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Effect of studies in processing and preservation of *Cissus quadrangularis* for value added powder based product and their storage stability

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Abstract

The processed stem branches as base material exhibited a tendency towards alkaline pH (5.0-.5.5) very low titratable acidity (oxalic acid) (0.22-.045%) (4^o brix) which indicate complete leaching of oxalates contribute acidity in the raw material. The prepared products of *Cissus quadrangularis* on chemical analysis revealed alkaline P^H (6.5-.75), very low acidity (0.007%) to nil as indicated by instant colour change in all these products. The chemical analysis of the refrigerated storage products of *Cissus quadrangularis* over a period of 35days showed a tendency towards the titratable acidity was found to be nil in all the products of *Cissus quadrangularis*, where as in the other products and in the mixed product showed a negligible amount ranging from 0.0011-0.047% in *Cissus quadrangularis*. There was a gradual decrease in acidity of squash and gradual increase in acidity of chutney during the storage period of 35 days. There was a gradual decrease in TSS in all the products of *Cissus quadrangularis* was witnessed during the storage period of 35 days.

Keywords: *Cissus quadrangularis*, TSS, pH, acidity, preservation and storage stability, value addition

Introduction

Cissus quadrangularis and *Cissus hemaderohensis Cissus quadrangularis (Cissus quadrangularis)* is one of the most common species scattered all over India particularly in tropical regions (Guhabakshi *et al.*, 2001) [1]. *C. quadrangularis* belongs to the family Vitaceae, which is a perennial plant commonly known as Veldt Grape or Devils backbone (Kumbhojkar *et al.*, 1991). It is known to be an ancient medicinal plant, with optimal healing in white tissue area of the body (tendon, ligament, etc.) (Justin and Joseph, 2011) [2]. Phytochemical analysis of *Cissus quadrangularis* indicates the presence of carotene, phytosterol, terpenoids, β -sitosterol, δ -amyrin, δ amyron and calcium (Mishra *et al.*, 2011) [2]. The stem of *C. quadrangularis* is also an important medicinal plant in Ayurveda as alterative, anthelmintic, dyspeptic, digestive tonic, analgesic in eye and ear diseases, in the treatment of irregular menstruation and asthma, in complaints of the back and spine (Sen *et al.*, 1966).

Cissus quadrangularis is a herb, reaching a height of 1.5 m and has quadrangular-sectioned branches with internodes 8 to 10 cm long and 1.2 to 1.5 cm wide. *Cissus quadrangularis* grows natively in hot, dry regions of India, such as the Deccan peninsula. It is also found on the lower slopes of the Western Ghats, and is widespread across drier areas of Arabia and Africa (Justin and Joseph, 2011) [2]. It has been prescribed in the ancient Ayurvedic texts as a general tonic and analgesic, with specific bone fracture healing properties. *Cissus quadrangularis* is used for obesity, diabetes, a cluster of heart disease risk factors called "metabolic syndrome, scurvy, cancer, upset stomach, hemorrhoids, peptic ulcer disease (PUD), painful menstrual periods, asthma, and pain. It is also used in body building supplements as an alternative to anabolic steroids (Justin and Joseph, 2011) [2].

Cissus quadrangularis is a succulent plant commonly known as Asthisamhari found in tropical and subtropical plant. It can be found throughout the hotter parts of India, neighboring countries like Pakistan, Bangladesh, Srilanka and Malaysia. It can be cultivated in plains coastal areas. Plant is propagated using cuttings. The stem juice of plant is used to treat scurvy, menstrual disorders, otorrhoea and epistaxis. The plant has been documented in Ayurveda for the treatment of osteoarthritis, rheumatoid arthritis and osteoporosis (Paulsen *et al.*, 2007; Yoganarisimhan, 2000). A paste of stem is given in asthma, burns and wounds, bites of poisonous insects and for saddle sores of horses and camels.

Cissus quadrangularis (Linn) has been used by common man in India for promotion of fracture healing and well known as "*Cissus quadrangularis*". It is also known as *Vitis quadrangularis*. It is a common perennial climber, which is distributed throughout India particularly in tropical regions. The plant is commonly known as Vajravalli in Sanskrit,

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Cissus quadrangularis in Hindi, Kandvel in Marathi, Haddjor in Punjabi, Hadbhanga in Oriya, Vedhari in Gujarati, Perandi in Tamil, Nalleru in Telugu and Veldgrap, Edible Stemmed Vine in English (Ghouse, 2015).

Phytochemical analyses of *Cissus quadrangularis* reveal a high content of ascorbic acid, carotene, phytosterol substances and calcium (Manikandan and Ilyas, 2013) and there have also been reports of the presence of β -sitosterol, δ -amyrin and δ -amyron (Mehta *et al.*, 2001). All these components have potentially different metabolic and physiologic effects (Shirwaikar *et al.*, 2003; Combaret *et al.*, 2004). Although researchers have investigated several uses of *Cissus quadrangularis*, its potential application against metabolic syndrome has not yet been reported.

Phytochemical studies of *Cissus quadrangularis* have shown the presence of various versatile constituents such as flavanoids, triterpenoids, Vitamin C, stilbene derivatives and many others, e.g. resveratrol, piceatannol, pallidol perthenocissin and phytosterols. Out of which ascorbic acid, triterpene, β -sitosterol, ketosteroid, two asymmetrical tetracyclic triterpenoids and calcium were identified as major constituents of this plant (Jainu and Devi, 2003; 2004).

In the last few years, there has been an exponential growth in the field of herbal medicine and gaining popularity both in developing and developed countries because of their natural origin and less side effects. A comprehensive review was conducted to pile up information about medicinal plants used for the treatment of arthritic, osteoporosis, diabetes mellitus. Many traditional plants products have been shown to possess disease combating potential against modern age 'life style diseases' like arthritis, obesity, diabetes, cardiovascular diseases, etc. In the present research plan, efforts are made in this direction; accordingly *Cissus quadrangularis* are evaluated for their arthritis, antidiabetic and functional properties.

Materials and Methods

The present investigation entitled "Studies on utilization of *Cissus quadrangularis* (*Cissus quadrangularis*) stem powder as a nutraceutical in bread" was carried out.

Materials

Cissus quadrangularis (*Cissus quadrangularis*) stems and *Cissus quadrangularis* stem were obtained from the Department of Botany and Medicinal Plant in Pulivendula and from local Pulivendula region. The work was carried out at College of Food Science and Technology, Pulivendula. Sugar and citric acid were purchased from local market of Pulivendula region.

Ingredients

Ingredients used in the preparation of *Cissus quadrangularis* value added products were taken from the local market of Pulivendula region. Sugar, SMP, GMS, salt, vinegar, hydrogenated vegetable oil, calcium propionate were purchased from Pulivendula local market.

Chemicals

Most of the chemicals used in this investigation were of analytical grade which were obtained from Department of Food Science and Technology, Department of Food Science and Technology, Department of Food Chemistry and Nutrition, College of Food Science and Technology, Pulivendula, Kadapa.

Processing and analytical equipments

The processing and analytical equipments included cabinet drier (for drying of fresh *Cissus quadrangularis* stem), sieve analyser (for obtaining equal particle size), hot air oven, soxhlet apparatus, micro kjeldhal, muffle furnace, and electronic balance with the accuracy of 0.001g for weight measurements, required Packaging material Packaging material i.e. Low Density Polyethylene (LDPE) were purchased from Pulivendula local market Pulivendula.

Methods

Physiochemical analysis of *Cissus quadrangularis* stem and stem powder

Physical properties of *Cissus quadrangularis* (*Cissus quadrangularis*) stem of *Cissus quadrangularis* (*Cissus quadrangularis*) stem powder

Colour

Colour of *Cissus quadrangularis* stem was inspected calorimeter.

Weight

Weight of *Cissus quadrangularis* stem was determined using electronic weighing balance.

Stem length and width

Leaf length and width were determined by vernier calliper.

Shape

Shape of *Cissus quadrangularis* stem was analyzed by subjective evaluation.

Bulk Density and Tapped Density

30 g of *Cissus quadrangularis* stem powder was filled into the 100 ml measuring cylinder with the aid of a funnel without any losses. The initial volume was noted and the sample was then tapped until no further reduction in volume was noted. The initial volume gave the bulk density value and after tapping the volume reduced, giving the value of tapped density (Lachman *et al.*, 1991).

Carr's Index

Carr's index has been used as an indirect method of quantifying powder flowability from bulk density; this method was developed by Carr. The percentage compressibility of a powder is a direct measure of the potential powder arch or bridge strength and stability, and is calculated according to following equation.

Formula

Carr's index (per cent Compressibility) = $100 \times (1 - D_t / D_b)$

Where D_b = Bulk density,

D_t = Tapped density.

Hausner's Ratio Hausner's ratio has been also used as indirect method of quantifying powder flowability from bulk density.

Hausner's ratio = D_t / D_b .

Where,

D_b = Bulk density and

D_t = Tapped density.

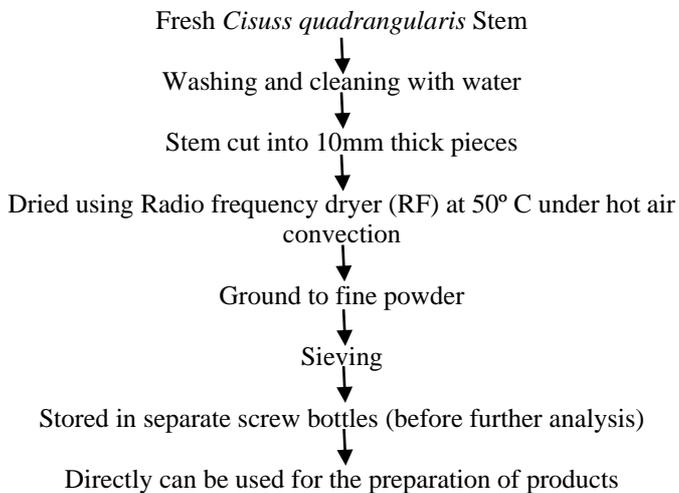
Determination of total yield

Total yield was determined by calculating the percentage of powder obtained with respect to the quantity of *Cissus quadrangularis* stem taken (Karadbhajne *et al.*, 2014) [3].

Weight of powder Yield of powder (%) = $\frac{\text{Weight of powder}}{\text{Weight of stem}} \times 100$

Process technology for preparation of *Cissus quadrangularis* stem powder

Flow sheet No: 1 preparation of *Cissus quadrangularis* stem powder given by Karadbhajnne *et al.*, (2014)^[3].



Formulation of bread with varying proportions of *Cissus quadrangularis* (*Cissus quadrangularis*) stems powder.

Formulation of bread incorporated with *Cissus quadrangularis* stem powder is given in Table 1 and the recipe for preparation of bread is outlined and mentioned below in Table 2.

The *Cissus quadrangularis* stem powder was incorporated into refined wheat flour for the preparation of bread. The control sample of bread (T₀) was prepared by using only refined wheat flour (100 per cent). The *Cissus quadrangularis* stem powder was incorporated into refined wheat flour for the preparation of bread. The control sample of bread (T₀) was prepared by using only refined wheat flour (100 per cent).

Table 1: Formulation of bread with varying proportions of *Cissus quadrangularis* (*Cissus quadrangularis*) stems powder.

Treatments	Refined wheat flour (%)	<i>Cissus quadrangularis</i> stem powder (%)
(Control) T ₀	100	0
T ₁	98	2
T ₂	96	4
T ₃	94	6
T ₄	92	8

Results and Discussion

The present investigation entitled “Studies in processing and preservation of *Cissus* species for value added products and their storage stability” was carried out in Department of Food Science and Technology, College of Food Science and Technology, Pulivendula during academic year 2011-12. The quality of chutney was prepared by using with different proportion of *Cissus quadrangularis* (*Cissus quadrangularis*) stem powder. The efforts has been made to the chemical composition and nutraceutical /phytochemical profile of *Cissus quadrangularis* stem powder. The prepared bread was then evaluated physicochemical properties, sensory attributes and texture profile analysis. The results of the present investigation are presented and discussed under suitable captions and sub captions as under. Morphological characteristics of *Cissus quadrangularis* stem. The *Cissus*

quadrangularis stem was observed for different morphological characteristics with respect to colour, length, width and thickness. The results pertaining to morphological characteristics are presented

Chemical composition of processed raw pulp of *Cissus quadrangularis*

The results of the above studies revealed that the processed raw material pulp of the *Cissus quadrangularis* species showed a pH of 5.5, titratable acidity (predominating acidity in *Cissus quadrangularis* is oxalic acid) 0.45% and TSS 4⁰ brix.

The results of the above studies revealed that the processed raw material pulp of the *Cissus hemaderohensis* species showed a pH of 5.0, titratable acidity (predominating acidity in *Cissus hemaderohensis* is oxalic acid) 0.22% and TSS 4⁰ brix. The chemical analysis of the refrigerated storage products of *Cissus quadrangularis* over a period of 35days showed a tendency towards the alkaline p^H (7.0-.7.5) in jam and jelly, 6-.75 in squash and 6.5-7.5 in chutney.

The TSS 68-70% in jam, 64.5-65% in jelly, 53-55% in squash and 50% in chutney were witnessed in these freshly prepared products of *Cissus quadrangularis*.

*Each value is average of three determinations

The data presented in Table 3 indicated that the *Cissus quadrangularis* stem was observed to have pale green in colour. The morphology study showed that the stem was very long, green, thick fleshy and like succulent cactus. Three variants of cactus *quadrangularis* were reported to have square, stemmed round stemmed and flat in shape. The stem was four angled with four thick and long wing are central part of the stem Vijayalakshmi *et al.*, (2013)^[6]. It was observed that the length of the stem was ranged from 2.5 to 4 cm, width 1.5 to 2 cm and the average thickness was 1.8 mm.

Morphological characteristics of *Cissus quadrangularis* stem

The *Cissus quadrangularis* stem was observed for different morphological characteristics with respect to colour, length, width and thickness. The results pertaining to morphological characteristics are presented in Table 3.

Table 2: Morphological characteristics of *Cissus quadrangularis* stem

Sr. No	Parameter	Observations
1	Colour	Pale green to deep green in colour
2	Length (mm)	.6-8
3	Width (cm)	1.3-5
4	Thickness (mm)	1-8

*Each value is average of three determinations

The data presented in table 3 indicated that the *Cissus quadrangularis* stem was observed to have pale green in colour. The morphology study showed that the stem was very long, green, thick fleshy and like succulent cactus.

Three variants of cactus *quadrangularis* were reported to have square, stemmed round stemmed and flat in shape. The stem was four angled with four thick and long wing are central part of the stem Vijayalakshmi *et al.*, (2013)^[6]. It was observed that the length of the stem was ranged from 2.5 to 4 cm, width 1.5 to 2 cm and the average thickness was 1.8 mm.

Per cent yield of *Cissus quadrangularis* stem powder

The per cent yield of *Cissus quadrangularis* stem powder was obtained from using cabinet dryer as showed in Table 4.

Table 3: Per cent yield of *Cisuss quadrangularis* stem powder

Sr. no	Sample	Observations
1	Weight of stem (kg)	1
2	Loss on drying(g)	917
3	(%) Yield of stem powder	83gm

*Each value is average of three determinations

The fresh stem of *Cisuss quadrangularis* plant was kept in cabinet dryer at 110°C for 6 hrs. It revealed that it was clear that cabinet dried powder (yield of dried powder 83g/100gm of fresh stem of *Cisuss quadrangularis*) and loss on drying was 917gm/1Kg. The result obtained was in Table 4 (Karadbhanje *et al.*, 2014).

Organoleptic characteristics of *Cisuss quadrangularis* stem powder

The prepared *Cisuss quadrangularis* stem powder was evaluated for various organoleptic properties and result are given in Table 5.

Table 4: Organoleptic Characteristics of *Cisuss quadrangularis* Stem powder

Sr. No.	Organoleptic characteristics	Observation
1	Colour	Green
2	Taste	Astringent
3	Odour	Pungent
4	Texture	Rough

*Each value is average of three determinations

It could be observed from Table 5 that under normal condition of light the organoleptic characteristics of *Cisuss quadrangularis* stem powder like colour was found to be pale green and the taste was astringent. (Shirane and Gogle, 2016) [5].

The stem powder had showed good functional properties. The fresh stem of *Cisuss quadrangularis* plant was kept in cabinet dryer at 110°C for 6 hrs. It revealed that it was clear that cabinet dried powder (yield of dried powder 83g/100gm of fresh stem of *Cisuss quadrangularis*) and loss on drying was 917gm/1Kg. The result obtained was in Table 4 (Karadbhanje *et al.*, 2014)

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The chemical analysis of the refrigerated storage products of *Cissus quadrangularis* over a period of 35 days showed a tendency towards the titratable acidity was found to be nil in in jam and jelly, where as in the squash and in the chutney showed a negligible amount ranging from 0.0011-0.047% in *Cissus quadrangularis*. There was a gradual decrease in acidity of squash and gradual increase in acidity of chutney during the storage period of 35 days.

The stem powder had pungent smell and rough in texture. The astringent taste of *Cisuss quadrangularis* stem powder was attributed due to tannin content. (Okwu and Josiah, 2006).

Conclusion

Hadjod stem powder was prepared using cabinet dryer. The stem powder was incorporated in bread using baking oven method at 200°C for 15 min. In review of the above The quality of bread prepared by using different proportions of hadjod (*Cissus quadrangularis*) stem powder in bread it was assessed for its chemical composition and nutraceutical

/phytochemical profile of hadjod stem powder, physicochemical properties, sensory attributes and TPA of bread. This project was designed to evaluate the suitability of hadjod stem powder.

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