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Antioxidant and Nutritional Analysis of Ivy gourd *(Coccinia grandis)*

Anjana Singh[1], Ila Joshi[2]

[1]Research Scholar, Department of Home Science, IIS (deemed to be university, Jaipur)
Email: *anji.libra[at]gmail.com*

[2]Professor, Department of Home Science, IIS (deemed to be university, Jaipur)

Abstract: ***Ayurveda is a holistic healing system for humans that stems back to ancient. It was discovered in India approximately 3,000 years ago. Its main goal is to promote good health without any side effects and primarily with the help of herbal medicine. Among these herbs "Ivy gourd" is a clean and green form of medicine with no side effects and cost effective form of therapy to treat diabetes. In India, it is widely grown in Maharashtra, Rajasthan, and Andhra Pradesh. In current research, the Ivy gourd herb, commonly known as Tindora, Tindora, Kundru and Kundriin other languages, has been studied for its antidiabetic properties. The secondary data reports blood glucose lowering property of Ivy gourd due to the presence of bioactive components- triterpenoids and pectin. Triterpenoids has β-cell regeneration property, whereas pectin leads to less absorption of glucose in the small intestine. Various parts of Ivy gourd herb, viz. fruit, leaf, stem and root were analysed for various biochemical components present and a comparison was also done. The analysis showed the presence of good amounts of triterpenoids and pectin in fruit, which can further be used for lowering blood glucose levels among type 2 diabetics.***

Keywords: Ivy gourd, *Coccinia grandis*, antidiabetic, triterpenoids, pectin, Diabetes mellitus, antidiabetic properties

1. Introduction

Ivy gourd is a unique tropical plant that is a member of the family of Cucurbitaceous. Ivy gourd has been classified as a medicinal herb in traditional Ayurveda medicine. Its native range comprises India, Philippines, Cambodia, China, Indonesia, Malaysia, Myanmar, and Thailand, and in India it is abundantly cultivated in Ahmedabad, Tamil Nadu, and Jaipur in India. Ivy gourd is a perennial climber with flat leaves and single tendrils. The leaves are 6.5–8.5 cm long and 7–8 cm broad, with 5 lobes. Female and male flowers have three stamens and emerge from the axils on the petiole.It is commonly known as *tindora, tindori, kundru and kundri* in other languages.

A major number of the humans specially those living in remote area, rely on herbs for managing blood glucose levels, As pharmaceutical drugs are not easily accessible, affordable and also costlier form of treatment. In recent period there has been a rise in the field of herbal treatment for diabetes and these herbs are gaining attention in many parts of the world because of their natural origin, fewer side effects and easily affordable to diabetics(Grover *et al*., 2002)[1].One such herb is the Ivy gourd, it is an indigenous herb plant grown in India. Ivy gourd gaining traction as a diabetic herb due to its blood glucose lowering property (Yadav*et al*., 2010)[2].

Figure 1: Showing flower and fruit of ivy gourd

According to WHO (2010)[3],NCDs are responsible for the majority of deaths worldwide. Among theseDiabetes mellitus is one of most potential health risks of the 21st century. Diabetes mellitus occurs when the body generates very little or no insulin, or when the body's response to insulin is impaired (insulin resistance).

Classification of Diabetes mellitus:

1) Type 1 Diabetes is caused by a cellular-mediated autoimmune destruction of the pancreatic -cells.
2) People with Type 2 diabetes who are resistant to insulin and experience relative (rather than absolute) insulin shortage, at least initially and then periodically throughout their lives.

3) Other types of diabetes marked by hyperglycaemia that develops at a young age (generally before age 25 years).

In the present research, Ivy gourd, an herb, was analysed for its biochemicalcontent and its effect on diabetics' blood glucose levels

1.2 Medicinal value of herb

Anti-hyperglycaemic activity
The anti-hyperglycaemic activity of Ivy gourdis due to presence of pectin which help in inhibition glucose absorbance in the small intestine. Secondary data too reported thatblood glucose level reduction was observed after the consumption of Ivy gourd extract in streptozotocin induced diabetic ratsAttanayake*et al*.,(2017)[4].

β-cell regenerative potency
The presence of triterpenoids in Ivy gourd plant enables the ability to regenerate cells. After administration of Ivy gourd extract in streptozotocin induced diabetic rats, Attanayake*et al*.,(2017)[4] showed an increase in insulin secreting -cells.

2. Methodology

The present study was carried out on Ivy gourd (*Cocciniagrandis*) herb. Different parts of the herb plant, *viz*. fruit, leaf, stem, and root were analysed for macronutrient, micronutrient and antioxidant content.

2.1 Procurement of the herb root and culture

Ivy gourd herb was procured from the market by the researcher and the four parts of the plant*viz*., fruit, leaf, stem and root were analysed using standard technique andanalytical grade chemicals.

2.2 Biochemical analysis of Ivy gourd (*Cocciniagrandis*)

- Fruit, leaf, stem and root of herb Ivy gourdwere analysed for macronutrient, micronutrient and antioxidant content.
- Aliquots were produced from samples of various parts of the plant and experiments were performed in triplicate for biochemical analysis. The methods used for biochemical analyses are given in Table 1.

Table 1: Methods used for estimation of macronutrient, micronutrient and antioxidant content of Ivy gourd *(Cocciniagrandis)* herb

S.No.	Nutrients (g/100)	Method	Reference
1.	Moisture	Oven drying	AOAC,2017[5]
2.	Protein	Micro-kjeldhal	AOAC,2017
3.	Fat	Ether extractive	AOAC,2017
4.	Fibre	Acid alkali treatment	AOAC,2017
5.	Ash	Muffle furnace	AOAC,2017
6.	Carbohydrate	Composite method	AOAC,2017
7.	Pectin	Chromatography	AOAC,2017
8.	Energy	Calculation	AOAC,2017
9.	Beta carotene	Spectrophotometry	NIN,2003[6]
10.	Vitamin C	Tritration	AOAC,2017
11.	Vitamin E	Spectrophotometry	NIN,2003
12.	Calcium	Tritration	Rangana, 2010[7]
14.	Phosphorous	Colorimetry	Rangana,2010
15.	Triterpenoids	HPLC	Harborne (1998)[8]
16.	Alpha lipoic	HPLC	Saha*et al*.(2018)[9]
17.	Flavonoids	Colorimetry	Bohm and kocipai (1994)[10]
18.	Beta sitosterol	HPLC	Mallick et al.,(2014)[11]
19.	Alkaloids	HPLC	Harborne (1998)
20.	Glycoside	HPLC	Harborne (1998)

3. Result and Discussion

3.1 Analysis of macro and micro nutrients and antioxidants content

The results of nutrient estimation of different parts of Ivy gourd herb, on fresh weight basis exhibited, moisture per cent to be highest in fruit (91.14 per cent) Besides moisture, mean content of pectin (0.29±0.02g/100g) was also high, being more by 65-69 per cent in fruit in comparison to leaf, stem and root (Table 2). Root, on the other hand, had highest content of crude fiber (7.18±0.42g/100g), ash (2.56±0.41g/100g), calcium (792.22±215.41mg/100g), phosphorous (68.64±7.60mg/100g), vitamin C (139.00±11.00mg/100g), carbohydrate (18.02±0.24g/100g) and energy (86.46±3.17 Kcal/100g)(Table 2). From the above given results it could be concluded that root has good amount of estimated nutrients (on fresh weight basis) and fruit sample showed considerable amount of pectin, which is a blood sugar lowering element.

Statistical analysis showed significantly ($p \leq 0.05$) high mean values of energy, carbohydrate, ash and vitamin C in root in comparison to fruit, leaf and stem of Ivy gourd herb. Mean content of protein, crude fiber, calcium and potassium in fruit and leaf were significantly ($p \leq 0.05$) low than that found in stem and root. The mean value of pectin in fruit also differed significantly from that present in leaf, stem and root. On the other hand mean value of phosphorus in fruit and leaf were significantly more than in stem and root.

Table 2: Mean nutrient content of different parts of Ivy gourd herb*

Nutrients	Fruit	Leaf	Stem	Root
Moisture (per cent)	91.14	90.77	86.45	68.81
Protein(g/100g)	1.35 ± 0.02^{a}	1.58 ± 0.03^{a}	2.18 ± 0.30^{b}	3.34 ± 0.24^{b}
Fat (g/100g)	ND	ND	ND	ND
Crude fiber (g/100g)	1.80 ± 0.07^{a}	0.75 ± 0.03^{a}	3.02 ± 0.70^{b}	7.18 ± 0.42^{b}
Ash (g/100g)	0.16 ± 0.02^{a}	0.10 ± 0.00^{a}	0.32 ± 0.16^{a}	2.56 ± 0.41^{b}

Carbohydrate(g/100g)	6.94±0.13[a]	6.66±0.01[a]	7.63±0.18[a]	18.02±0.24[b]
Energy (kcal/100g)	31.52± 0.54[a]	35.44±0.17[a]	40.36±0.24[a]	86.46±3.17[b]
Pectin (g/100g)	0.29±0.02[a]	0.09±0.02[b]	0.04±0.02[b]	0.06±0.16[b]
Vitamin C (mg/100g)	32.74±0.00[a]	12.50±0.77[a]	11.62±5.13[a]	91.00±11.00[b]
Calcium (mg/100g)	59.32±4.77[a]	56.20±20.17[a]	142.42±72.73[b]	280.22±15.41[b]
Phosphorous(mg/100g)	6.03±0.00[a]	11.15±0.90[b]	9.52±5.20[b]	38.64±7.60[a]
Potassium(mg/100g)	14.74±0.01[a]	21.32±0.03[a]	39.03±0.14[b]	54.03±0.00[b]

Values of samples are given as Mean±SD Estimation is on fresh weight basis*
Carbohydrate values were calculated by [100 – (moisture+ protein+ fat+ ash+ crude fiber)]
Mean values with different superscripts in a row significant difference (p≤ 0.05)
Mean values with same superscripts row-wise does not differ significantly at p≤0.05

The estimation results revealed high mean content of flavonoids, alkaloids, triterpenoids, alpha lipoic acid and glycosides in fruit sample of Ivy gourd than the other parts of the herb, the same being 0.41±0.00mg/100g, 0.76±0.00mg/100g, 0.97±0.01mg/100g, 0.23±0.00mg/100g and 0.92±0.01mg/100g, respectively (Table 2).Estimations further revealed Ivy gourd leaves to be rich in antioxidant β-sitosterol (0.86±0.02mg/100g). Of all the herb parts, stem and root samples showed low content of almostall the antioxidants (Table 3). When compared statistically, the mean content of alkaloid, alpha lipoic acid, β-sitosterol, flavonoid, glycosides and triterpenoids in fruit and lead demonstrated significantly higher content (p≤ 0.05) than that found in the stem and root.

Table 3: Mean antioxidant content of different parts of Ivy gourd herb*

Nutrients	Fruit	Leaf	Stem	Root
Alkaloid (mg/100g)	0.76±0.01[a]	0.66±0.01[a]	0.45±0.00[b]	0.24±0.01[b]
Alpha-lipoic acid(mg/100g)	0.23±0.01[a]	0.22±0.01[a]	0[b]	0[b]
β-sitosterol(mg/100g)	0.34±0.00[a]	0.86±0.02[a]	0.05±0.01[b]	0.01±0.00[b]
Flavonoid(mg/100g)	0.41±0.00[a]	0.14±0.01[a]	0.02±0.00[b]	0.07±0.01[b]
Glycosides (mg/100g)	0.92±0.01[a]	0.53±0.00[a]	0.27±0.01[b]	0.14±0.01[b]
Triterpenoids(mg/100g)	0.97±0.01[a]	0.85±0.00[a]	0.74±0.01[a]	0.73±0.04[a]

Values of samples are given as Mean±SD
*Estimation is on fresh weight basis
Mean values with different superscripts in a row significant difference (p≤ 0.05)
Mean values with same superscripts row-wise does not differ significantly at p≤0.05

4. Conclusion

Nutrient property of Ivy gourd
The nutrient analysis of various parts *viz*., fruit, leaf, stem and root revealed that Ivy gourd fruit contain considerable amounts of pectin and triterpenoids. Pectin leads to lower absorption of glucose from intestine and triterpenoids prevent development of insulin resistance.

Medicinal property of Ivy gourd
Ivy gourd fruit powder is an effective, feasible, low cost without any side effects treatment to control blood glucose level. It can be used as a home remedy for the treatment Diabetes mellitus.

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