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Advancement and Interpretation Embodied Herbal Vitamin ‘C’ And Milk Thistle Nutraceutical Gummies

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Abstract

The present study focuses on the formulation and evaluation of nutraceutical gummies incorporating Silybum marianum (Milk Thistle) seed extract and herbal Vitamin C derived from guava fruit powder, designed to deliver antioxidant and hepatoprotective benefits in a palatable oral dosage form. Conventional dosage forms such as tablets and capsules often suffer from swallowing difficulties and reduced compliance; hence, a gelatin-based gummy matrix was developed as a patient-friendly alternative combining efficacy with sensory appeal. Four formulations (F1–F4) were prepared by varying the concentrations of S. marianum extract and water content. The optimized formulation utilized gelatin, sucrose, glucose, citric acid, and guava powder, which provided both flavor and Vitamin C enrichment. Evaluations included morphological characteristics, pH, moisture content, texture, microbial stability, and storage stability. Among all, formulation F3 demonstrated superior physical characteristics with optimal pH (4.0), desirable softness, non-stickiness, and absence of microbial contamination during a 20-day observation period. The combination of silymarin and herbal Vitamin C exhibited synergistic antioxidant potential, contributing to enhanced detoxification and skin health benefits. Overall, the formulation of Milk Thistle–Vitamin C gummies proved stable, pleasant, and safe, illustrating the feasibility of developing an effective antioxidant nutraceutical in gummy form. Future studies will emphasize quantifying antioxidant activity, bioavailability, and large-scale manufacturing feasibility.

Keywords: Milkthistle Powder, Guava Fresh Fruit, Guava Fruit Powder by Freeze Dried, Gelatin, Ascorbic Acid, Sucrose, Purified Water.

1. Introduction

Gummy is a Viscous or sticky in nature but reduction of sugar and healthier and some improved health characteristics to a product that usually is devoid of nutrition. Gummies can be used for masking agent and paediatrics as well as youngster. According to World, health organization depression is most common lifestyle disorder. The reduction of sugar and the addition of healthier ingredients in gummy jellies brings some improved health characteristics to a product that usually is devoid of nutrition. The

rapid absorption of medication through the buccal mucosa during chewing results in a quicker onset of action compared to traditional oral dosage forms. Any medication not absorbed through the oral mucosa is subsequently swallowed and enters the gastrointestinal tract for systemic absorption, ensuring a rapid and efficient delivery of the active ingredients. Gummy candies, popular among both children and adults, typically contain fruit extracts, sugars, gelatinizing agents, acids, flavours, and colourings. Studies have indicated that gummies exhibit lower bioavailability variability compared to tablets, leading to more consistent peak blood concentrations and faster absorption of active compounds. The origins of medicated gummies, particularly herbal medicated gummies, can be traced back to ancient civilizations that valued the healing properties of natural ingredients. Herbalism, deeply rooted in cultural practices and botanical knowledge, has been a longstanding tradition in medicine.14

Herbal gummies are unique medication delivery product that is designed to be either systematically absorbed through the oral mucosa or used locally to treat oral ailments. It contains a gum base with pharmacological active component. Herbal gum is thought to be a medicine delivery mechanism or a vehicle for delivering active ingredients that enhance nutrition and overall health; gums are portable medication administration on devices. Gum that is meant to be chewed but not swallowed in a cohesive soft substance. Gum base sweeteners softeners/plasticizers flavors colors and usually a hard or polyol coating make up modern chewing gum. Herbal gummies have emerged as a popular and convenient way to consume natural supplements. Unlike traditional pills or capsules, these gummies are infused with plant based extracts, vitamins, and minerals, offering a tasty and approachable alternative for supporting overall health and wellness. Herbal gummies are often marketed for a wide range of health benefits, including boosting immunity, reducing stress, improving sleep, and enhancing energy levels. Their growing popularity reflects a broader trend toward natural remedies and functional foods, as consumers seek more enjoyable and accessible ways to integrate herbal medicine into their daily routines. By bridging the gap between traditional herbal practices and modern convenience, herbal gummies represent and innovative step in the evolving field of natural health products.15

Advantages of Gummies:

Medicated gummies causes the mouth bite frequently, which improves facial blood flow and trainsthe muscles used for biting and chewing.

Medicated gummies are a convenient dosage form that can be easily consumed and making them an attractive option for individuals who have difficulty swallowing pills orcapsules.

Gummies resemble traditional candies and can be consumed discreetly, which is particularly beneficial for individuals who may feel stigmatized or uncomfortable taking medication in public

Medicine-infused gummies can be formulated to contain a wide range of active ingredients, including vitamins, minerals, and herbal extracts, allowing customization to meet individual health needs.

Gummies are often flavored, making them more palatable and enjoyable to consume compared to traditional medication forms.

When consumed orally, the active ingredients in gummies are slowly released into the bloodstream, leading to longer-lasting effects compared to other forms of medication

Disadvantages of Gummies:

Gummies can be difficult to cut or break into smaller doses, leading to potential inaccuracies in dosing.

The potency of gummies can vary depending on the manufacturing process, leading to inconsistencies in the amount of active ingredients present in each gummy.

The candy-like appearance and taste of gummies can increase the risk of overconsumption, particularly in children or individuals with impulse control issues.

The gelatin or pectin base used in gummies may not be compatible with certain drugs, leading to decreased efficacy or stability.

Gummies often contain high amounts of sugar, which can be problematic for individuals with diabetes or other health conditions.16

Ideal properties of gummies:

- Faster on set of action.
- Enhance absorption and bioavailability.
- Appearance should be good.
- Should have good taste.
- Should be stable.

Production of gummies:

In gummy production, gelling is the core process that gives gummies their chewy, jelly like structure. This involves forming a semi solid structure using gelling agents in the presence of water, heat and other ingredients like sugars, acids flavors and colors. Following are the main types of gelling methods used in gummy preparation based on the gelling agent:

1. Gelatin based method

2. Pectin based method

3. Agar based method

Gelatin based method:

Gelatin is very popular pharmaceutical and food ingredient. Gelatin is obtained by partial hydrolysis of insoluble collage originating from pigs, cows, fish etc.

Method:

 Gelatin is soaked in water to bloom.

 Heated to dissolve and mixed with sweeteners, acids and flavors.

 Poured in to molds and allowed to set at room temperature or refrigerated.

 Pectin based method:

Pectin is a purified carbohydrates obtained by aqueous extraction from citrus peel or apple pomace. Chemically pectin molecule comprises methoxy groups, carboxy groups and amide groups.

Method:

 Pectin is mixed with sugar and heated.

 Acid (usually citric acid) is added to trigger gelling.

 Mixture poured in to molds and cooled to set.17

 Agar based method:

Agar refers to a jelly – like substance derived from red algae that acts as a gelling agent and thickener.

Method:

 Agar is boiled in water to activate.

 Combined with sugars and flavors.

 Sets upon cooling at room temperature.

Glutathione:

Glutathione is a tri peptide (cysteine, glycine and glutamic acid) found in relatively high concentrations in many bodily tissues. It plays a pivotal role in reducing oxidative stress, maintaining redox balance enhancing metabolic detoxification and regulating the immune system.

Foods that promote Glutathione production:

These foods often certain surface a key ingredient in glutathione synthesis.

 Cruciferous vegetables:

Broccoli Brussels sprouts, cabbage and cauliflower are rich in sulfur compounds and gluco simulates that enhance glutathione production.

 Allium vegetables:

Garlic and onions are high in suffer supporting the body's natural production of glutathione.

 Eggs:

Contain cysteine an amind acid that is a glutathione precursor.

 Nuts and Legumes:

Provide key minerals and plans based protein along with glutathione precursor.

 Meat and Fish:

Unprocessed meats and fish contain glutathione precursor.

 Citrus fruits:

Oranges grape fruit and lemons are high in vitamin C which helps the body recycle and increase glutathione levels.19

Glutathione is a naturally occurring substance produced by the liver and found in fruits, vegetables and meat. It is synthesized by cells from three amino acids; cysteine ,glutamic acid and glycine.

Glutathione levels in the body can be depleted by several factors including poor nutrition, environment toxins and stress. Additionally, its level can decline with age.

Benefits of glutathione:

Depending on the method of use and the patient's purpose, glutathione offers different benefits,

specifically.

Oral glutathione for the treatment:

 Glaucoma and cataracts

 Preventing aging

 Treating and preventing alcohol addiction, asthama, heart disease, cancer, hepatitis, liver diseases that weaken the immune system.(including AIDS and chronic fatigue syndrome), memory loss, Alzheimer's disease, osteoarthritis and Parkinson's disease.

 Maintaining a healthy immune system and preventing metal and poisoning.20

Use of inhaled glutathione for treatment:

 Lung infections including cystic fibrosis, idiopathic pulmonary fibrosis and lung disease

in individuals with HIV.

Intravenous glutathione for treatment:

 Male infertility.

 Preventing dangerous side effects of cancer treatment.

 Preventing fatigue and anemia in patients with kidney disease undergoing dialysis.

 Preventing kidney problems after heart surgery.

 Treating Parkinson's disease.

 Improving blood flow and reducing blood clots in people with altherosclerosis.

 Treating diabetis.

 Preventing dangerous side effects of chemotherapy.

Mechanism of action of glutathione:

Glutathione is involved in numerous biological processes including tissue building and repair and the production of essential chemicals and proteins for the body and immune system. As a powerful antioxidant, glutathione is essential for maintaining healthy cells. It acts like a magnet attracting free radicals. Heavy metals and toxins absorbed daily through the skin, breath, water and food stimulating steir elimination from the body and keeping the body health. Glutathione is not only produced naturally by the body but can also be recycled. If glutathione cannot be recycled. The body becomes overloaded with toxins leading to an imbalance. Glutathione whitens skin by reducing the tyrosinase enzyme's activity, a key player in melanin production and shifting melanin synthesis from dark eumelanin to lighter phaeomelanin.21

Tyrosinase inhibition:

Glutathione directly inhibits the tyrosinase enzyme, an essential component in melanin synthesis.

 Chelating copper: The thiol group of glutathione binds to the copper ions in tyrosinase's active site, preventing function.

 Interfering with transfer: Glutathione can block the transport of tyrosinase to premelanosomes, the cellular compartments where melanin is made.

 Antioxidant effects: By neutralizing free radicals and peroxides that can induce tyrosinase activity, glutathione indirectly reduces melanin synthesis.

Mechanism of action of glutathione

Glutathione dosage:

Glutathione comes in two forms.

 Powder form

 Sachet form

The dosage glutathione depends on the purpose of use, age, health condition and other factors of each individual. Taking glutathione for skin whitening differs from taking it for disease prevention and treatment. 22

 Glutathione dosage for skin whitening(oral):

For the first 3 months, you can take approximately 1000mg -2000mg of glutathione, then reduce it to 500mg per day.

 Glutathione dosage to support cancer treatment(oral):

To support cancer treatment patients can supplement with glutathione to protect the body from the dangerous side effects of chemotherapy.

Taking 1000mg of glutathione daily helps protect kidney cells and nerve cells from the toxic effects of chemotherapy (cisplatin, coxaplatin, cyclophosphamide etc)

Taking 500-1000mg/day, helps improve and restore health and prevent fatigue in cancer patients.

Side effects of glutathione:

A diet rich in foods high in glutathione does not pose any health risks. However not everyone can supplement with glutathione. It is best to consult your doctor to determine if it is right for you.

When using glutathione, you may experience the following side effects.

 Abdominal cramps

 Bloating

 Difficulty breathing due to bronchial spasms

 Allergic reactions such as rash

 Uneven skin tone

 Skin sensitivity

 Mild and temporary pain and redness

Precautions before using glutathione:

 Before using glutathione, you should consult doctor if you are in the following conditions.

 Pregnant or breastfeeding

 Using other medications

 Allergic to any substance in glutathione or other drugs, herbs

 Have other medical conditions 23

AIM AND OBJECTIVE:

AIM

The main aim of the present work is **to formulate, develop, and evaluate medicated gummies using the seed extract of *Silybum marianum*** with the purpose of delivering natural antioxidants beneficial for maintaining and protecting skin health. The research focuses on transforming the phytoconstituents of *Silybum marianum*—notably flavonolignans and flavonoids—into an acceptable and stable oral dosage form in the form of chewable gummies that combine efficacy, palatability, and convenience.

This study is driven by the growing need for novel nutraceutical delivery systems that improve patient compliance while ensuring stability and bioavailability of herbal actives. Traditional *Silybum marianum* preparations such as powders, capsules, or tinctures often face limitations such as poor taste, low adherence, and degradation of active compounds. By formulating medicated gummies, this project intends to bridge the gap between conventional dosage forms and consumer-friendly functional foods. The research further aims to establish a scientific basis for incorporating *Silybum marianum* seed extract in a gummy matrix through systematic formulation optimization and physicochemical evaluation.

In essence, the project seeks to design an innovative, stable, and consumer-acceptable antioxidant gummy supplement that not only demonstrates good physical characteristics but also retains the phytochemical integrity and biological activity of *Silybum marianum* extract. This work could serve as a foundation for developing similar herbal or nutraceutical gummy products with therapeutic or preventive potential against oxidative stress-related skin aging and cellular damage.

OBJECTIVES

To fulfill the above aim, the present study is organized around the following specific objectives, each designed to contribute to the successful formulation and scientific validation of the medicated gummies:

1. To prepare and optimize medicated gummies incorporating

***Silybum marianum* seed extract.**

The first objective is to develop a series of gummy formulations using *Silybum marianum* extract as the active ingredient. The preparation process involves selecting a suitable gelling agent (gelatin or pectin), sweeteners, plasticizers, colorants, and flavoring agents to ensure uniform dispersion of the extract while maintaining desirable textural and sensory characteristics.

2. To ensure the antioxidant efficacy of the developed gummies for

skin protection.

The *Silybum marianum* seed extract is rich in silymarin complex—a mixture of flavonolignans known for potent free-radical scavenging and hepatoprotective effects, which also contribute to maintaining healthy skin. This objective focuses on evaluating the antioxidant potential of the extract and the final gummy formulations using established assays such as DPPH, FRAP, and total phenolic content estimation.26

3. To develop an ideal medicated gummy formulation with optimum

physical and sensory attributes.

A successful gummy product must exhibit appealing color, uniform size and weight, adequate hardness, and minimal stickiness. This objective addresses the optimization of formulation parameters to produce gummies with these ideal qualities. Organoleptic evaluation will assess color, odor, taste, and texture, while physicochemical tests—such as weight variation, thickness, moisture content, and pH—will quantify product uniformity. Achieving a formulation with both functional and sensory acceptability is key to patient and consumer adherence.

4. To identify, characterize, and quantify bioactive compounds in

***Silybum marianum* seed extract.**

The therapeutic potential of *Silybum marianum* largely depends on its bioactive constituents such as silybin, silydianin, silychristin, flavonoids, and small quantities of proteins and phenolics. This objective involves qualitative phytochemical screening to confirm the presence of these compounds, followed by quantitative analyses such as total flavonoid and phenolic content assays. Advanced analytical techniques like thin-layer chromatography (TLC), Fourier transform infrared spectroscopy (FTIR), and UV–visible spectrophotometry will be used to identify characteristic peaks and confirm chemical integrity. This step establishes the phytochemical fingerprint of the extract and helps in correlating composition with observed biological activity.

5. To evaluate the safety, stability, and quality of the formulated

gummies.

The formulated gummies will undergo stability testing under controlled environmental conditions to monitor changes in physical appearance, antioxidant activity, and assay content over time. Microbial limit tests will ensure the product meets acceptable safety standards for edible dosage forms. The aim is to confirm that the gummies remain stable, safe, and effective during storage, reflecting good manufacturing practice (GMP) standards suitable for nutraceutical applications.

6. To assess the efficacy of the developed formulation in comparison

with standard antioxidants.

This objective focuses on benchmarking the antioxidant performance of the optimized gummy formulation against known standards such as ascorbic acid or Trolox. Comparative analysis will determine relative efficacy and establish scientific credibility for the formulation’s antioxidant claims. Such evaluation will support potential positioning of the gummies as effective functional supplements for combating oxidative stress-related skin damage.

7. To contribute to the development of patient-friendly herbal dosage forms.

One of the broader objectives of this research is to demonstrate that gummies can serve as an innovative, patient-compliant delivery system for herbal extracts. The project emphasizes transforming a traditional plant-based medicine into a modern dosage form with improved palatability, stability, and acceptance, thus promoting better adherence among children and adults alike. This aligns with current trends in nutraceutical product design where consumer preference strongly influences therapeutic success.27

CHEMICAL COMPOSITION OF MILK THISTLE:

The active constituent of milk thistle seeds are three flavonolignans namely, silibinin, silichristin and silidianin

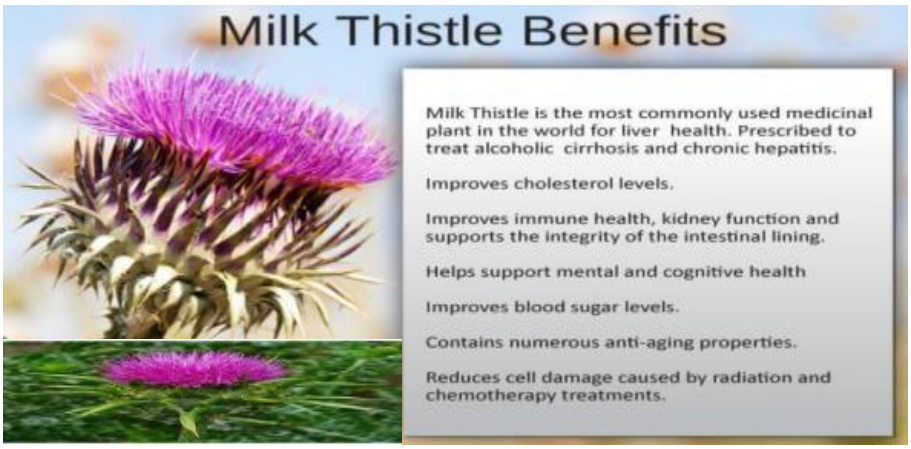
Which are collectively known as as silymarin extracted from milk thistle seeds.

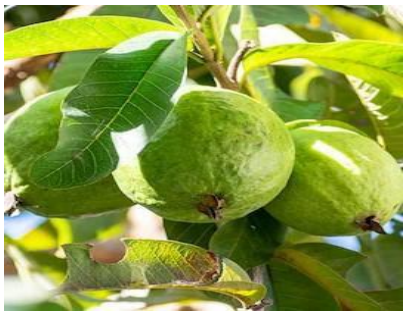
Carbohydrates: glucose, fructose and xylose

Minerals: potassium, calcium phosphorus, iron (Fe), zinc (Zn) and manganese.

Proteins: Amino acids

BENEFITS OF MILK THISTLE:





GUAVA FRUIT POWDER:

Biological Name: Psidium guajava

Family: Mytraceae

Other Common name: Guava, lemon guava, mubera

CHEMICAL COMPOSITION OF GUAVA FRUIT:

Key chemical constituents include Ascorbic acid and citric acid.

Minerals: Guava is a good source of iron, calcium, and phosphorus.

Organic acids: Ascorbic acid and citric acid are major components and contribute

to the fruit's antimutagenic properties.

Fibers and other nutrients: Guava is a good source of dietary fiber and contains proteins and essential amino acids.

Bioactive compounds:

Flavonoids: Includes quercetin, catechin,,and rutin.

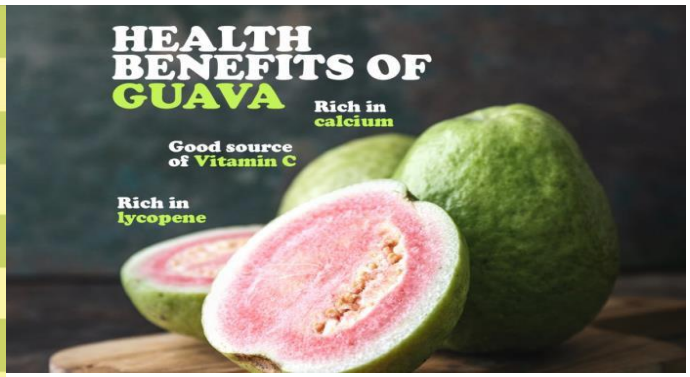
Tannins: A class of polyphenols found in guavas.

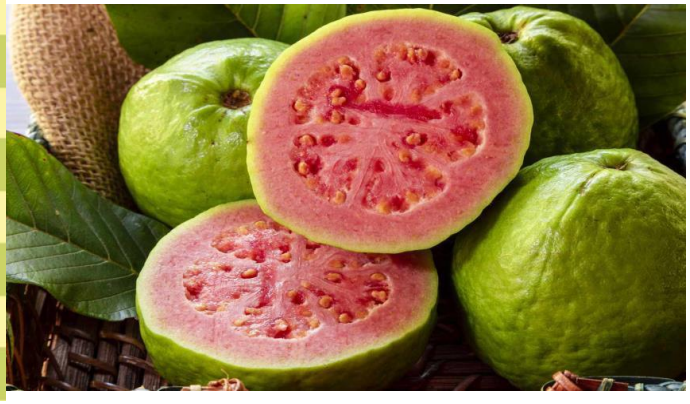
Other compounds: Saponins, lectins, and various fatty acids are also found in guava.

BENEFITS OF GUAVA FRUIT POWDER:

Guava is loaded with nutrients. Not only does it have more vitamin C than oranges, but guava is also rich in other antioxidants and has been shown to have a number of health benefits.

- Improves digestion
- Prevents cancer
- Stimulates brain function
- Maintains heart health
- Helps in weight loss
- Promotes skin health
- Boosts immunity
- Regulates thyroid function
- Maintains optimal blood circulation
- Relieves stress
- Lowers blood sugar level
- Maintains dental health
- Relieves cough and cold
- Reduces inflammation
- Enhances vision





AIM:

AIM & OBJECTIVES

To formulate and evaluate herbal nutraceutical gummies incorporating vitamin c and milk thistle extract for enhanced antioxidant and hepatoprotective [liver- protecting] benefits.

OBJECTIVES:

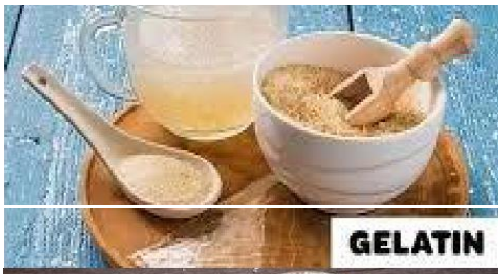
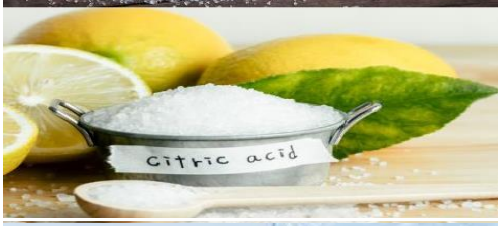
To prepare herbal gummies containing vitamin c and milk thistle extract using natural ingredients Identify natural ingredients and their health care benefits (antioxidant,anticancer,antidiabetic,anti-inflammatory)..

To ensure the antioxidant efficacy of the developed gummies for skin protection

To promote a convenient, palatable,and natural delivery system for daily nutraceutical intake.

Compare herbal vs synthetic nutraceutical gummies in terms of safety,efficacy,cost,quality,consumer preference and challenges(stability, shelf life)

DESCRIPTION OF MATERIALS AND EQUIPMENTS MATERIALS USED:

MATERIALS	USES	Figures
GELATIN EXTRACT [SILYMARIN]	GELLING AGENT ANTI OXICIDANT, ANTI CANCER	
SUCROSE	SWEETENER	
CITRIC ACID	PH ADUJUSTER	
PURIFIED WATER	SOLVENT	

METHODOLOGY

COMPARATIVE FORMULATION AND DEVELOPMENT:

SN NO.	INGREDIENTS	F1(W/W)	F2(W/W)	F3(W/W)	F4(W/W)
1.	MILK THISTLE POWDER	1GM	1GM	1GM	1GM
2.	GUAVA FRUIT POWDER	-----	1GM	1GM	1GM
3.	GUAVA FRUIT PULP	1GM	……	…..	….
4.	GELATIN	0.8GM	0.8GM	0.8GM	0.8GM
5.	SUCROSE	0.4GM	0.4GM	0.4GM	0.4GM
6.	CITRIC ACID	0.04GM	0.04GM	0.04GM	0.04GM
7.	PURIFIED WATER	15ML	10ML	5ML	5ML
8.	TOTAL WEIGHT	3.24gm	3.24gm	3.24gm	3.24gm

PREPARATION METHOD:

The following steps prepared the gummies:

In a clean container gelatin was soaked in half of the purified water. It is allowed to stand for 15-20 mins for proper hydration.

Milk thistle powder was dispersed in the remaining portion of the purified water.

Guava fruit powder and sucrose which have been weighed accurately. It is incorporated in the gelatin preparation along with milk thistle.

Now heat the mixture at 55 C temp until the required texture has been formed. Here we added the citric acid to adjust the pH of the mixture.

After this step gummies mixture poured in to the silicone moulds. Allow it for cool around 2-3 hours in refrigerator.

EVALUATION OF GUMMIES:

Morphological Evaluation :

Physical properties: The gummies were observed for the colour, odour and appearance.

Thickness :

The thickness of gummies were measured using Vernier caliper. The thickness of 5 gummies were checked.

pH determination:

The total pH of gummies were measured by using pH meter.

First the electrode of pH meter was washed through and dipped into the edistilled water to calibrate the pH. Then pH of gummy mixture was measured.

Moisture content:

one gummy was weighed and then crushed in a mortar and pestle. From the 1gm of the sample was weighed and dried for 24 hours in dessication. The sample was weighed after 24 hours.

	F1	F2	F3	F4
MOISTURE CONTENT	30%	25%	20%	20%

Stability testing:

Stability testing was performed at 50C at such temperature the gummies

started to melt. Meanwhile the gummies were stable at room temperature.

Microbial examination:

In the control medium growth of microorganism has observed and in the test medium minimal growth is produced. Which can be concluded by the proof of sterility of the formulation and antimicrobial of product.

RESULTS

Sr.No	Parameter	F1	F2	F3	F4
1.	COLOUR	YELLOWISH GREEN	BROWN	BROWN	BROWN
2.	ODOUR	FRUITY	FRUITY	FRUITY	FRUITY
3.	TEXTURE	STICKY	STICKY	NON STICKY	NON STICKY
4.	SHAPE	ROUND	ROUND	ROUND	ROUND

DISCUSSION

The formulated Nutraceutical gummies containing Silybum marianum seed extract were and guava fruit powder were evaluated for their physicochemical, morphological, and microbiological characteristics. The evaluation was aimed at identifying the most stable, effective, and consumer-acceptable formulation among four variations (F1–F4).

CONCLUSION

The present research successfully achieved the Advancement and Interpretation embodied herbal vitamin C and Milk thistle gummies containing Silybum marianum (Milk Thistle) seed extract in combination, designed to deliver potent antioxidant and hepatoprotective effects in an acceptable oral dosage form.

The study was undertaken to develop a nutraceutical product that is not only effective in combating oxidative stress but also convenient, palatable, and suitable for regular consumption. Four formulations (F1–F4) were prepared by varying the concentrations of the extract, glutathione, and excipients to determine the most suitable composition with optimal physicochemical and sensory attributes.

Among the prepared batches, formulation F3 emerged as the most stable and acceptable preparation based on comprehensive evaluation. It exhibited excellent physical characteristics including uniform

color, smooth texture, non-sticky surface, and pleasant flavor. The pH of the formulation remained within the ideal range for oral gummies, indicating good compatibility between the active ingredients and excipients.

Physicochemical tests such as weight variation, hardness, and moisture content demonstrated high uniformity and reproducibility, confirming that the formulation process was well-optimized. Microbiological analysis further confirmed that the gummies were free from bacterial and fungal contamination, establishing their safety for consumption.

Future investigations should emphasize in vivo evaluation to confirm bioavailability and therapeutic efficacy, as well as pilot-scale manufacturing studies to ensure large-scale reproducibility.

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