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From Forgotten Superfood to Functional Jelly: Harnessing the Nutritional Power of Garden Cress Seeds

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ABSTRACT:The demand for nutracuetical is increasing day by day. Nutraceutical products are recognized not only for their better health outcomes to reduce the risk of cancer, heart diseases, cataracts, menopausal symptoms, insomnia, anaemia, bronchial asthma and gastrointestinal problems. GC/Garden cress seeds acts as a superfood that promote overall health and well-being by providing ample nutrition. It is a good source of iron, calcium, potassium and vitamins that are required to maintain the homeostasis of our body. GC seeds are also known to have anti-inflammatory, anticancer, antiasthma and antibacterial activities. This article focuses on preparation of GC seed jellies as a nutraceutical. People of diverse age groups will be able to consume this nutraceutical, thus increasing patient compliance.

KEYWORDS: Garden cress seeds,Jellies, Anticancer, Nutraceutical, Chandrashura.

I. INTRODUCTION

Malnutrition as a whole encompasses all nutrition imbalance related disorders including obesity. It is a serious global threat that has apprehended both underdeveloped and developed nations in its vicious claws. According to the latest WHO fact sheet around 890 million people (<18 years of age) have been affected with obesity. Around 390 million are found to be below the specified weight limit. 50% deaths of children under 5 years of age have occurred due to undernutrition [1]. Therefore, the need for nutraceuticals has become even more eminent than before. The nutraceutical market has crossed the 500 billion mark as of 2024 and is expected to cross the 900 billion mark till 2030 [2] Simple nutraceutical preparations have become popular not only for their patient compliance but also for their natural source. Diversified preparations like candies, jellies, powders, chyavanprash etc have become mainstay formulations. Jellies can be a good choice to target patients of all ages and fortification with essential nutrients. For example, a medicated jelly augmented with Ajwain and Glycyrrhiza has been developed and is favourable for patients having issues with swallowing [3].

Lepidium sativum is an annual herbaceous plant titled as Chandrashura in Indian Ayurvedic pharmacopeia. Garden cress seeds (GSC) can be a viable selection for fortifying jellies with rich macronutrient as well as micronutrient reserves exhibiting multifarious healthcare applications. It is a potential prebiotic due to its specific polysaccharide content and has been leveraged by multifarious traditions across the globe [5]. Indians use it for anaemic disorders and lactogenic supplement, Arabs expend it for maternal recovery support, Germans use it as a diuretic tea and Europeans use it to ease coughing.

Table 1: Overall chemical constituent content in garden cress seed [6]

Constituent	**Amount**
Moisture	7.05 %
Protein	19.73 %
Fat	14.15 %
Carbohydrate	35.45 %
Fibres	18.79 %
Potassium	2955g/100g
Phosphorous	947.32mg/100g
Magnesium	322mg/100g
Phenols	157.24mg/g
Flavonoids	75.01mg/g
MUFA	46.8 %

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PUFA	37.6 %
Ash	4.8%

Out of the total protein content of GCS, almost 98% is composed of essential amino acids with glutamic acid being most abundant 19.33g/100g protein, followed by aspartic acid 9.76g/100g protein. Leucine and valine are approximately 8g/100g protein [5]. GCS seeds are a source of fatty acids mainly oleic acid, linolenic acid, arachidicacid,eicosaenoic acid. GCS oil is mostly composed of fatty acids, tocopherols and carotenoids. α, β, γ tocopherols are present in the concentration range of 286-327 µmol/100 g , higher amounts observed in Soxhlet extracted oil. β - Carotene, zeaxanthin, Lutein are the commonly found carotenoids with their total content ranging in between 0.7-1 µmol/100 g [7].

Apart from possessing the mentioned bioactivities as per figure 1, GCS also has antithrombotic, neuroprotective, anti-anaemic, anti-asthama,demulcent, carminative, galactagogue and bone fracture healing properties. [8,9,10] Presence of rutin in GCS primes it with antithrombotic and neuroprotective effects. We therefore propose the preparation of GCS and GCS oil jellies as a supplement to tackle macronutrient as well as macronutrient deficiencies and act as a protective agent to prevent and help as an adjuvant in various disorders.

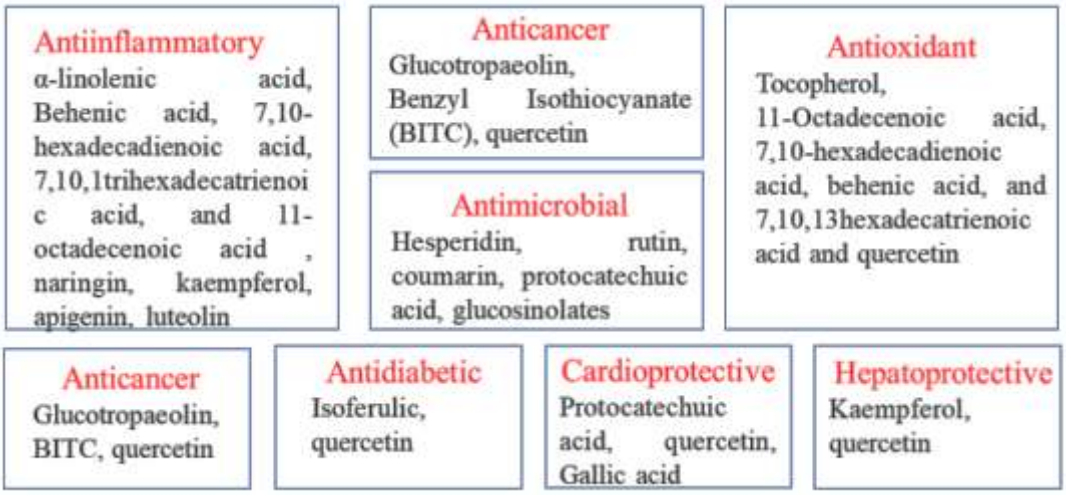

Figure 1: Chemical constituents and their role in various bioactivities exhibited by GC[5]

II. METHODS AND MATERIALS

Materials: Lepidium sativum seeds and other ingredients were obtained from the local market**.**

III. EXPERIMENTAL

Extraction of garden cress oil (GCS oil)

Soxhlet extraction of garden cress seed was carried out using ether and hexane as solvent for extraction. The heating mantle was used to maintain temperature of 30-50°C. The operation went on for almost one hour until the thimble portion of the apparatus got colourless.

Preparation of Jelly

The formulation is being prepared by altering the composition of ingredients so as to produce the best possible formulation. Jellies were made using GCS as well GCS oil. Different formulations of jelly were prepared by using different gelling agents in different concentrations as per given in the Formulation table 3. Various concentrations of the gelling agents were tried initially at to achieve desired appearance, stiffness and release. The jellies are prepared by taking the gelling agent, propylene glycol, citric acid in a beaker and heated with continuous stirring to get solution form. Sweetening and flavouring agents were added at the end and mixed thoroughly. The dispersion was transferred into moulds to avoid exposure to the outer environment. The formed jellies were wrapped in wax paper and stored in a dry place.

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Ingredients	F1	F2	F3	F4	F5	F6
GC seeds	0.375g	0.375g	0.375g	0.375g	0.375g	0.375g
Gelling agent	0.4g (Agar)	0.2g (Gelatin)	0.6g(Pectin)	3g (Pectin)	0.3 (China grass)	0.3g (Carrageenan)
Citric acid	0.1g	0.1g	0.1g	1.5g	0.2g	0.2g
Propylene Glycol	0.3ml	0.3ml	0.3ml	4.5ml	0.1ml	0.1ml
Sugar syrup	6ml (honey)	6ml (honey)	6ml (honey)	4.5ml (honey)	6ml (liquid jaggery)	6 ml (honey)
Methyl paraben	1 drop	1 drop	1 drop	1 drop	1 drop	1 drop
Vanilla	1 drop	1 drop	1 drop	1 drop	1 drop	1 drop
Water	sq.	qs	qs	qs	qs	qs

Table 3: Formulation Table (GCS seeds jellies)

Figure 2: Preparation of Jelly

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Table 4: Formulation Table (GCS Oil jellies)

Ingredients	**PECTIN**	**PECTIN + CARRAGEENAN**	**PECTIN+GELATIN**
GC seed oil	2-3 drops	2-3 drops	2-3 drops
Gelling agent	0.3g pectin	0.3gpectin+0.3g carrageenan	0.3g pectin + 0.3gelatin/ 0,5g pectin+0.5g gelatin
Citric acid	0.1g	0.1g	0.1g
Propylene glycol	1ml	1ml	1ml
Sugar syrup	7ml (honey)	7ml	3.3ml
Dextrose	Not used	Not used	0.33g(0.3g pectin+0.3g gelatin)
Honey, water	qs	qs	qs

Evaluation of the jellies: The evaluation of includes physical appearance, homogeneity, pH measurement and stability studies.

Physical appearance: The prepared jellies were evaluated for colour, odour, texture, stickiness, grittiness, clarity and consistency.

pH: The stability of the jellies is influenced by pH of the formulation. 0.5g of jelly was dispersed in 50 ml of distilled water ad pH was measured with digital pH meter.

Stability studies: Stability studies of the prepared jellies were carried out at storing the formulation at room temperature. Various parameters like appearance, pH ad stiffness were monitored..

IV. RESULT AND DISCUSSION:

The results of the evaluation tests were reported in table:

Formulation	**F1**	**F2**	**F3**	**F6**	**F5**
Clarity	Not clear	Clear	Clear	Clear	Clear
Colour	Whitish yellow	Yellow	Yellow	Yellow	Yellow

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Consistency	Dry viscous	Thick	Melting at room temp	Jelly structure	Jelly structure
Stickiness	Not sticky	More sticky	Sticky	less sticky	Less sticky
Grittiness	Not gritty	More gritty	Not gritty	Not gritty	Not gritty
pH	6.80	6.30	3.61	6.90	6.80

Table 5: Evaluation of jellies with GCS

Formulation F4 was failed the jellies formed were very hard and had strong odour. F5 and F6 had comparable physical characteristics. Sugar syrup is replaced with hone and liquid jaggery to enhance nutritional values. Liquid jaggery is rich in minerals like iron, calcium, and magnesium, and also a good source of antioxidants. It's known to boost immunity, aid digestion, and potentially purify blood [11]. Honey is also a good source of antioxidant. It helps to reduce cholesterol levels [12]. The combination of these sweeteners with GCS may have synergistic effect and enhance its nutritional value.

Table 6: Evaluation of jellies with GCS oil

Formulation	**F6**	**F7**	**F8**
Clarity	Not clear	Clear	Clear
Colour	Whitish yellow	Yellow	Yellow
Consistency	Dry viscous	Thick	Jelly structure
Stickiness	Not sticky	More sticky	less sticky
Grittiness	Not gritty	More gritty	Not gritty
pH	6.80	6.30	6.90

Formulation F8 was found out to be optimum formulation for GCS oil jellies. To have a correct consistency the sugar syrup was partially replaced with dextrose powder.

The pH of jellies was monitored over a period of at room temperature to evaluate the stability of jellies. pH is the most important factor that affects the stability of jellies.

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Table 7: pH and stability

	F3	F1	F2	F6	F5	F8
Freshly prepared	6.80	6.30	3.61	6.90	6.80	6.90
After 24 hours	4.16	6.30	3.6	6.65	7.12	5.65
Stability of jellies over 30 days	Dry viscous did not retain jelly structure	Thick, jelly structure retained	Melting at room temperature	Jelly structure retained	Jelly structure retained	Jelly structure retained

GC seed jellies Vs GC seed oil jellies

The GC seed when added to the formulation may not get homogeneously dispersed in the formulation if not mixed properly. A better alternative to this can be the use of GCS oil which disperses homogeneously throughout the jelly. Dose calculation harder in case of GCS but easier in case of GC seed oil. But swelling of seeds increases the stability of the jelly and makes the jelly retain its structure. The biggest disadvantage of GCS oil is that it lacks the swelling property of seed thus making the formulation difficult. The GCS during the formulation heating procedure swell even more whereas the GCS oil on the other hand will probably degrade due to excessive heating procedure and may not have desired nutritional value. All fatty acids flavonoids and compounds like phenylacetonitrile, sabinene, tocopherol, cineole, limonene, thujone, delta-5-avenasterol, furfuranol are oil soluble howeer amino acids like aspartic acid, histidine, glutamic acid, serine and also tannins, glucosinolates, cardiac glycosides are not oil soluble [51, 52, 53]. Hence, the GCS jellies will be of more nutritional value as compared to CS oil jellies. GCS jellies are more stable than GS oil jellies due to stability of oil.

V. CONCLUSION

Consuming GCS have many health benefits and often used as remedy for anaemia, inflammation, asthma and blood purifier. It also shows antioxidant,diuretic,antidiarrheal, hepatoprotective, anti-inflammatory,anti-hyperglycemic and lipid-lowering effects. GCS is used in various functional foods.

GCS and GCS oil jellies both contain the required nutrients, heavily fortified with flavonoids, MUFA and PUFA etc which are responsible for antioxidant, anti-inflammatory and anti-anaemic properties. These two formulations also provide and fulfil a person's daily intake of vitamins and all essential minerals. The jellies have better patient compliance and have the potential to help as an adjuvant therapy supplement in various diseases such as anaemia, diarrhoea, diabetes and inflammatory diseases.

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