The increased in carbohydrate content was 40 per cent. The highest content of iron was found in sweet and sour vegetable (4.0 mg / 100 gm) and minimum in *sweet & salty lassi and coolcool drink* (0.47mg / 100 gm). The per cent increase in iron content after incorporation of soaked garden cress seeds was 50 whereas in *lassi* (*sweet & salty*) and *coolcool drink* the increase was 37 per cent. Calcium content of the developed food preparations ranged from 25.74mg (*cool cool drink*) to 453.2mg (pudding) per100gm. However the increase in calcium content of pudding was 7.9 per cent and 22.57 per cent (*cool cool drink*).

Table 3 (A): Nutrient contents (per 100 gm) of the most acceptable roasted garden cress seeds incorporated food preparations

Food Preparations		Energy (kcal)	Protein (g)	Fat (g)	Carbohydrates (gms)	Ash (mg)	Iron (mg)	Calcium (mg)
<i>Atta Besan Laddoo</i>	GCSIFP	491.6	7.42	23.58	53.75	1.38	3.5	24.49
	Control	445	5.12	20.9	50.8	0.85	1.63	0.79
	Percentage increased (%)	10.47	44.9	12.8	5.8	62.3	114.7	3000
<i>Shakarpara</i>	GCSIFP	479.9	6.78	12.9	83.2	0.94	5.2	83.07
	Control	376.4	3.98	9.72	79.3	0.31	2.9	40.59
	Percentage increased (%)	27.49	70.35	32.7	4.9	203.2	79.3	104.65
<i>Chikki</i>	GCSIFP	308.3	9.2	85.5	39.2	2.3	4.4	84.29
	Control	229	5.2	81	33.7	1.4	1.3	44
	Percentage increased (%)	34.6	76.9	5.5	16.3	64.3	238.4	91.6
<i>Mathri</i>	GCSIFP	319.2	7.46	25.86	18.6	3.36	4.94	50.4
	Control	226	2.7	20.5	12.1	2.3	1.2	3
	Percentage increased (%)	41.23	176.29	26.14	53.7	46.08	311.6	94.04
<i>Matrey</i>	GCSIFP	319.2	7.46	25.86	18.6	3.36	4.94	50.4
	Control	226	2.7	20.5	12.1	2.3	1.2	3
	Percentage increased (%)	41.23	176.29	26.14	53.7	46.08	311.6	94.04

GCSIFP -Garden cress seeds incorporated food preparations

Table 3 (B): Nutrient contents (per 100 gm) of the most acceptable soaked garden cress seeds incorporated food preparations.

Food preparations		Energy (kcal)	Protein (gm)	Fat (gm)	Carbos (gm)	Ash (mg)	Iron (mg)	Calcium (mg)
Lassi (sweet)	GCSIFP	83.3	1.8	3.7	10	0.92	0.47	109.7
	Control	74	1.4	3.3	9.4	0.8	0.1	105
	Percentage increased (%)	12.5	28.6	12.12	6.38	15	37	4.47

Lassi (salty)	GCSIFP	39	1.9	2.4	2.1	0.5	0.47	79.24
	Control	30	1.5	2	1.5	0.4	0.1	74.5
	Percentage increased (%)	30	26.6	20	40	25	37	6.36
Cool drink	GCSIFP	116.3	0.7	0.7	26.3	0.4	0.47	25.74
	Control	107	0.3	0.3	25.7	0.3	0.1	21
	Percentage increased (%)	8.7	133.3	133.3	2.3	33	37	22.57
Custard	GCSIFP	202.9	5.49	7.84	23.5	1.3	1.1	223.0
	Control	179.6	4.3	6.5	20.3	0.8	0.2	211.2
	Percentage increased (%)	12.9	27.67	20.6	7.8	62.5	450	5.59
Kheer	GCSIFP	164.4	5.5	7.8	15.8	1.04	1.56	193.29
	Control	131.78	3.85	6.0	13.58	0.67	0.26	176.7
	Percentage increased (%)	24.75	42.85	30	17.03	55.2	500	9.38
Shake	GCSIFP	189.2	6.1	9.4	15.31	1.19	1.7	214.13
	Control	156.5	4.43	7.55	13.04	0.82	0.4	197.54
	Percentage increased (%)	20.9	37.7	25.3	17.4	45.12	325	8.39
Sweet and Sour veg.	GCSIFP	352.6	4.3	31.8	5.3	1.17	4.0	30.6
	Control	320	2.7	30	3.1	0.8	2.7	14
	Percentage increased (%)	10.9	59.25	6	70.9	46.25	48.15	118.57
Porridge	GCSIFP	191.6	6.9	12.68	23.2	1.6	2.27	168.7
	Control	145	4.6	10	20	1.1	0.4	145
	Percentage increased (%)	32.13	50	26.8	16	45.4	467.5	16.34
Pudding	GCSIFP	379.2	14.5	18.15	39.8	2.3	3.3	453.2
	Control	314	11.2	14.4	35.3	1.6	0.7	420
	Percentage increased (%)	20.76	29.5	25.7	12.74	43.75	371.4	7.9

* GCSIFP -Garden cress seeds incorporated food products

CONCLUSION

All the food preparations developed by incorporating garden cress seeds were found to be organoleptically acceptable by the panel judges. The acceptable level of incorporation of garden cress seeds varied in different food preparations ranging from 2.0 per cent (*lassi* and cool cooldrink) to 25 per cent (*mathri* and *matrey*). Amongst the roasted garden cress seeds incorporated food preparations, the mean scores for overall acceptability was highest for *atta besan ladoo* and minimum for *matrey*. The overall acceptability was highest for sweet and sour vegetable and lowest for *salty lassi* among soaked garden cress seeds. The nutrient content of all the developed food preparations increased enormously by incorporation of garden cress seeds. The maximum per cent increased in energy, protein, fat, carbohydrates, ash, iron and calcium was 41.23, 176.29, 32.7, 53.7, 203.2, 238.2, and 3000 per cent respectively among roasted garden cress seeds. In soaked garden cress seeds food preparations the maximum per cent increase in energy, protein, fat, carbohydrates, ash, iron and calcium was 32.13, 133.3, 133.3, 70.9, 62.5, 500, and 118.57% respectively.

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