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NUTRITIONAL AND ANTIOXIDANT POTENTIAL OF *KUNDRU* (*COCCINIA INDICA* WIGHT & ARN.) AND *KIKAR* (*ACACIA NILOTICA* L. DEL.) PODS

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Abstract

Kundru (Coccinia indica) and *Kikar (Acacia nilotica)* are well known for their uses in Indian ayurveda to treat diabetes. Although the two plants are well known for their medicinal properties, not much literature is available regarding their nutritional composition. The present study reports the nutritional composition and antioxidant activity of fruits of the two plants. Significant ($P \leq 0.05$) differences were observed in ash and crude protein content of *Kikar* (2.47 and 17.30 g/100 g, respectively) and *kundru* (1.97 and 7.54 g/100 g, respectively). Resistant starch in *Kundru* and *Keekar* was 0.52 and 0.12 g/100g, respectively. I*n-vitro* protein digestibility was significantly ($P \leq 0.05$) higher in *Kikar* (35.43 %). Total phenol, flavonoids, DPPH scavenging activity and ferric reducing antioxidant power was observed to be significantly ($P \leq 0.05$) higher in *Kundru* (65.13 mg GAE/100 g, 80.04 mg RE/100g, 75.14 mg TE/100 g and 68.95 mg TE/100 g, respectively) as compared to *Kikar* (51.05 mg GAE/100 g, 25.29 mg RE/100 g, 63.84 mg TE/100g and 35.22 mg TE/100g, respectively).

Introduction

Kundru (Coccinia indica) is a creeper commonly known as Ivy Gourd or Little gourd and belongs to family *Cucurbitaceae*. It is native of Africa and Asia. It has been used in ayurvedic medicine in Sri Lanka and India to treat diabetes from ancient times (Jamwal and Kumar 2019). Young leaves and long slender stem tops as well as tender green fruits of the plant are cooked and eaten as a potherb or added to soups (Gunjan *et al*. 2010, Ramakrishnan *et al.* 2011). Ayurveda and Unani systems claim *Kundru* as antidiabetic agent and other traditional uses are anti-inflammatory, antimicrobial, antibacterial, antidepressant and expectorant (Randhawa *et al*. 2015, Kaushik and Kaushik 2022).

Kikar (Acacia nilotica), a plant species native to subtropical and tropical areas, is widely found throughout Asia, Africa, and America (Raj 2015). It is also known for its anti-diabetic effects (Kalaivani *et al.* 2011, Pareek and Chaudhary, 2013). Legumes of this plant are known to cause hypoglycemia by stimulating insulin secretion in the islets of langerhans through direct or indirect effects on β-cells (Farzana and Tharique 2014, Ojetunde 2021). In India, young pods and mature seeds of *Kikar* are known to be cooked and eaten in Rajasthan. Although the two plants are well known for their medicinal properties, not much literature is available regarding their nutritional composition. The present study was therefore planned to study the nutritional composition and antioxidant activity of fruits of the two plants.

Material and Methods

Kundru (*Coccinia indica)* vegetable was purchased from the local market in a single lot and *Kikar* (*Acacia nilotica)* pods were collected from Department of Forestry, CCSHAU Hisar, India. The clean and healthy *Kundru* were selected and washed properly, chopped in fine pieces and tray

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dried at 60-62°C for 36 hours. The dried *Kundru* were grounded to make fine powder. *Kikar* pods were also cleaned, washed, dried and grounded to fine powder in a similar way. The developed powders were further subjected to nutritional analysis using standard methods.

Nutritional analysis: Moisture, ash, crude fat, crude protein and crude fiber were estimated by employing the standard methods of analysis (AOAC 2012). The total carbohydrate and available carbohydrate were calculated by the difference method.

Total carbohydrate (%) = 100 – [Moisture (%) + Crude protein (%) + Crude fat (%) + Total ash (%)]

Available carbohydrate (%) = 100 – [Moisture (%) + Crude protein (%) + Crude fat (%) + Total Dietary fibre (%) + Total ash (%)].

Total soluble sugars, reducing sugars and starch were analysed by methods as suggested by Yemm and Willis (1954), Somogyi (1945) and Cerning and Guilhot (1973), respectively. Total, soluble and insoluble dietary fiber constituents were determined by the enzymatic method (Furda 1981). *In vitro* digestibility of protein and starch was carried out by the method of Singh and Jambunathan (1981) and Singh *et al.* (1982), respectively.

Total minerals (iron, calcium, zinc, potassium and magnesium) in acid digested samples were determined using Atomic Absorption Spectrophotometer Model No: Pinaacle 700AA. For determination of available minerals, samples were extracted in 0.1% pepsin in 0.1 N HCl (Kim and Zemel 1986) and further determined similar to total minerals. Ionizable iron in the samples was extracted and estimated according to the procedure of Rao and Prabhavati (1978).

The samples were subjected to extraction using 80% methanol acidified to pH 2.0 with 6N HCl. The concentration of total phenol of the methanolic extracts was determined by the Folin–Ciocalteau colorimetric method (Singleton *et al*. 1999). Total flavonoid content , scavenging activity of stable DPPH free radical and Ferric reducing antioxidant power were determined following Zhishen *et al.* 1999; Williams *et al*. 1995 and Tadhani 2009, respectively.

Statistical analysis was carried out using OPSTAT software provided by CCSHAU (CCSHAU 2023). Data were subjected to One way ANOVA. Means were compared using critical difference at the 95% confidence limit.

Results and Discussion

Significant ($P \leq 0.05$) differences were observed in moisture, crude fat, ash and crude protein content of *Kikar* (7.15, 3.03, 2.47 and 17.30 g/100g, respectively) and kundru (2.65, 2.07, 1.97 and 7.54 g/100g, respectively) (Table 1).Whereas *Kundru* had significantly ($P \leq 0.05$) higher total (85.78 and 70.05 g/100 g) and average (80.35 and 52.05g/100 g) carbohydrates; no significant ($P \leq 0.05$) differences were observed in crude fiber (5.43 and 5.80 g/100 g, respectively).

It was further observed that *Kikar* had significantly ($P \leq 0.05$) higher total soluble and non-reducing sugar (1.69 and 1.41 g/100g, respectively) than *Kundru* (0.89 and 0.72 g/100g, respectively). No significant ($P \leq 0.05$) difference, however, was observed in reducing sugar content (0.18 and 0.20 g/100g, respectively). Starch (29.05 and 22.15 g/100g, respectively) and resistant starch (0.52 and 0.12 g/100g, respectively) content was observed to be significantly higher in *Kundru*. Total, soluble and insoluble dietary fiber was observed to be significantly higher ($P \leq 0.05$) in *Kikar* (18.01, 6.50 and 11.51 g/100g, respectively) as compared to *Kundru* (5.61, 2.02 and 3.59 g/100g, respectively). *In-vitro* starch digestibility was significantly ($P \leq 0.05$) higher in *Kundru* (29.58 mg maltose/g) as compared to *Kikar* (21.29 mg maltose/g) whereas *in-vitro* protein digestibility was significantly ($P \leq 0.05$) higher in *Kikar* (35.43 %) (Table 1).

Total phenol, flavonoids, DPPH scavenging activity and ferric reducing antioxidant power was observed to be significantly ($P \leq 0.05$) higher in *Kundru* (65.13 mg GAE/100 g, 80.04 mg RE/100 g, 75.14 mg TE/100 g and 68.95 mg TE/100g, respectively) as compared to *Kikar* (51.05 mg GAE/100 g, 25.29 mg RE/100g, 63.84 mg TE/100g and 35.22 mg TE/100g, respectively) (Table 2).

Table 1. Proximate composition and Carbohydrate Profile of *Kundru* and *Kikar* pod powder (db).

Parameters	*Kundru* (g/100 g)	*Kikar* (g/100 g)	CD ($p \leq 0.05$)
Moisture	2.65±0.03	7.15±0.03	0.13
Crude Fat	2.07±0.12	3.03±0.09	0.43
Ash	1.97±0.03	2.47±0.03	0.13
Crude Protein	7.54±0.10	17.30±0.14	0.51
Crude Fibre	5.43±0.35	5.80± 0.47	N/A
Total Carbohydrates	85.78±0.06	70.05±0.11	0.35
Average Carbohydrates	80.35±0.06	52.05±0.65	1.87
Total Soluble Sugar	0.89±0.03	1.61±0.01	0.09
Reducing Sugar	0.18±0.02	0.20±0.01	N/A
Non-Reducing Sugar	0.72±0.01	1.41±0.01	0.04
Starch	29.05±0.05	22.15±0.03	0.17
Resistant Starch	0.52±0.02	0.12±0.01	0.05
Total Dietary Fiber	5.61±0.24	18.01±0.28	1.04
Soluble Dietary Fiber	2.02±0.04	6.50±0.22	0.63
Insoluble Dietary Fiber	3.59±0.19	11.51±0.06	0.59
In-vitro starch digestibility (mg maltose/g)	29.58±0.36	21.29±0.25	1.24
In-vitro protein digestibility (%)	32.40±0.32	35.43±0.12	0.97

Values are mean ± SE of six independent determinations.

Table 2. Total antioxidant activity in *Kundru* and *Kikar* pod powders (db).

Parameters	*Kundru*	*Kikar*	CD ($p \leq 0.05$)
Total phenols (mg GAE/100g)	65.13 ± 0.03	51.05 ± 0.06	0.18
Total Flavonoids (mg RE/100g)	80.04 ± 0.03	25.29 ± 0.01	0.07
Antioxidant activity DPPH (mg TE/100g)	75.14 ± 0.03	63.84 ± 0.02	0.10
Antioxidant activity FRAP (mg TE/100g)	68.95 ± 0.03	35.22 ± 0.02	0.10

Values are mean ± SE of six independent determinations.

Kikar had a significantly ($P \leq 0.05$) higher content of total iron, calcium, potassium and magnesium content (16.49, 209.11, 912.44 and 109.46 mg/100g, respectively) as compared to *Kundru* (15.10, 81.29, 815.28 and 100.32 mg/100g, respectively) (Table 3).

Kundru, however, had significantly ($P \leq 0.05$) higher total and available zinc content (18.08 and 9.26 mg/100g) than *Kikar* (12.92 and 5.84 mg/100g). Available calcium, potassium and magnesium content was significantly ($P \leq 0.05$) higher in *Kikar* (100.89, 522.06 and 64.52 mg/100g, respectively). No significant ($P \leq 0.05$) difference was observed between the available iron content of *Kundru* (6.22 mg/100g) and *Kikar* pods (6.16 mg/100 g) (Table 4). In terms of per cent availability, *Kundru* had significantly higher per cent availability of iron, zinc, calcium, potassium and magnesium (41.18, 51.22, 53.24, 60.22 and 59.23 %, respectively) as compared to *Kikar* (37.31, 45.21, 48.25, 57.22 and 58.94 %, respectively).

Table 3. Total and available minerals in *Kundru* and *Kikar* pod powders (db).

Parameters	*Kundru*	*Kikar*	CD ($p \leq 0.05$)
Iron			
Total (mg/100g)	15.10 ± 0.16	16.49 ± 0.09	0.52
Available (mg/100g)	6.22 ± 0.07	6.16 ± 0.03	N/A
Zinc			
Total (mg/100g)	18.08 ± 0.12	12.92 ± 0.08	0.41
Available (mg/100g)	9.26 ± 0.08	5.84 ± 0.04	0.25
Calcium			
Total (mg/100g)	81.29 ± 0.67	209.11 ± 0.11	1.93
Available (mg/100g)	43.28 ± 0.32	100.89 ± 0.10	0.95
Potassium			
Total (mg/100g)	815.28 ± 0.46	912.44 ± 0.35	1.73
Available (mg/100g)	490.96 ± 0.86	522.06 ± 0.36	2.64
Magnesium			
Total (mg/100g)	100.32 ± 0.34	109.46 ± 0.29	1.29
Available (mg/100g)	59.42 ± 0.15	64.52 ± 0.22	0.76

Values are mean ± SE of six independent determinations

Although not much explored for human nutrition, *Kikar* (*Acacia nilotica*) has often attracted scientists as a protein source (Abdalla *et al.* 2013; Malik *et al*., 2021). Increasing the utilization of plant proteins is needed to support the production of protein-rich foods that could replace animal proteins in the human diet so as to reduce the strain that intensive animal husbandry poses to the environment (Pihlanto *et al*. 2017) and this can be achieved by incorporating more legumes or protein rich plant products. *Kikar* pods have high potential for exploitation as protein source in human nutrition.

Both *Kikar* pods and *Kundru* were observed to be considerable source for micronutrient as well as antioxidant activity. The phytochemicals in plant foods are being explored for beneficial health effects because they combat oxidative stress in body by maintaining a balance between oxidants and antioxidants. In recent times natural antioxidants have raised considerable interest among nutritionists, food manufacturers and consumers because of their presumed safety and potential therapeutic value. Several studies have reported on the important role antioxidants play in acting against several reactive oxygen species, helping to prevent metabolic syndromes like diabetes and to stabilize health and various cellular activities in humans (Bjørklund & Chirumbolo

2017, D'Angelo 2020 and Michalak 2022). The antioxidant potential of both *Kundru* and *Kikar* has drawn interest of scientific community earlier also (Shaheen *et al*. 2018 and Shrivastava 2019).

It can be concluded that both *Kikar* pods and *Kundru* are good source of nutrients as well as antioxidant content and should be channelized into human nutrition through product development. Their fibre and antioxidant potential can be explored for development of functional foods for diabetics as well as cardiovascular patients..

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