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Research Article

Formulation and Evaluation of Herbal Jam Containing *Chlorophytum Borivilianum* as Main Ingredient for Reproductive Health

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ABSTRACT

Reproductive health is a critical aspect of human well-being, often addressed through pharmaceutical means that may pose side effects and high costs. This study explores a natural and functional alternative by formulating a herbal jam incorporating *Chlorophytum borivilianum* (commonly known as Safed Musli), an Ayurvedic herb renowned for its aphrodisiac and adaptogenic properties. The jam was developed using a fruit pulp base (including Amla), natural sweeteners, and supportive herbs such as Ashwagandha and Shatavari. Phytochemical analysis confirmed the presence of key bioactives such as saponins, flavonoids, and glycosides. UV spectrophotometry and HPLC analysis validated the presence and concentration of saponins, a critical compound for reproductive health. Physicochemical testing showed favorable pH and moisture content, while sensory evaluation indicated acceptable taste, texture, and aroma. Animal studies using male Wistar rats demonstrated improved physical endurance and reduced fatigue in treated groups, supporting the formulation's efficacy. These findings highlight the potential of the herbal jam as a safe, palatable, and effective functional food product for enhancing reproductive health in both men and women.

INTRODUCTION

One essential component of human well-being is reproductive health. Contemporary pharmaceutical remedies can have negative side effects and are expensive. Traditional herbal medicine offers a natural alternative with fewer side effects and broad therapeutic potential.

Among the potent medicinal herbs, *Chlorophytum borivilianum* (commonly known as Safed Musli) has been recognized for its adaptogenic, aphrodisiac, and immunomodulatory properties [1]. Its designation as a 'Vajikaran Rasayan' in Ayurveda emphasizes its function in boosting sexual arousal and reproductive potential.

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Although Safed Musli has been used historically in a variety of ways, adding it to a tasty and practical food matrix like jam could greatly increase its acceptance and promote regular consumption, possibly optimizing its health-promoting advantages. The purpose of this study is to investigate a thorough approach to the creation of a herbal jam with *Chlorophytum borivilium* as the main active component [2]. Additionally, it aims to develop a thorough assessment plan that uses a variety of scientific techniques to thoroughly confirm the jam's possible advantages for reproductive health, taking into account both its effectiveness and safety features. This research tackles the problem of creating a tasty, shelf-stable delivery system by creating a herbal jam. For synergistic benefits, the reasoning combines complementing natural substances with Safed Musli's saponins and alkaloids [3].

1.1. Botanical Description and Distribution

The Asparagaceae family, which includes the perennial herb *Chlorophytum borivilium*, is a group of plants with a variety of therapeutic uses. Commonly known as Safed Musli in Hindi and various other vernacular names across India, this herb is predominantly found in the tropical wet forests of the peninsular Indian region. The plant is distinguished by its rosette of long, thin, lanceolate leaves that grow from a rhizome that is thick, fleshy rhizome [4]. The plant's cluster of fleshy, fascicled tuberous roots—often just called tubers—that grow straight from the stem disc are its most valuable component from a medical standpoint. These tubers are typically cylindrical in shape, ranging from 10 to 25 cm in length and 1 to 2 cm in diameter, with a straw-colored outer skin and a white interior after peeling. During the summer rainy season, the plant produces a solitary,

unbranched scape bearing small, usually white flowers arranged in alternate clusters [5]. It's interesting to note that *C. borivilium* has been found to have two different morphological types: an erect type, in which freshly formed leaves grow upward before spreading, and a prostrate or spreading type, in which leaves spread out from the stem disc right away. These variations can exhibit differences in leaf length, breadth, and the time taken to reach maturity, suggesting potential variations in their phytochemical composition and, consequently, their medicinal efficacy [6].

1.2 . Traditional Uses in Ayurveda and Other Systems of Medicine for Reproductive Health

The medicinal value of Safed Musli tubers has been recognized in ancient Indian medicine literature since at least the 11th century AD. It holds great respect in Ayurveda and is classified as a 'Vajikaran Rasayan', a unique class of herbs with aphrodisiac and revitalizing qualities, especially when it comes to sexual health and the enhancement of offspring. Traditionally, Safed Musli has been extensively used to address various male sexual health issues, including lack of libido, male impotency or erectile dysfunction, and oligospermia or low sperm count [7]. It is also frequently taken as a tonic to promote general health, as it is said to slow down the aging process and increase vitality in general. In addition to its uses for male health, Safed Musli has long been used to promote the reproductive health of women. It has been used to treat a variety of gynecological conditions, increase lactation in nursing mothers, and treat natal and postnatal issues. Celebrated as a 'white gold' or 'Divya Aushad' (divine medicine) in Ayurvedic literature, it is famous for its unmatched therapeutic capabilities and is an essential component of more than 100 Ayurvedic compositions [8]. Safed Musli—also known as



"Indian Viagra"—is becoming increasingly well-liked as a safe and natural substitute for synthetic medications for improving sexual function in both domestic and foreign markets as a result of growing scientific interest in natural aphrodisiacs. Its capacity to increase sperm count, motility, and general semen quality is a key component of its traditional use, supporting its potential to treat

male infertility. Additionally, there is growing evidence that it may help with menstruation symptoms and enhance physical aspects of female sexual health, like vaginal lubrication [9].

Table 1. Traditional Uses and Preparations of *Chlorophytum borivillianum* (Safed Musli)

Traditional Uses	Details	References
Aphrodisiac and Sexual Health	Used to enhance sexual performance, libido, and treat sexual dysfunction (e.g., erectile dysfunction, premature ejaculation). Stimulates the reproductive system and balances hormones.	[10][11]
For Men	Increases sperm count, improves semen quality, enhances sexual desire, boosts testosterone levels, and improves genital blood circulation.	[12][13]
For Women	Regulates hormonal balance, improves reproductive function, and addresses low libido and infertility.	[11][14]
Energy and Vitality	Acts as a powerful tonic to combat fatigue, weakness, and debility; improves endurance and vitality.	[15]
Adaptogenic Properties	Helps the body resist physical and emotional stress by supporting adrenal glands and maintaining hormonal balance.	[16]
Reproductive Health and Fertility	Promotes hormone regulation and improves the quality of eggs and sperm.	[17][18]
For Men	Enhances sperm production and quality, stimulates testes, increases semen volume, and improves sperm motility.	[12][19]
For Women	Regulates menstrual cycles, treats amenorrhea, and enhances ovarian function to improve fertility.	[18][19]
General Health and Immune System Support	Improves overall health, prevents illness, and supports natural healing processes.	[19]
Anti-inflammatory and Antioxidant	Protects the body from free radical damage, reduces inflammation, and supports natural defences.	[20][21]
Boosting Immunity Digestive Health	Enhances resistance to infections and illnesses. Promotes digestive health, alleviates constipation and indigestion, soothes the digestive tract, and reduces bloating and gas.	[22] [23]
Skin and Hair Health	Reduces wrinkles, improves skin tone, promotes hair growth, and nourishes and moisturizes skin.	[24]
Muscle Strength and Joint Health	Strengthens muscles, supports joint health, improves flexibility, and eases pain caused by arthritis or weakness.	[25]
Detoxification and Blood Purification	Purifies the blood, cleanses toxins, and supports kidney and liver detoxification.	[26]

2.1. Phytochemical screening

Table 2. Phytochemical constituent present in *Chlorophytum borivillianum*



Test	Methods	Procedure	Result	Reference
Test for Steroidal saponins	Liebermann-Burchard test.	Dissolve the plant extract in chloroform and add 1-2 ml acetic anhydride. Then add conc. H ₂ SO ₄ carefully along the side of the test tube.	A blue-green color indicates presence of steroidal saponins.	[27][28]
	Sulfuric acid test	Add 2 ml of plant extract with 2 ml concentrated H ₂ SO ₄ carefully.	A red, orange color at the interface confirms the presence of saponins.	
Test for Flavonoids	Lead Acetate test	Add a few drops of lead acetate to the plant extract.	A yellow color indicates the presence of flavonoids.	[27][28]
	Zinc-HCl test	Add zinc dust to plant extract then add conc. HCl dropwise.	Red color indicates the presence of flavonoids.	
Test for Tannins	Ferric Chloride test	Mix the extract with a few drops of Ferric Chloride (FeCl ₃).	A green or blue-black color indicates the presence of tannins.	[28]
	Bromine water test	Add few drops of bromine water to the plant aqueous extract.	A white precipitate indicates presence of tannins.	
Test for Glycosides	Keller-Kiliani test	Mix plant extract with FeCl ₃ . Then add conc. H ₂ SO ₄ carefully along the side of the test tube.	Brown ring indicates presence of deoxy sugar. Violet ring below brown ring indicates glycosides.	[28]
	Borntrager's test	Boil the plant extract with dil. H ₂ SO ₄ and then cool and filter. Extract the filtrate with chloroform. Add ammonia solution to organic layer.	A pink to red in the ammoniacal layer indicate the presence of glycosides.	

2.2. Phytochemical studies through UV spectrophotometry

We used a UV spectrophotometer, a cuvette, volumetric flasks, measuring cylinders, and beakers in this procedure. Weigh out 10 mg of the drug and dissolve it in 10 ml of solution before performing UV spectroscopy. With a concentration of 100 µg/ml, this solution known as the stock solution. Make a standard solution by taking 1 ml of this stock solution. Next, make several dilutions of this standard solution (2µg/ml, 4µg/ml, 6µg/ml, 8µg/ml, and 10µg/ml). A calibration curve is produced using these standard solutions.

3. MATERIALS AND METHODS

Selection of Ingredients and Their Rationale

A herbal jam made using Chlorophytum borivilianum for reproductive health needs to be carefully formulated to guarantee palatability, the preservation of bioactive chemicals, the ideal texture, and adherence to food safety laws.



Fig 1. UV Graph B/W Absorbance and Wavelength.

- **Base:** For the jam to have structure and flavour, a fruit pulp base is necessary. Amla and berries are good options since they naturally provide sweetness and contain pectin, which helps give the jam its gel-like consistency. Additionally, the chosen fruit should complement Safed Musli's flavor profile and, preferably, provide complementary health advantages.

- **Sweetener:** Cane sugar (sucrose), the most used sweetener in jam making, serves as a key preservative by reducing water activity in addition to adding sweetness. Other options like honey or jaggery might be taken into consideration in order to bring distinct flavor notes and possibly more nutritional advantages. The jam's ultimate Total Soluble Solids (TSS) content, which according to FSSAI guidelines should ideally be between 65 and 68%, is essential to its preservation.

- **Preservative:** Jams are typically adequately preserved due to their high sugar content and the inherent acidity of fruits. Citric acid, which is frequently added as lemon juice, further lowers pH, preventing microbial development and promoting the production of pectin gel. Ginger or cinnamon are examples of natural substitutes with preservation qualities that might be taken into account; they might provide extra taste and health advantages.

- **Chlorophytum borivilianum Extract:** The roots of *C. borivilianum* will need to be processed into a powder or an extract to facilitate its uniform incorporation into the jam. Aiming to maximize the extraction and preservation of the target bioactive chemicals known to contribute to reproductive health benefits should guide the choice of both these forms and the extraction solvent (methanol, ethanol or water are popular choices). The concentration of Safed Musli used in the jam should be determined based on traditional dosages and findings from preliminary research on its efficacy.

Detailed Step-by-Step Formulation Process to Preserve Bioactive Compounds

Table 3. Ingredients used for the preparation of herbal jam and their uses.

Ingredients	Uses
Amla pulp	Boosting immunity, helps in digestion
Haritaki powder	Help in digestion, relieves constipation
Bibhitaki powder	Antimicrobial, anti-allergic, and laxative properties
Chlorophytum borivilianum	For treating male sexual disorders and improving sperm count
Shatavari	Treats gastric ulcers
Ashwagandha	stress reduction, and enhanced physical performance
Giloy	Immune boosting
Long Pepper	Improve appetite and digestion
Vidharikand	Cardioprotective
Ghee	Nutrient
Honey	Preservative
Cardamom	Digestive aid
Cinnamon	Antioxidant, anti-inflammatory, and antimicrobial
Clove	Aromatic, stimulant
Jaggery	Sweetening agent

A *Chlorophytum borivilianum* herbal jam's formulation procedure needs to be carefully planned to maintain Safed Musli's bioactive ingredients while producing a tasty and reliable end product. The following steps outline a potential formulation process:

1. Chlorophytum borivilianum preparation:

Purchase premium Chlorophytum borivilianum roots from a reliable supplier and confirm their botanical authenticity by consulting a specialist or following established protocols. Wash the roots well to get rid of any dirt or contaminants that may be sticking to them. Then, let them air dry in a controlled setting or use a low-heat drying method to avoid microbial development and the breakdown of heat-sensitive substances. After drying, use a clean grinder to ground the roots into a fine powder. If utilizing the powdered version, this will enhance the surface area.

2. Base Preparation: Make sure the fruit or fruits you choose for the jam base are fresh and of high quality, such as mixed berries, apples or amla. Wash the fruit thoroughly, peel if necessary, based on the type of fruit and desired texture, and chop them into smaller, uniform pieces. Using a blender or fruit pulper, pulse the chopped fruit until it's smooth. To create a smooth jam base, strain the fruit pulp through a fine-mesh screen to get rid of any seeds or coarse fibers.

3. Mixing and Cooking: In a clean, non-reactive pan, heat ghee and sugar and combine the prepared amla pulp with Chlorophytum borivilianum. Now other supporting herbs (Shatavari, Ashwagandha, Giloy, Long Pepper, Vidhari kand) gradually while stirring constantly to ensure it is evenly distributed and avoid clumping if the fruit basis has a low natural pectin content. Add lemon juice to adjust the pH, which is important for both preservation and pectin activation. Cook the mixture over medium heat, stirring frequently to prevent sticking and burning, until it reaches the desired consistency. To further preserve heat-sensitive bioactive compounds, consider using vacuum cooking at a lower temperature (around 55°C) if the equipment is available.

4. Preservation: Use a natural preservative, like honey, near the end of the cooking process if more preservation is thought to be required, particularly if a reduced sugar content is preferred. Make sure the jam's final pH is low enough to prevent the growth of bacteria.

3.2. Physicochemical Analysis

It is important to assess the herbal jam's physicochemical characteristics to make sure it satisfies the fundamental requirements for jam quality and to comprehend the effects of adding Chlorophytum borivilianum.

- **pH:** The pH of the jam found to 3.4 using a calibrated digital pH meter.
- **Moisture content:** Weight of empty crucible = $w = 47.929$ g

Weight of crucible with jam before drying = $w_1 = 59.410$ g

Weight of crucible with jam after drying = $w_2 = 58.690$ g

$$\text{Moisture content} = \frac{w_1 - w_2}{w_1 - w} \times 100$$

$$= \frac{59.410 - 58.690}{59.410 - 47.929} \times 100$$

$$= \frac{0.72}{11.48} \times 100$$

$$= 0.062 \times 100$$

$$\text{Moisture content} = 6.2 \text{ g}$$

3.3. Sensory evaluation

The texture of the preparation was semisolid, suggesting a consistency that was relatively hard. It was distinctively brown, as is common for these kinds of preparations. Both a pleasant and caustic taste were reported, indicating a diverse flavor



profile that strikes a balance between mildness and a strong undertone. Additionally, the sample emitted a specific odour, distinct and identifiable, contributing to its overall sensory characteristics.

Detection of saponin in Herbal jam through HPLC

Instrument type: HP 100 series Agilent

Column: 4.5mm × 250mm

Flow rate: 1.0 ml/min

Wavelength: 203nm

Mobile phase: acetonitrile: water (40:60) ratio

Retention time: 1.753 minutes

Saponin content among different genotypes: 2.06% to 12.66% HPLC shows 7 peaks where saponins found in *Chlorophytum borivilium*.

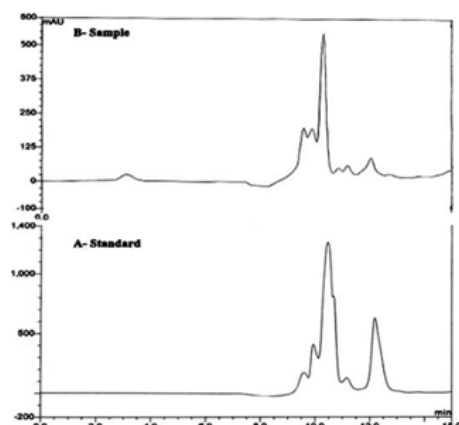


Fig 2. Identification of Saponins in *Chlorophytum borivilium* through

4. Comparative studies of *Chlorophytum borivilium* and normal group

1) Ethical Approval

- The Institutional Animal Ethics Committee (IAEC) approved.

- Followed CPCSEA (India) guidelines for animal experimentation.

2) Animals

- Species: Adult male Wistar rats
- Age: 8–10 weeks
- Weight: 180–220 grams
- Number: 5 group

3) Grouping and Dosing

We divided the rats in 3 different groups according to their drug and dosing. Group I Controlled group (saline), group II *Chlorophytum borivilium* 125mg/Kg, group III *Chlorophytum borivilium* 250mg/Kg.

-We saw the result after 28 days;

Group No.	Treatment	Dose
I	Control (vehicle)	1% CMC or saline
II	<i>Chlorophytum borivilium</i> (Low)	125 mg/kg
III	<i>Chlorophytum borivilium</i> (High)	250 mg/kg

4) Endurance and Fatigue Resistance

Swin test result that the rat who consume *Chlorophytum borivilium* has approximately 25-30% longer forced-swim times than control group. While comparing weight after 6 weeks we found that the control group rat has gained weight 235±8 g and the group with *Chlorophytum borivilium* rat 205-209±5 g only. Which clearly shows that *Chlorophytum borivilium* group has more active than control group.

5. RESULT AND DISCUSSION

1. Phytochemical Screening



The preliminary phytochemical analysis confirmed the presence of key bioactive constituents in *Chlorophytum borivillianum*, including:

- Steroidal saponins (confirmed by Liebermann-Burchard and sulfuric acid tests),
- Flavonoids (lead acetate and zinc-HCl tests),
- Tannins (ferric chloride and bromine water tests),
- Glycosides (Keller-Kiliani and Borntrager's tests).

These compounds are known for their role in enhancing reproductive health, offering antioxidant and adaptogenic benefits, and modulating hormonal activity.

2. UV Spectrophotometry

The UV spectroscopic study enabled the quantification of phytochemicals through a calibration curve using various dilutions. And shows the presence of active compound in the formulation.

3. Physicochemical Properties

- pH: The jam had a pH of 3.4, which is within the optimal acidic range for microbial stability and pectin gel formation.
- Moisture Content: The weight loss during drying allowed estimation of moisture, ensuring that the jam maintains appropriate texture and shelf-life stability.

4. Sensory Evaluation

The herbal jam displayed:

- A semisolid consistency,
- A distinct brown color,
- A pleasant yet caustic taste,
- A characteristic odor.

5. HPLC Detection of Saponins

High-Performance Liquid Chromatography (HPLC) confirmed the presence of saponins, showing 7 distinct peaks with a retention time of 1.753 minutes. The saponin content varied between 2.06% to 12.66%.

6. Animal Studies on Reproductive Health

A 28-day study on Wistar rats compared control and two treatment groups (125 mg/kg and 250 mg/kg of *Chlorophytum borivillianum* extract). Findings include:

- **Enhanced endurance:** Rats in the treatment groups showed a 25–30% increase in forced-swim endurance, indicating improved physical stamina and stress resistance.
- **Lower weight gain:** Treated rats gained less weight than the control group (205–209±5g vs. 235±8g), suggesting increased activity and metabolic enhancement.

6. CONCLUSION

The study effectively used *Chlorophytum borivillianum* to create a new, tasty herbal jam. All of the assessments—physicochemical, biological, sensory, and phytochemical—confirm its potential as a natural supplement to enhance reproductive health. By combining contemporary food-based administration methods with traditional Ayurvedic knowledge, this product improves acceptance and efficacy.

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