International Journal of Environment, Agriculture and Biotechnology
Vol-10, Issue-3; May-Jun, 2025
Peer-Reviewed International Journal
Journal Home Page Available: https://ijeab.com/
Journal DOI: 10.22161/ijeab

Proximate Composition and Functional Enhancement of *Panjiri* through Giloy (Tinospora cordifolia) Stem Supplementation

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Received: 20 May 2025; Received in revised form: 15 Jun 2025; Accepted: 21 Jun 2025; Available online: 26 Jun 2025

***Abstract*— *The present investigation was carried out to develop and standardize value added* panjiri *by incorporating giloy (*Tinospora cordifolia*) stem powder at varying concentrations of 5, 10, and 15 per cent. Traditional* panjiri*, a nutrient-dense Indian sweet prepared using wheat flour, ghee, sugar, dry fruits, and aromatic spices, holds cultural and medicinal significance, particularly during the winter season and for lactating mothers. In this study, giloy stem powder—renowned in ayurveda for its therapeutic properties—was selected for its rich bioactive profile and high medicinal value, especially concentrated in the stem. The present study aim was to enhance the nutritional and functional properties of* panjiri *through herbal supplementation. Among the three supplemented formulations, Type-I* panjiri *containing 5 per cent giloy stem powder was found to be the most organoleptically acceptable. The proximate composition of this formulation revealed moisture content of 2.82 per cent, crude protein 5.84 per cent, crude fat 24.16 per cent, crude fibre 1.73 per cent, and ash content 2.51 per cent. The findings suggest that incorporating medicinal plant extracts such as giloy into traditional foods can improve both their therapeutic potential and nutritional profile, offering a novel approach to functional food development.*

***Keywords*— Gioly, Panjiri, health benefits, supplemented panjiri, giloy stem**

I. INTRODUCTION

Medicinal plants are now seen as valuable health supplements due to their proven nutritional and therapeutic properties and low or non-existent toxicity compared to modern pharmaceuticals and synthetic or semi-synthetic supplements (Semwal *et al.,*2024). Tinospora cordifolia is one such medicinal plant which is a semi-evergreen, deciduous climbing shrub commonly located on the trunks of large trees such as mango and neem. It is capable of thriving in various soil types, ranging from acidic to basic, under conditions of average moisture (Singh et al., 2003). The stems of the plant exhibit moisture and thickness, featuring prominent aerial roots that extend from the branches with differing diameters. The younger stems are characterized by a green hue and smooth surfaces, whereas the older stems present a light brown coloration (Sardhara & Gopal, 2013). Though different plant parts have several medicinal properties (Singh et al., 2025). But this research aims to unearth medicinal values of stem and how its incorporation in a traditional Indian food item called *panjiri* enhances the overall health benefits of the eatable product. Creating novel foods with additional health benefits can be a great boost to marketing of that product (Gawade et al., 2023).

II. REVIEW OF LITERATURE

Verma et al., (2021) revealed that giloy is beneficent in ailments like diabetes, stomach ache, jaundice also in skin and stomach disorders. In similar way Jayswal, (2021) described about windfalls of this plant also stating that it is also called Amrita. Specially mentioned its perks in being effective in various 21st century diseases like corona virus, swine flu as it is general immunity booster. As it is a climber plant it is said if it climbs neem tree then medicinal properties get boost up. Sodha (2025) mentioned its indulgences in prevention several chronic diseases; also added fringes in this plant being a cure for malaria, urinary tract infections but also bright to limelight that it can be antagonistic to people suffering from autoimmune diseases and it can cause constipation in some people. Sharma et al. (2025) found various components contained in giloy plant like vitamins, proteins, fibre, carbohydrates etc. due to which this plant was used to cure inflammation, cancer, HIV etc.

III. MATERIALS AND METHODS

Procurement of materials: Giloy (Tinospora Cordiofolia) stem was harvested from nearest locally available sources. Other ingredients required for the preparation of value-added products and packaging material was purchased from the local market in a single lot.

Processing of giloy stem: The giloy stem was thoroughly washed with tap and distilled water to remove adhering impurities. Stem was cut into small pieces. Stem was dried in hot air oven at 50±5^{O}C. Then the dried stem was powdered, passed through 60 mesh sieve and stored in an air tight container till further use. Other ingredients were stored in the LDPE package until further use.

Fig.1: Giloy stem

Food products mixed with giloy stem powder: *Panjiri* was standardized and developed by adding giloy stem powder at different proportions in standard recipes.

Fig.2: Panjiri developed by adding giloy stem powder

Panjiri

Ingredients	**Amount**
Wheat Flour	100 g
Ghee	30 g
Sugar	30 g

Method of preparations:

1. Sieved wheat flour.
2. Roasted wheat flour in ghee till light brown.
3. Allowed to cool slightly.
4. Added the powdered sugar and mixed thoroughly.
5. Stored in air tight container.
6. In type-1, type-II and type-III panjiri wheat flour was substituted with 5, 10 and 15 gm of giloy stem powder.

Nutritional evaluation of *panjiri* developed using *Giloy* stem powder

Proximate composition

Proximate composition *viz,* moisture, crude fat, crude fiber, crude protein, total ash and carbohydrate of *panjiri* were determined by standard procedures given by AOAC (2000). All the analysis was done in triplicates.

Moisture: To estimate moisture content, the AOAC (2000) method was employed. A sample of two gram of *panjiri* was weighed and placed in a clean, dry, and weighed aluminum dish (dried at 130 ± 3°C for 20 minutes). The sample was dried in a hot air oven at 130 ± 3°C for approximately 1 hour until it attained an uniform weight, then cooled in a desiccator. Weight loss was then estimated as a percentage of moisture content:

$$\text{Moisture } (\%) = \frac{\text{Loss in weight}}{\text{Weight of sample}} \text{x} 100$$

Crude protein: Crude protein was analysed by standard method of analysis (AOAC, 2000), using KEL PLUS Automatic Nitrogen Estimation System. A factor of 6.25 was applied to convert the amount of nitrogen to crude protein.

Digestion

A 1 g sample was combined with 25 ml of concentrated sulfuric acid and 3 g of digestion mixture, then heated at 420 °C in a digestion unit. The mixture was considered fully digested when it turned bluish-green and visible flames subsided, typically within 1–2 hours. If needed, an additional 15 minutes of heating was applied. After digestion, the tubes were cooled for 15 minutes on a stand before proceeding.

Distillation

To determine nitrogen content, the digested sample was treated with 40 per cent sodium hydroxide in a Kjeldahl distillation unit. Released ammonia was captured in 10 ml boric acid with mixed indicator and titrated using N/100 hydrochloric acid. A distinct color change marked the end point.

$$\text{Total N (\%)} = \frac{14 \times \text{Titrant value} \times \text{Normality of acid}}{1000 \times \text{sample weight (g)}} \times 100$$

Where,

Titrant value = Volume of N/100 HCl used for titration.

Crude Fat Estimation

Crude fat content in the stem was determined using the AOAC (2000) method with an Automatic SOCS Plus Solvent Extraction Apparatus.

Procedure

Clean, dry extraction beakers were weighed before use. Two grams of moisture-free sample was placed in a pre-weighed thimble and inserted into the beaker containing ~100 ml petroleum ether (boiling point 60–80 °C). Extraction was performed at 100 °C for one hour. Post-extraction, the solvent was recovered by raising the temperature to 120 °C. Beakers containing extracted fat were dried in a hot air oven at 60 °C until constant weight, then cooled in a desiccator and reweighed. Crude fat content was calculated based on the weight difference.

$$\text{Fat (\%)} = \frac{W_2 - W_1}{W} \times 100$$

Where,

W = Weight of sample (g)

W_1 = Weight of empty beaker

W_2 = Weight of beaker with fat

Crude Fiber Estimation: Crude fiber was determined following the AOAC (2000) standard method.

Procedure

A 1 g fat-free, oven-dried sample was boiled with 200 ml of 1.25% H_2SO_4 and a few drops of antifoaming agent for 30 minutes using a crude fiber apparatus. The mixture was filtered through a Buchner funnel, and the residue was boiled again for 30 minutes with 200 ml of 1.25% NaOH. The insoluble material was filtered, thoroughly washed with hot water, followed by ethanol (twice) and acetone (three times), then dried at 100 °C to constant weight. The dried residue was ashed in a muffle furnace at 550 °C for 1 hour, cooled in a desiccator, and weighed to determine crude fiber content.

$$\text{Crude fiber (\%)} = \frac{W2 - W3}{W1} X\, 100$$

Where,

W1 = Weight of sample (g)

W2 = Weight of insoluble matter (wt. of crucible + insoluble matter– wt. of crucible)

W3 = Weight of ash (wt. of crucible + wt. of ash – wt. of crucible)

Total Ash: Ash was determined following AOAC (2000) guidelines. Five grams of oven-dried sample were placed in a silica crucible and pre-ignited to remove charred material. The crucible was then heated in a muffle furnace at 500 °C for 5 hours or until white ash formed. After cooling in a desiccator, the crucible was weighed. The remaining residue represented the ash content.

IV. RESULT AND DISCUSSION

Table 1 shows proximate composition of *panjiri,* developed using giloy stem powder (%, on dry weight basis)

Treatment	**Moisture (g/100g)**	**Crude Protein (g/100g)**	**Crude Fat (g/100g)**	**Crude Fibre (g/100g)**	**Ash (g/100g)**
Control (WF:100)	2.76 ± 0.06[d]	7.33 ± 0.20[a]	24.63 ± 0.01[a]	1.18 ± 0.04[c]	2.21 ± 0.08[a]
Type-I	2.82 ± 0.05[c]	5.84 ± 0.01[b]	24.16 ± 0.32[a]	1.73 ± 0.15[bc]	2.51 ± 0.19[a]
Type-II	3.05 ± 0.04[b]	4.92 ± 0.04[c]	23.66 ± 0.17[b]	2.78 ± 0.11[b]	2.78 ± 0.48[a]
Type-III	3.15 ± 0.05[a]	4.67 ± 0.05[c]	22.85 ± 0.09[c]	3.93 ± 0.08[a]	3.93 ± 0.07[b]
C.D. (*P<0.05*)	0.16	0.36	0.62	0.34	0.88

Table 1 presents the composition of control wheat flour *panjiri* and giloy stem incorporated *panjiri*. The incorporation of (Giloy Stem Powder) GSP in *panjiri* showed a significant ($p<0.05$) effect on proximate compositions. Moisture content in 100 per cent wheat flour *panjiri* (control) was 2.76 g/100g, while that of type-I, type-II, and type-III supplemented *panjiri* were 2.82, 3.05, and 3.15 g/100g, respectively. Concentration of GSP in type-I, type-II, and type-III increased following this pattern- 5, 10 and 15 per cent respectively (Figure 3). The crude protein content in control *panjiri* was 7.33 g/100g, which was significantly (*p≤0.05*) higher than type-I (5.84 g/100g), type-II (4.92 g/100g) and type-III (4.67 g/100g) GSP-supplemented *panjiri*. However, it was observed that the protein content of type-III was significantly (P≤0.05) lower than that of type-I and type-II (Figure 4).

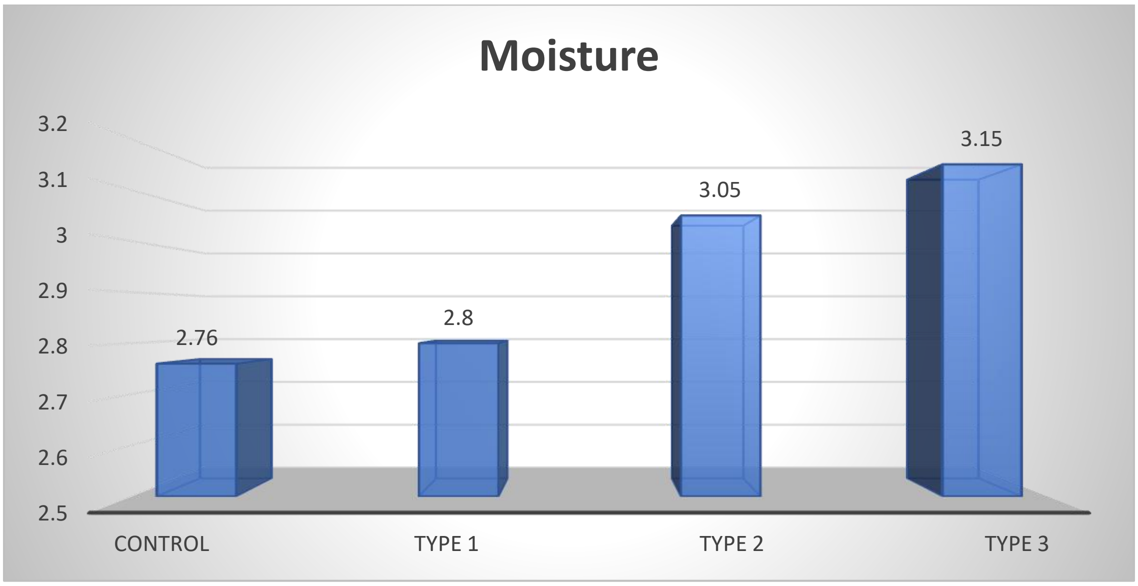

Fig.3: Moisture content of panjiri

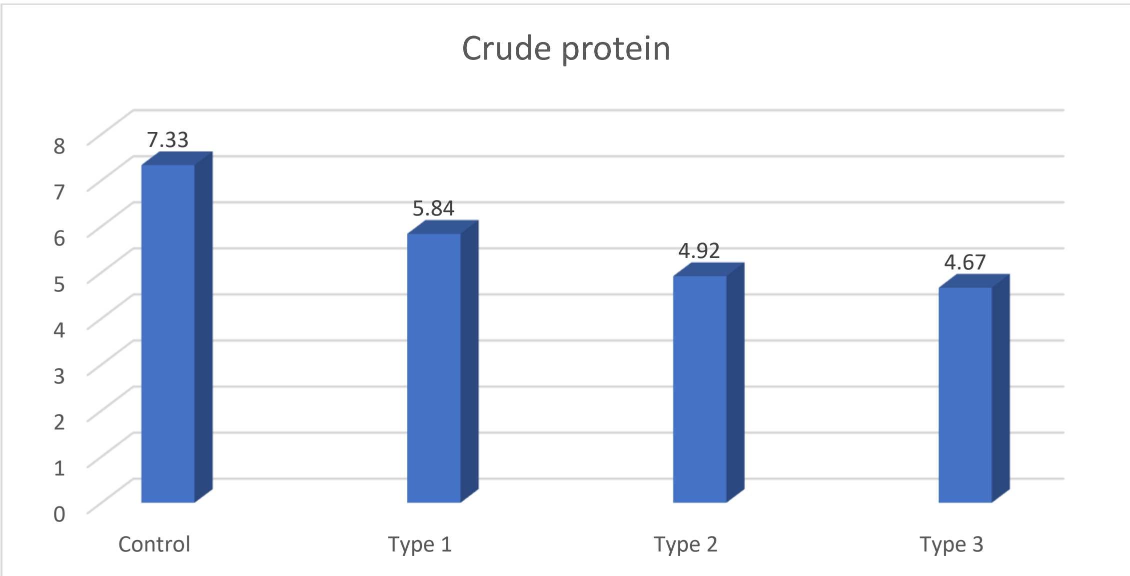

Fig.4: Crude protein content of panjiri

The fat content in control *panjiri* was 24.63 g/100g, which was significantly higher than that of type-II (23.66 g/100g) and type-III (22.85 g/100g) *panjiri*. The fat content in type-I (24.16 g/100g) was not significantly different from control (Figure 5).

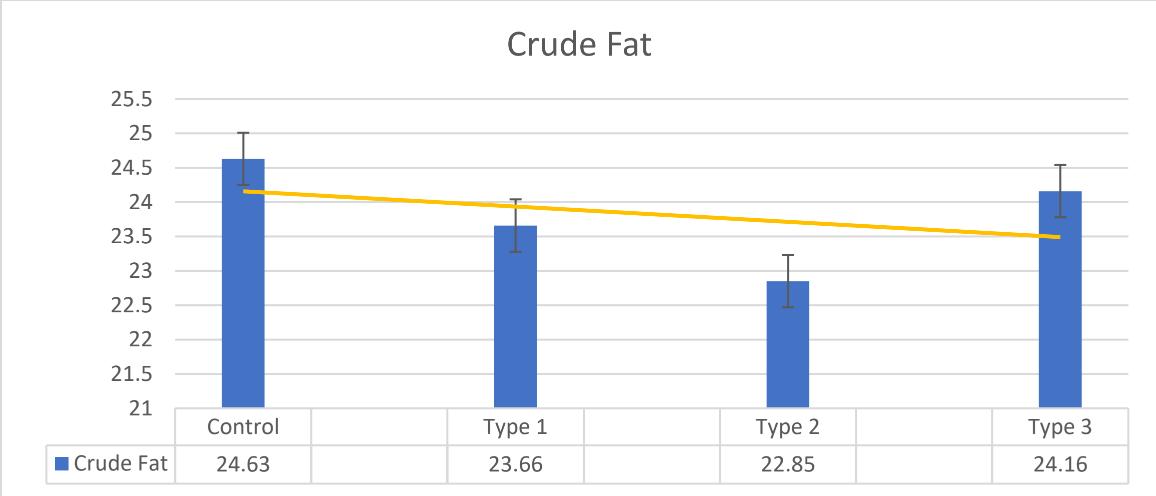

Fig.5: Crude fat content of panjiri

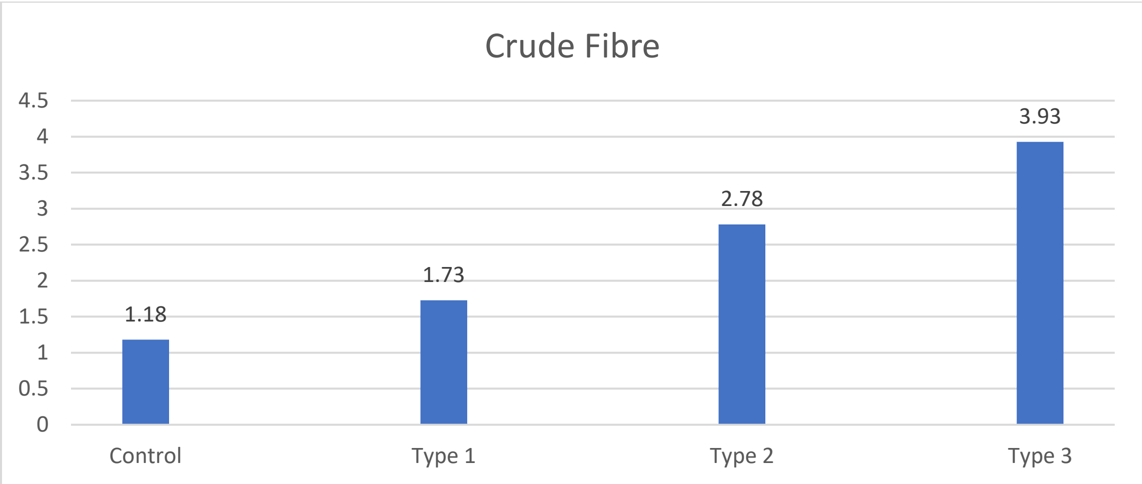

Fig.6: Crude fiber content of panjiri

The crude fibre content of control *panjiri* was 1.18 g/100g, which increased significantly in type-I (1.73 g/100g), type-II (2.78 g/100g), and type-III (3.93 g/100g), respectively. Concentration of GSP in type-I, type-II, and type-III increased following this pattern- 5%, 10% and 15% respectively. (Figure 6).

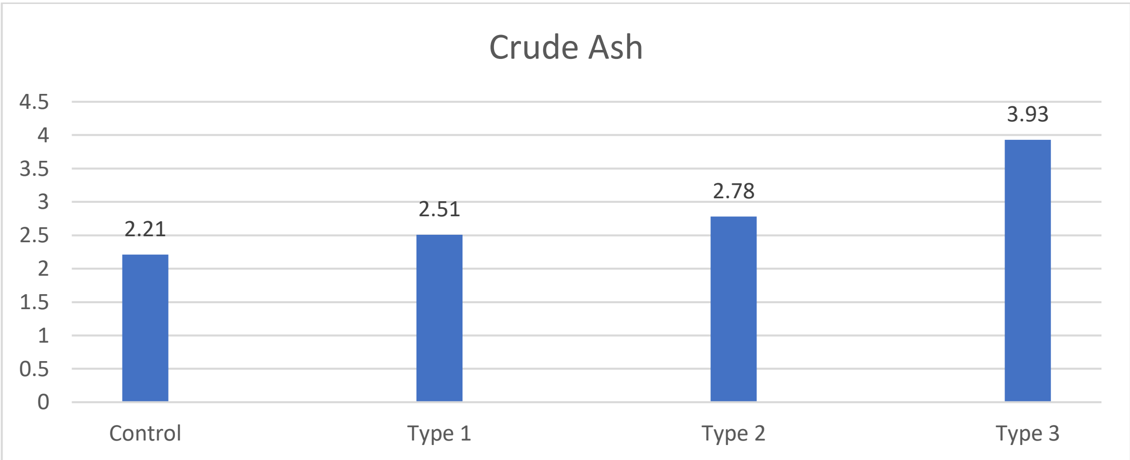

Fig.7: Ash content of panjiri

The ash content of control, type-I, type-II, and type-III *panjiri* was 2.21, 2.51, 2.78, and 3.93 g/100g, respectively. However, no significant difference ($p>0.05$) was observed in ash content between control and type-I, type-II *panjiri*, while type-III showed a significant increase ($p<0.05$) (Figure 7).

Discussion: In Indian culture, *panjiri* is a widely consumed traditional snack, valued for its long shelf-life and palatable composition due to its sugar and fat content, similar to how cookies are consumed in Western or modern urban cultures (Okpala & Okoli, 2012). Despite modernization, *panjiri* remains especially popular in rural India (Vijayaraghavan & Rao, 1998). This study focused on the development of *giloy*-supplemented *panjiri*, emphasizing its potential health benefits. The findings align with those of Gawade et al. (2023), who reported similar benefits in *giloy*-enriched cookies.Giloy (*Tinospora cordifolia*) is known for its medicinal properties, including immune-boosting effects (Sankhala et al., 2012), and its traditional use in managing fever, jaundice, and emaciation (Srivastava, 2020), as well as chronic conditions like diabetes and hepatitis (Saha & Ghosh, 2012). The analysis revealed an increase in moisture, crude fibre, and ash content with rising *giloy* concentration, while protein and fat content decreased in comparison to the control. The rise in fibre and ash enhances the functional value of *panjiri*, particularly for individuals with constipation and lactating mothers. A reduction in fat content is nutritionally advantageous, as excessive fat contributes to rancidity and obesity (Ullah et al., 2003). Although protein content decreased, this may be due to heat-induced denaturation, and the reduction is not nutritionally concerning given the body's limited requirement for protein. Increased moisture improved the palatability of the product, making it more suitable for individuals needing hydration, such as lactating women. Overall, the incorporation of *giloy* enhanced the nutritional profile of *panjiri*, supporting its use as a functional, health-promoting traditional food.

Conclusion- Therefore, it can be concluded that supplemented *panjiri* is definitely better than control *panjiri* and is a healthy option for people suffering with weak immune system, diabetes, urinary track infection; and this type of supplemented food is definitely a boon for lactating mothers as it has sufficient moisture and fibre in their diet and reduces extra fat and extra protein from their meals. *Panjiri* is a good snacking option and can be taken in moderate quantity as per the bodily requirement of the individual consuming it.

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