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Formulation of *Cisuss quadrangularis* (*Cissus quadrangularis*) stem powder and its nutritional and phytochemical analysis

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Abstract
Cissus quadrangularis Linn. Is a native medicinal plant that is often grown in India and is known to hasten the mending of broken bones. Often referred to as Devil's Backbone or Hadjod, this Vitaceae family member has important traditional medicinal uses, especially for bone-related conditions. The species' complex phytochemical composition, which includes glycosides, alkaloids, and flavonoids, is largely responsible for its many medicinal qualities, which include anti-inflammatory, antioxidant, and antibacterial actions. The purpose of this study was to create a powdered *Cissus quadrangularis* stem and examine its phytochemical and nutritional characteristics. The mineral content, anti-nutritional characteristics, and proximate composition of the stem powder were assessed. The findings showed that there was a considerable mineral presence, including calcium (32.29 mg/100 g), magnesium (1.38 mg/100 g), and phosphorus (0.26 mg/100 g), along with a protein content of 15.60 g/100 g and a carbohydrate content of 40.90 g/100 g. Phytate and tannin levels, two anti-nutritional components, were also found at 0.5 and 21 mg/100 g, respectively. These results support the use of *Cissus quadrangularis* in traditional medicine and dietary applications by offering important new information about its nutritional profile. To investigate its wider health advantages and its uses in food science, more investigation is necessary.

Keywords: *Cissus quadrangularis*, phytochemicals, bone healing, stem powder

Introduction
Cissus quadrangularis Linn. Is a native medicinal plant that is grown in India. It is capable of quickening the healing process of broken bones. (Brahmkshatriya *et al.* 2015) [3]. *Cissus quadrangularis*, a member of the Vitaceae family, is also known as Devil's Backbone, Veldt Grape, and Asthisanharak (pacification of bones). In Sanskrit, the plant is known as Asthisandhani, which repairs bone fractures, and Hadjod, which means "bone setting" or "bone healer," in Hindi. (Mishra *et al.* 2010) [10]. *Cissus quadrangularis* (Vitaceae) species are generally found in tropical regions of Sri Lanka and India. (Chopra *et al.* 1986) [5]. *Cissus quadrangularis* has quadrangular-sectioned branches with internodes that are 8-10 cm long and 1.2-1.5 cm broad. It can reach a height of 1.5 m. The edges of each angle are leathery. The nodes give rise to toothed trilobe leaves, which range in width from 2 to 5 cm. Each has a tendril that emerges from the node's opposite side. Racemes of tiny blossoms that are white, yellow, or green; globular berries that turn red when ripe. (Frank *et al.* 1995) [6]. *Cissus quadrangularis* has a greater impact on osteoblastic growth Compared with other cellular responses, Histological and histochemical investigations confirmed that the collagen and mucopolysaccharide levels in the treated group's bones returned to normal in just four weeks, while the control group's levels needed six weeks to do so. (Singh *et al.* 1962) [14]. *Cissus quadrangularis* Stems are useful as purgatives, anti-arthritis, antioxidants, antimicrobials, and cholesterol-lowering substances in both health and disease. They can also be used to cure broken bones. When *Cissus quadrangularis* hadjod stem powder is administered, bone abrasion is significantly reduced, cortisol's detrimental effects on muscles are avoided, and muscle formation is encouraged. Similar to glycosides, alkoloids, and flavonoids found in stem powder, phytoconstituents may be responsible for its anti-arthritic action. (Udaya kumar *et al.* 2004) [15].

Cissus quadrangularis is used to cure a variety of ailments, including as high cholesterol, worm infestation, leucorrhea, syphilis, peptic ulcers, hemorrhoids, diabetes, and obesity. It's also used as a supplement in bodybuilding. India's northeastern states eat the stem as a vegetable. It is prescribed in the Siddha medical system to treat gonorrhea, cough, asthma, piles, and bone fractures. It's also used as an anti-aging plant. (Riccioti *et al.* 2011) [13]. *Cissus quadrangularis* promotes early bone remodeling and ossification. Plants aid in fracture healing by promoting metabolism and enhancing the absorption of minerals calcium, sulfur, and strontium by osteoblasts in damaged bone. (Jainu *et al.* 2005) [7]. Phytochemical experiments employing various solvent extracts revealed that *Cissus quadrangularis* contains high quantities of ascorbic acid, carotene, phytosterols, and calcium. Important chemical compounds include α-sitosterol, amyrin, and amyrone. (Mehta *et al.*, 2001) [9].

Materials and Methods

The current investigation entitled "formulation of *Cissus quadrangularis* powder and its nutritional and phytochemical analysis" was carried out.

Materials

This study was conducted in the Foods and Nutrition labs of Department of Food Science and Nutrition, College of Community and Applied Sciences, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan. Raw material was collected from the *Cissus quadrangularis* plant stem from local area of Udaipur.

Methods

Nutritional properties of *Cissus quadrangularis* stem powder:-

Proximate composition estimation

The current study revealed composition of *Cissus quadrangularis* stem powder crude protein, carbohydrate, fat, Ash, crude fiber which is delivers critical nutritional information to help with product development, quality control, and regulatory compliance. (AOAC 2012) [1].

Mineral estimation

The current study revealed composition of *Cissus quadrangularis* stem powder calcium magnesium and phosphorus which are essential for many bodily processes, including bone mineralization, cofactor roles in numerous enzyme systems, and maintaining muscle and nerve. (Cheng and Bray 1951) [4].

Phytochemical properties of *Cissus quadrangularis* powder

The current study revealed composition of *Cissus quadrangularis* stem powder tannin content (Atanassova, M., and Christova-Bagdassarian, V. 2009) [2] and phytate content (Jain and mogra 2006) [8] in which presence of tannin gives astringent taste of powder and phytate content prevent absorption of minerals.

Formulation of *Cissus quadrangularis* powder

- Sample Collection-The stem of the plant collected from the local areas of Udaipur.
- Sorting-Fresh, green undamaged stem collected to produce the best quality Powder.
- Cleaning and washing-The stem was washed 3-4 times with plenty of potable water to remove all the adhering dust, and dirt particles and cut into small slices.
- Drying-Drying of the sample was done in oven dryer at 50 °C to 60 °C for 72 Hr.
- Grinding-Dried stems were converted into a fine powder with the help of a mixer and Grinder and sieving.
- Storage-*Cissus quadrangularis* stem powder stored in vacuum packed bags Protected from humidity, heat, and light to avoid the growth of molds at room Temperature.

Results

Proximate composition estimation

The protein content of hadjod stem powder was 15.60 g/100 g, Proteins are involved in almost every biological function as structural elements, transporters, signaling molecules, and enzymes. In essence, proteins are the cell's workhorses, performing a wide range of essential life-sustaining tasks. Carbohydrate content 40.90 g /100 g in stem powder Carbohydrates work as fuel for body and help control blood glucose levels. Fat content 9.20 g /100 g in stem powder. The ash content were obtained 7.80/100 g and the crude fiber content were 11.40/100 g comparable result were discovered in (Nawghare *et al.*, 2017) [11] as shown in table 1.

Table 1: Proximate composition of formulated *Cissus quadrangularis* powder

S. No.	Nutrients (Dry weight basis)	Mean ± SD
1.	Moisture (g/100)	5.10±0.08
2.	Crude protein (g/100)	15.60±0.10
3.	Crude fiber (g/100)	11.40±0.11
4.	Fat (g/100)	9.20±0.09
5.	Ash (g/100)	7.80±0.12
6.	Carbohydrate (g/100)	40.90±0.14
7.	Energy (kcal)	308.80±1.06

Mineral estimation

This current study revealed mineral content of *Cissus quadrangularis* stem powder in which calcium was found in stem 32.29mg/100 g magnesium was found in stem 1.38mg/100 g and phosphorus was found in stem powder 0.26mg/100 g. These minerals that play crucial roles in various bodily functions, including bone health, nerve function, and muscle contractions. Comparable result were discovered in (Rex, C. M., and Ravi, L. 2020). As shown in table 2.

Table 2: Mineral estimation factors of formulated *Cissus quadrangularis* powder

S. No.	Nutrients (Dry weight basis)	Mean ± SD
1.	Calcium (mg/100)	32.29±0.69
2.	Magnesium (mg/100)	1.38±0.046
3.	Phosphorus (mg/100)	0.26±0.006

Phytochemical estimation

Antinutrientional factor estimation

This current study revealed Anti-nutrientional factor in *Cissus quadrangularis* powder in which tannin was found 0.5 mg/100 g and phytate content was found 21 mg/100 g comparable result were discovered in (Rex, C. M., and Ravi, L. 2020). As shown in table 3

Table 3: Anti-nutritional analysis factors of formulated *Cissus quadrangularis* powder

S. No.	Nutrients (Dry weight basis)	Mean ± SD
1.	Tannin (mg/100)	0.5±0.012
2.	Phytate (mg/100)	21.00±0.50

Conclusion

The study supports the traditional use of *Cissus quadrangularis* as a medicinal plant by highlighting its important nutritional and phytochemical qualities. A significant amount of protein and carbohydrates, which are necessary for a number of biological processes and the production of energy, are visible in the proximate composition. Furthermore, the identified minerals—phosphorus, magnesium, and calcium—are essential for metabolic and bone health. The existence of anti-nutritional elements like tannins and phytates suggests that dietary applications should be carefully considered. All things considered, *Cissus quadrangularis* shows promise as a medicinal agent and functional food ingredient, especially when it comes to supporting bone health and treating a variety of conditions.

In order to increase its usefulness in both conventional and contemporary healthcare practices, future study should concentrate on examining the mechanisms underlying its therapeutic qualities as well as possible applications in food science and nutrition.

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