



Formulation and Evaluation of Chewable-Gummies Gelatin based Stem Extract *Cissus Quadrangularis*.

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ABSTRACT:

This research paper investigates the formulation and characterization of chewable gummies enriched with *cissus quadrangularis* extract, renowned for its potential health benefits like source of calcium, phosphorus and bone fracture correction properties. The study focuses on optimizing the gummy matrix to encapsulate the bioactive compounds of *c. quadrangularis* while ensuring palatability and stability. Various formulation parameters, including gelling agents (gelatin), sweeteners, and flavouring agents, are systematically studied to enhance taste, texture. The results contribute to the development of innovative oral dosage form offering a convenient and enjoyable way to incorporate *c. quadrangularis* as a medication in bone related issues.

Introduction:

Nowadays, CGTs have been developed as nutraceuticals products since these are easier to swallow or chew compared to other dosage forms like tablets or capsules. Therefore, they are widely used in paediatrics, geriatric, and patients with swallowing problems. Chewable gummy tablets (CGTs), also known as a gummy confection or confectionary gel, consist of sucrose or syrup combined with a gelling agent such as gelatin, gum or pectin. Other excipients can be added to this formulation, including colouring agent, flavour and acidulant. This study is about the formulation of gelatin-based gummies of the *cissus quadrangularis* resulting optimal concentrations of gelatin for this purpose, i.e., 8, 9, and 10%. These results imply that the solubility, gumminess, texture increase with the concentration of gelatin. The development of CGTs supplemented by herbal ingredients is promising. *Cissus quadrangularis* Linn. is a natural source of herbal ingredient potential to be developed into CGTs since it contains alkaloids, steroids, vitamins, terpenes, glycosides, polyphenols etc.

Materials and method:

Plant profile: *cissus quadrangularis* the perennial or annual climbing herb green coloured leaves with buff coloured stem having greenish white small flowers. It is also known as Kandvel in Marathi, Hadjod in Bengali and Asthisamdhani in Sanskrit. It is also known as veld grape belongs to family Vitaceae. The dried stem powder is used for the formulation.

Materials:

The main material used in this study was *cissus quadrangularis* Linn. stem powder. The other excipients used were pharmaceutical grade or food-grade Mannitol, sucrose, propylene glycol, citric acid, sodium benzoate, olive oil lemon flavour, and the colouring agent. The tools and instruments used were digital weighing balance, glass beakers, thermometer, jelly mold, vernier calliper.

Method:

Soxhlet extraction:

Extraction of CQ stem powder was done with 95% of ethanol which is effective against the bone fracture, osteoporosis, and arthritis etc. stem powder was



extracted with 95% of ethanol. The extraction process allows to run for 8 hours. After 8 hrs the extract was cooled and allow to heat in hot water bath for isolating the solid powder from the extract.



Soxhlet apparatus

- **Formulation table for gelatin based *Cissus quadrangularis* chewable gummies:**

Ingredients	F1	F2	F3
CQ extract	200mg	200mg	200mg
Gelatin	500mg	600mg	700mg
Mannitol	1gm	1gm	1gm
Sucrose	3.5gm	3.5gm	3.5gm
Citric acid	100mg	100mg	100mg
Sodium benzoate	50mg	50mg	50mg
Propylene glycol	400mg	400mg	400mg
Lemon flavour	400mg	400mg	400mg
Coloring agent (red)	1mg	1mg	1mg
Olive oil	0.4ml	0.4ml	0.4ml
Purified water	q.s.	q.s.	q.s.

Procedure:

- The CQ stem powder moistened with propylene glycol in a 1:5 ratio (w/w), followed by dispersing the moistened powder in 4 ml of purified water.
- An accurate amount of sucrose was dissolved in hot purified water (80°C) and continuously stirred in a glass beaker.

- Mannitol was mixed with olive oil, and then this mixture was added to the sucrose solution.
- Gelling agent (gelatin or pectin) was added to the mixture gradually and uniformly while stirred continuously until homogenous dispersions were observed. Subsequently, propylene glycol was added to the mixture while stirred continuously.
- Citric acid, sodium benzoate, lemon flavour and colouring (red) agent were dissolved separately in hot water, and then there salted solutions were first mixed before being added to the previous mixture with continuous stirring at 80°C.
- When the temperature of the mixture reached 60°C, the dispersed CQ stem powder was poured gradually into the mixture then stirred homogeneously for 10 minutes. The mixture obtained was then poured into the jelly mold and stored in an airtight container at room temperature (25–30°C) for 24 hours to harden to CGTs.
- These CGTs were then and stored in an air tight jar for further analyses, including physical characteristics evaluation.

Results and discussion:

- **Chemical analysis of Hadjod stems powder:**

Parameters Studies	Result/100mg
Ash value %	11.88 ± 0.006
Water soluble leach %	6.52 ± 0.04
Acid insoluble leach %	5.70 ± 0.004
Moisture content	4.8
Protein	17.5
Fat	10.3
Crude fibre	3.5
Carbohydrates	5.2

- **Mineral profile of Hadjod stems powder:**

Minerals	Per cent Composition (mg per 100mg)
Calcium (Ca)	3.33
Phosphorus (P)	0.2
Potassium (K)	0.9
Zinc (Zn)	0.866
Magnesium (Mg)	1.49
Iron (Fe)	735.55



- **Average weights and measures:** Average weight=sum of weight of all tablets/no. of tablets

Batches	Average weight (mg)
Batch F1	2.29
Batch F2	2.46
Batch F3	2.64

- **Physical characteristics:** The prepared cissus quadrangularis CGTs were observed organo lepticly for color, taste, shape, texture.

Organoleptic characters	Results
Color	Red
Taste	Sweet
Shape	Circular
Chewiness	Easily Chewable
Texture	Elastic

- **Tablet Dimension Test:**

Batch F1	Batch F2	Batch F3
Diameter:1.9cm	Diameter:1.9cm	Diameter:1.9cm
Thickness(mm):	Thickness(mm):	Thickness(mm):
1] 0.7	1] 0.7	1] 0.7
2] 0.6	2] 0.7	2] 0.6
3] 0.5	3] 0.6	3] 0.7
4] 0.7	4] 0.6	4] 0.7
5] 0.6	5] 0.5	5] 0.6
6] 0.7	6] 0.7	6] 0.7
7] 0.4	7] 0.5	7] 0.7
	8] 0.6	8] 0.7
	9] 0.7	9] 0.6
Average=0.6	Average=0.622	Average=0.666

- **Swelling ratio test:**

A simple method of determining the water absorption capacity of a gel structure. The CGT from each formulation was first weighed then immersed in 100 ml

of purified water. Before the second weighing, the remaining water on the tablet's surface was removed using filter paper. The swelling ratio was calculated by dividing the weight difference between before and after immersion by the initial tablets weight.

Swelling ratio=initial weight –final weight (%)

Batches	Initial weight (mg)	Final weight (mg)	Swelling ratio (%)
Batch F1	2.27	0	0.0227
Batch F2	2.77	2.61	0.0016
Batch F3	2.61	2.04	0.0057

- **Dispersion Time Test:**

The dispersion test was performed using a flask that contained 100 ml of purified water at 37°C. The CGT from each formulation was placed in the flask and constantly stirrer during a magnetic stirrer. The time it took for it to disperse completely was observed. The standard requires a dispersion time of 10–30 minutes for CGTs.

Batches	Dispersion time (minutes/seconds)
Batch F1	5 :47
Batch F2	8:26
Batch F3	15:60

- **Syneresis Test:**

Syneresis occurs when water drains from a contracting or shrinking structure by extraction or expulsion, potentially reducing the CGT quality. This test was performed at room temperature ($25 \pm 5^\circ\text{C}$) by weighing the samples. First, an absorbent paper was attached to the surface of each tablet, and then the final weights of the preparations were observed. A significant difference between the initial and final weights indicates syneresis.

Batches	Initial weight(mg)	Final weight(mg)	Syneresis (%)
Batch F1	2.41	2.18	0.0023
Batch F2	2.89	2.39	0.005
Batch F3	2.48	2.12	0.0036



Conclusion:

The type and concentration of gelling agents and interaction between these two factors significantly affect the dispersion time, syneresis, gumminess, and chewiness of *Cissus quadrangularis* chewable-gummy tablets (CGTs). As the gelling agent, gelatin can produce CGTs with a more robust gel structure; hence, the gelatin-based CGTs have higher dispersion time and gumminess and chewiness values. CGTs developed using 6% gelatin and 7% gelatin are considered optimal formulations because these fulfill all the required physical characteristics for CGTs, show less syneresis during storage, and provide a better texture than the other formulation. This study prepared CGTs containing *Cissus quadrangularis* stem powder using gelatin within three different concentrations as gelling agent, the formulated gummies are circular in shape and are in red colour, lemony aroma and sweet taste. This homogenous appearance shows a positive impact on consumer perception and acceptance.

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