

## PRODUCTION OF HEALTHY MILK DRINK FORTIFIED WITH GARDEN-CRESS

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**ABSTRACT:** *The main objective of this study was to produce healthy milk drink from skim and soya milk fortified with garden-cress seeds .*

*Different percentages of garden-cress seeds powder (1 – 5 % ) were added to skim or soya milk . Increasing the concentration of garden-cress increased protein, fat and ash. Content Also, adding garden-cress powder seeds to skim or soya milk increased potassium and magnesium while, calcium percentage increased in soya milk than skim milk and iron increased in skim milk .*

*Vitamin C increased from 0.0 to 3.45 mg/100g and vitamin A increased from 3.0 to 20.0 mg/100g in soya milk, while vitamin C increased from 19.0 to 22.45 and vitamin A increased from 62.0 to 79.30 in skim milk .*

*Addition of garden-cress seeds powder increased the flavonoids content in skim milk than soya milk. Increasing the concentration of garden-cress powder decreased total bacterial count til the end of storage period .*

*The sensory evaluation of health drinks prepared with fortification of garden-cress seeds powder at 4 % exhibited the highest overall acceptability compared to other treatments .*

**Key words:** *Milk health drink , Garden- cress*

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### INTRODUCTION

Garden-Cress (*Lepidium Sativum*) is grown in India, North America and parts of Europe. The whole seeds have health promoting properties, it was assumed that these seed can serve as raw material for functional foods sharing its peppery, tangy flavor and aroma (Roy *et al.*, 2002). The whole seeds contain 25-39 % protein 14-24% lipid and 6.4 minerals (Patel *et al.*, 2009; Fekadu *et al.*, 2002).

Garden-cress seeds contain antioxidants like vitamin A and E which help protect cells from damage by free radicals, these seeds have a chemo protective nature.

*L. sativum* seeds were largely used for the treatment of hypertension and renal disease (Jouad *et al.*, 2001). It is also used as a laxative for gastrointestinal disorders, prevention of cancers since it has the ability to trap free-radicals, as memory boosters as it contains essential fatty acids like erucic, arachidic and linoleic acids, to control mild glycemia in diabetic patients as it is rich source of a phytochemical called lipidimoid which prevents reabsorption of glucose from

the renal system back in blood (Eddouks and Maghrani, 2008). Since, it is a good source of calcium it often helps in normal contraction of muscle for healthy movements of limbs and heart (Gopalan *et al.*, 2004). Iron content in the seed powder often helps to cure mild anaemic conditions, especially in children, phosphorus needed for general healthy metabolic activities of the body.

Further studies on the seed contents revealed that the seeds are a rich source of omega 3-fatty acids which helps to lower cholesterol in hyper cholesterolemic patients (Golay *et al.*, 1990).

Another important observation was recorded by Camilla *et al.*, (2008) that seed powder helps in building up of lean muscles in the body and this was very attractive to those who wanted to build muscles but without the fat in it.

This research was planned to evaluate the nutritional values of garden-cress seeds and use this seeds for production healthy milk drinks .

## **MATERIALS AND METHODS**

### **Materials**

Garden cress seed powder , skim milk , soya milk, sugar and stabilizer (carrageen moss) were purchased from local market.

Preparation of healthy drinks using garden cress seeds powder was varied from 1-5% (w/v) in skim and soya milk .

### **Methods**

#### **Preparation of skim and soya milk drink**

Garden-cress seeds was washed with distilled water and dried at 40 °C for 4h. The seeds were ground to powder and stored in tightly capped glass bottles

Preparation of skim and soya milk

Different types of healthy drinks were prepared by using 100 ml. of skim and soya milk, adding 5 gram of sugar, 0.05 gram of stabilizer and adding seed powder 1-5 % (w/v) . the batches were stored for 14 days at 5 °C .

Table (1) shows preparing healthy drinks with garden cress.

#### **Chemical analysis of skim and soya milk**

The seeds and healthy drinks were analyzed chemically for moisture, protein

content , crude fat content (using Gerber method) and ash content according to AOAC (2007). Iron, calcium, magnesium, potassium and sodium content (Ranganna,1986). Vitamins were determined according to the methods described in AOAC (2005).

Qualitative and quantitative of vitamins, minerals and isolated flavonoids were determined using HPLC separation(aglient 1200,series1050).

Table (2) illustrate the chemical composition of garden cress seeds, skim milk and soya milk used in preparation of healthy milk drinks .

#### **Microbiological analysis**

Milk products were microbiologically examined for lactic acid, bacterial count, mould and yeasts count and E. coli according to American Public Health Assoc. (APHA1992).

#### **Sensory Evaluation**

The sensory characteristic of skim and soya milk drinks were judged by 10 panalists, according to the score sheet described by Homayouni *et al.*, (2008).

#### **Statistical analysis**

Analysis of data was carried out using SAS procedure guide (SAS.2004) .

**Table (1): Different types of healthy drinks were prepared with garden cress seeds**

Healthy drink formula	Milk (ml)	Garden cress seeds (g)	Sugar (g)	Stabilizer (g)
F1	100	0	5	0.05
F2	100	1	5	0.05
F3	100	2	5	0.05
F4	100	3	5	0.05
F5	100	4	5	0.05
F6	100	5	5	0.05

## ***Production of healthy milk drink fortified with garden-cress***

**Table (2): Chemical composition of garden cress seeds, skim milk and soya milk used in preparation of milk drinks**

Chemical Composition	Garden cress seeds(100g)	Skim milk(100ml)	Soya milk(100ml)
Protein	25 g	3.40g	2.86g
Fat	21 g	0.40	1.70
Calcium	81 mg	120.0	4.0
Potassium	606 mg	141.0	140.0
Sodium	40.90 mg	41.0	12.0
Magnesium	38 mg	10.0	19.0
Iron	1.3 mg	0.14	0.57
Vitamin C	69 mg	19.0	0.0
Vitamin A	346 mg	62.0	3.0
Ash	0.70g	0.73	0.28

### **RESULTS AND DISCUSSION**

The results from Table (3) showed that the fat was increased among treatments of skim and soya milk, while the protein increased from 3.40 to 4.55 in skim milk and from 2.86 to 4.11 in soya milk. Ash were slight increased in skim and soya milk .

The results in Table ( 4 ) refer to an increase in mineral contents of skim and soya milk with adding garden cress. It was observed that potassium increased from 141 to171.20(mg/100g) in skim milk drink and from 140 to 170.20(mg/100g) in soya milk drink. Skim milk contained a higher calcium amount than soya milk, so adding garden-cress seeds powder raised the amount of calcium content in soya milk. Adding garden-cress seeds raised mineral content in all samples of skim and soya milk drink.

Table (5) illustrate the effect of adding garden-cress on vitamins content of skim and soya milk. It can be noticed that, soya milk was very poor in vitamin C so adding

garden cress would be importante of soya milk drink. Vitamin C increased from 0.0 to 3.45mg/100g in soya milk drink and from 19.0 to 22.45mg/100g in skim milk drink ,while vitamin A increased from 3.0 to 20.30 in soys milk and from 62.0Mg/100g to 79.30 in skim milk .

Effect of adding garden-cress on flavonoids content of skim and soya milk were shown in Table (6). Flavonoids reduce the amount of cell damage often implicated in heart disease. Flavonoids also help improve vascular function and can assist in lowering blood pressure. They can also enhance the power of vitamin C and prevent inflammation throughout the body when eaten in proper amounts.

Flavonoids, in particular, isoflavonoids abundant in soybean seeds have various health-promoting activities including anti-cancer benefits of soy-based foods (Song *et al.*, 1999).

**Table (3): Effect of adding garden-cress on chemical composition of skim and soya milk drinks**

Treatments	Skim milk						LSD
	F1	F2	F3	F4	F5	F6	
Moisture	90.80 <sup>a</sup> ± 1.95	90.88 <sup>a</sup> ±1.88	91.09 <sup>a</sup> ± 1.83	91.21 <sup>a</sup> ± 1.07	91.40 <sup>a</sup> ± 1.72	91.58 <sup>a</sup> ± 2.60	3.16
Protein	3.40 <sup>a</sup> ± 0.79	3.55 <sup>a</sup> ± 0.49	3.80 <sup>a</sup> ± 1.39	4.05 <sup>a</sup> ± 0.32	4.30 <sup>a</sup> ± 0.56	4.55 <sup>a</sup> ± 0.85	1.45
Fat	0.40 <sup>d</sup> ± 0.36	0.61 <sup>cd</sup> ± 0.15	0.82 <sup>bcd</sup> ± 0.08	1.03 <sup>abc</sup> ± 0.17	1.24 <sup>ab</sup> ± 0.26	1.45 <sup>a</sup> ± 0.35	0.45
Ash	0.73 <sup>a</sup> ± 0.11	0.73 <sup>a</sup> ± 0.11	0.74 <sup>a</sup> ± 0.07	0.75 <sup>a</sup> ± 0.10	0.75 <sup>a</sup> ± 0.09	0.77 <sup>a</sup> ± 0.19	0.19
	Soya milk						
	F7	F8	F9	F10	F11	F12	LSD
Moisture	93.20 <sup>a</sup> ± 1.38	93.24 <sup>a</sup> ± 0.86	93.38 <sup>a</sup> ± 1.44	93.55 <sup>a</sup> ± 0.88	93.70 <sup>a</sup> ± 0.91	93.81 <sup>a</sup> ± 0.79	1.92
Protein	2.86 <sup>c</sup> ± 0.27	3.11 <sup>bc</sup> ± 0.29	3.36 <sup>abc</sup> ± 0.52	3.61 <sup>abc</sup> ± 0.17	3.86 <sup>ab</sup> ± 0.78	4.11 <sup>a</sup> ± 0.33	0.79
Fat	1.70 <sup>b</sup> ± 0.72	1.82 <sup>ab</sup> ± 0.36	2.03 <sup>ab</sup> ± 0.09	2.24 <sup>ab</sup> ± 0.15	2.45 <sup>ab</sup> ± 0.58	2.66 <sup>a</sup> ± 0.74	0.91
Ash	0.28 <sup>a</sup> ± 0.08	0.28 <sup>a</sup> ± 0.08	0.30 <sup>a</sup> ± 0.09	0.31 <sup>a</sup> ± 0.09	0.35 <sup>a</sup> ± 0.12	0.36 <sup>a</sup> ± 0.12	0.18

\* F1: Skim milk without adding garden cress      F7: Soya milk without adding garden cress  
 F2 : Skim milk with adding 1 % garden cress      F8: Soya milk with adding 1% garden cress  
 F3 : Skim milk with adding 2 % garden cress      F9: Soya milk with adding 2% garden cress  
 F4 : Skim milk with adding 3 % garden cress      F10: Soya milk with adding 3% garden cress  
 F5 : Skim milk with adding 4 % garden cress      F11: Soya milk with adding 4% garden cress  
 F6 : Skim milk with adding 5 % garden cress      F12: Soya milk with adding 5% garden cress

**Table (4): Effect of adding garden-cress on minerals content (mg/100g) of skim and soya milk drinks**

Treatments	Skim milk				
	Ca	Na	Mg	K	Fe
F1	120.0	41.0	10.0	141.0	0.14
F2	120.8	41.4	10.38	147.04	0.153
F3	121.6	41.82	10.76	153.08	0.166
F4	122.4	42.23	11.14	159.12	0.179
F5	123.2	42.64	11.52	165.16	0.192
F6	124.0	43.05	11.90	171.20	1.205
	Soya milk				
F7	4.0	12.0	19.0	140.0	0.570
F8	4.8	11.41	19.38	146.04	0.583
F9	5.6	11.82	19.76	152.08	0.596
F10	6.4	12.23	20.14	158.12	0.609
F11	7.2	12.64	20.52	164.16	0.622
F12	8.0	13.05	20.90	170.20	0.635

\*see Table (3) for details

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**Table (5): Effect of adding garden-cress on vitamin contents(mg/100g) of skim and soya milk drinks**

Treatments	Vitamin C	Vitamin A
	Skim milk	
F1	19.0	62.0
F2	19.69	65.46
F3	20.38	68.46
F4	21.07	72.38
F5	21.76	75.84
F6	22.45	79.30
	Soya milk	
F7	0.0	3.0
F8	0.69	6.46
F9	1.38	9.92
F10	2.07	113.38
F11	2.76	16.84
F12	3.45	20.30

\*see Table (3) for details

**Table (6): Effect of adding garden-cress on different flavonoid fractions (mg/100g) of skim and soya milk drinks**

Treatments	Skim milk					
	Quercetin	luteolin		Rutin	Hesperidin	Kaempferol
F1	5.0	6.87		4.022	8.0	8.12
F2	5.11	6.96		4.32	8.35	8.97
F3	5.14	6.95		4.71	8.85	9.14
F4	6.41	7.31		4.93	9.75	11.04
F5	6.81	8.34		5.12	10.0	12.06
F6	8.79	9.73		6.08	10.09	13.25
	Soya milk					
F7	152.0	75.08		133.0	177.0	180.20
F8	152.34	75.32		134.36	177.08	180.66
F9	152.15	75.44		134.36	177.75	182.56
F10	152.98	76.13		134.91	178.49	185.51
F11	154.24	76.79		136.11	179.12	188.09
F12	155.06	76.79		137.06	179.28	193.98

\*see Table (3) for details

Microbiological examination of skim and soya milk drinks with adding garden cress during storage periods were tabulated in Tables 7 and 8, the results showed that total bacterial count was decreased with increasing the ratio of garden-cress seeds. Mold and yeasts not detected in fresh samples, but number of colonies were found after storage for 14 days at 5+1°C .

The sensory evaluation of different milk drinks prepared using different ratios of garden-cress seeds powder showed that the

control samples had the highest scores for consumers (Table 9) .

It was observed that adding 1% of garden-cress seeds to skim and soya milk decreased the acceptability of samples more than the control. These results was due to the slight taste and odor while, the sample prepared with supplementation of garden-cress seeds powder at 4% had the highest overall acceptability compared with control samples.

**Table (7): Effect of adding garden-cress seeds powder on microbiological parameters of skim milk drink. Fresh and during storage after 7 and 14days at 5+2°C**

Treatments	Storage Period(days)	Total count (10 <sup>7</sup> )	Lactic Acid(10 <sup>7</sup> )	Mold&Yeast (10 <sup>2</sup> )	E.coli(10 <sup>1</sup> )
F1	0	15.5	6.5	N.D	N.D
	7	19.0	8.5	1.0	N.D
	14	17.5	9.0	9.0	N.D
F2	0	8.5	5.0	N.D	N.D
	7	12.0	6.0	7.0	N.D
	14	9.5	8.0	9.0	N.D
F3	0	10.5	3.0	N.D	N.D
	7	11.5	3.2	2.2	N.D
	14	9.5	3.5	3.0	N.D
F4	0	7.5	4.3	N.D	N.D
	7	10.0	5.0	9.0	N.D
	14	8.0	6.0	10.0	N.D
F5	0	6.5	3.5	N.D	N.D
	7	8.0	4.0	6.0	N.D
	14	5.5	5.0	7.0	N.D
F6	0	5.0	3.5	N.D	N.D
	7	6.0	4.0	4.0	N.D
	14	4.5	4.5	5.0	N.D

N.D : Not detected

\*see Table (3) for details

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**Table (8): Effect of adding garden-cress seeds powder on microbiological parameters of skim milk drink. Fresh and during storage after 7 and 14days at 5+2°C**

Treatments	Storage Period(days)	Total count (10 <sup>7</sup> )	Lactic Acid(10 <sup>7</sup> )	Mold&Yeast (10 <sup>2</sup> )	E.coli(10 <sup>1</sup> )
F7	0	14.0	7.0	N.D	N.D
	7	2.0	7.5	7.5	N.D
	14	17.5	9.0	9.0	N.D
F8	0	8.0	4.5	N.D	N.D
	7	12.5	6.0	7.0	N.D
	14	10.0	7.5	8.5	N.D
F9	0	9.0	2.0	N.D	N.D
	7	12.0	2.2	2.5	N.D
	14	10.5	2.5	3.0	N.D
F10	0	7.5	4.0	N.D	N.D
	7	9.0	5.0	8.0	N.D
	14	7.0	6.5	9.5	N.D
F11	0	6.0	9.5	N.D	N.D
	7	7.5	9.0	6.0	N.D
	14	5.0	5.0	7.0	N.D
F12	0	5.0	3.0	N.D	N.D
	7	5.5	3.5	4.0	N.D
	14	4.0	4.0	5.0	N.D

\*see Table (3) for details

**Table (9): Sensory evaluation of skim and soya milk drink with garden-cress**

Skim milk drink					
Treatments	Color (10)	Odor (10)	Taste (10)	Texture (10)	Appearance(10)
F1	10.0 <sup>a</sup> ± 0.78	10.0 <sup>a</sup> ± 0.48	19.0 <sup>a</sup> ± 0.42	9.0 <sup>a</sup> ± 0.51	10 <sup>a</sup> ± 0.32
F2	7.0 <sup>b</sup> ± 1.03	8.0 <sup>b</sup> ± 1.25	8.0 <sup>bc</sup> ± 1.05	9.0 <sup>b</sup> ± 1.08	9.0 <sup>b</sup> ± 1.10
F3	7.0 <sup>b</sup> ± 1.62	7.0 <sup>b</sup> ± 0.97	7.0 <sup>b</sup> ± 0.82	8.0 <sup>b</sup> ± 1.10	8.0 <sup>b</sup> ± 0.85
F4	6.0 <sup>b</sup> ± 0.85	6.5 <sup>b</sup> ± 1.32	6.0 <sup>bc</sup> ± 0.69	8.0 <sup>b</sup> ± 0.85	8.0 <sup>b</sup> ± 1.35
F5	8.0 <sup>b</sup> ± 1.39	8.5 <sup>bc</sup> ± 1.71	8.0 <sup>c</sup> ± 1.13	9.0 <sup>b</sup> ± 0.78	9.0 <sup>b</sup> ± 1.34
F6	6.0 <sup>b</sup> ± 1.23	5.5 <sup>bc</sup> ± 1.35	6.0 <sup>c</sup> ± .99	6.0 <sup>b</sup> ± 1.37	7.0 <sup>b</sup> ± 1.47
LSD	1.04	1.11	0.79	0.88	1.03
Soya milk					
Drink					
F7	8.0 <sup>a</sup> ± 1.59	8.0 <sup>ab</sup> ± 1.96	9.0 <sup>a</sup> ± 1.52	9.0 <sup>a</sup> ± 1.37	9.0 <sup>a</sup> ± 1.96
F8	7.0 <sup>a</sup> ± 1.52	6.0 <sup>ab</sup> ± 0.99	8.0 <sup>a</sup> ± 0.95	7.0 <sup>a</sup> ± 1.16	8.0 <sup>a</sup> ± 1.08
F9	7.5 <sup>a</sup> ± 0.71	6.0 <sup>a</sup> ± 0.96	7.0 <sup>a</sup> ± 1.25	6.0 <sup>a</sup> ± 0.99	8.0 <sup>a</sup> ± 0.82
F10	7.5 <sup>a</sup> ± 0.95	6.0 <sup>ab</sup> ± 1.45	7.0 <sup>a</sup> ± 1.43	6.0 <sup>a</sup> ± 1.03	7.0 <sup>a</sup> ± 1.23
F11	8.0 <sup>a</sup> ± 0.94	7.0 <sup>b</sup> ± 1.25	8.0 <sup>a</sup> ± 1.32	7.0 <sup>a</sup> ± 1.26	9.0 <sup>a</sup> ± 1.43
F12	6.0 <sup>a</sup> ± 1.08	5.5 <sup>b</sup> ± 1.59	6.0 <sup>a</sup> ± 1.29	6.0 <sup>a</sup> ± 1.05	6.0 <sup>a</sup> ± 1.26
LSD	1.06	1.27	1.03	1.21	1.20

see Table (3) for details \*



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### المخلص العربى

الهدف الاساسى من هذا البحث دراسة الحصول على مشروب لبنى صحى سهل الهضم سريع التداول مدعم بحب الرشاد . ينمو نبات حب الرشاد فى الهند و شمال امريكا و بعض اجزاء من اوربا . تحتوى البذرة الكاملة على خصائص صحية لذا يمكن ان تعمل هذه البذور كاغذيه وظيفيه كما تحتوى ايضا على نكهة وطعم مميز ، كما تعتبر بذور حب الرشاد غنية بالبروتين و الكربوهيدرات و بعض المعادن الهامة مثل الكالسيوم و الحديد و الفوسفور و الالياف الغذائية . فى هذا البحث تم استخدام لبن فرز و لبن صويا لعمل مشروب باضافة البذور المطحونة من حب الرشاد بنسب مختلفة ( ١ - ٥ % ) للحصول على افضل نسبة اضافة مقبولة . وتشير النتائج الى زيادة نسب البروتين و الدهن و الرماد ، كما وجد ان اضافة بذور حب الرشاد المجفف ادى الى زياده نسبة البوتاسيوم و الماغنسيوم فى كلا من اللبن الفرز و لبن الصويا ، بينما زادت نسبة الكالسيوم فى لبن الصويا و الحديد فى اللبن الفرز . و قد اذت اضافة بذور حب الرشاد الى زياده نسبة فيتامين C و فيتامين A فى كلا من اللبن الفرز و لبن الصويا . و كذلك لوحظ زيادة الفلافونويد فى لبن الصويا . اظهرت نتائج التحليل الميكروبي انخفاض العد الكلى للبكتيريا فى كلا من اللبن الفرز و لبن الصويا خلال التخزين لمدة ١٤ يوم . سجلت الخصائص الحسية اعلى درجات القبول للمظهر و القوام و الطعم و اللون و الرائحة فى عينات اللبن التى اضيف اليها نسبة ٤ % من بذور حب الرشاد المجفف .