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SHORT COMMUNICATION

Effect of household cooking methods on nutritional and anti nutritional factors in green cowpea *(Vigna unguiculata)* pods

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Abstract Steam pressure cooking (1 kg/cm^2) and boiling (100°C) for 3 standardized time periods were assessed. Prolonged cooking in both pressure cooking and boiling resulted in a significant ($p \leq 0.05$) loss in Fe and Ca. A significant loss of ascorbic acid and ß-carotene were observed during 2 cooking methods, the greater loss was during boiling. Pressure cooking and boiling resulted in significant ($p \leq 0.05$) destruction in the anti-nutrients like phytates, tannins and trypsin inhibitors. The in vitro protein digestibility was highest (93.9%) on 3 min pressure cooking followed by 15 min boiling (91.0%). The results indicated that pressure cooking should be preferred cooking method. Pressure cooking for 3 min and boiling for 15 min improved in vitro protein digestibility by reducing antinutrients considerably.

Keywords Cowpea pods · Proximate composition · Minerals · Ascorbic acid · Anti-nutrients · In vitro protein digestibility

Legumes are considered important and inexpensive protein and dietary fibre sources in human nutrition. Cowpea is of vital importance as from its production, rural families derive food, animal feed and cash income. Generally processing methods of cowpea pods are cooking at atmospheric pressure, pressure cooking or microwaving. Cooking pods in water, with or without pressure increases the protein quality and digestibility and inactivates protease and amylase inhibitors as well as lectins (Bressani 1989). Cooking increases dietary fibre content but also induces losses of vitamins and minerals (Walker and Kochhar 1982). Heat processing, when done under controlled time and temperature usually improves the protein quality of grain legumes (Bressani 1985).

Traditional home preparation of pods is primarily aimed at making them more palatable and improving their flavour. There is little attention paid to its nutritional value. Nutritional composition of cowpea pods as influenced by cooking periods has been seldom studied. The study was, therefore, undertaken to assess the changes in nutritional quality of cowpea pods during household cooking with variable cooking methods so that, the appropriate cooking time and the method of cooking can be determined where the consumers can attain maximum nutritional benefits from cowpea pods. Green immature pods of dual purpose cowpea variety 'CL-367' picked at 9th day after flowering were procured from the Department of Genetics and Plant Breeding, Punjab Agricultural University, Ludhiana, India.

Two most commonly used cooking methods by majority of Indian families namely, pressure cooking and boiling were employed. Three cooking times for each method of cooking were standardized keeping in view the integrity of texture of pods. The standardized times for cooking were 1, 2 and 3 min with pod and water ratio being 1:1, 1:1.5 and 1:2, respectively. Boiling was done at 100°C and boiling times standardized were 5, 10 and 15 min with pod to water ratio being 1:1, 1:3 and 1:4, respectively. The pressure cooking was done at (1 kg/cm^2) using domestic pressure cooker. Cooking time was noted from the development of full pressure, the time required to attain pressure condition being 5 min. Boiling started after 4 min and cooking time was noted from the time water started boiling.

Raw and cooked samples were oven dried at 60°C till constant weight. The dried samples were ground and pressed to pass through 5 mm sieve and preserved in 150 gauge

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polythene bags and stored at ambient conditions (20°C, 60% RH) for 28 days for analysis. Proximate composition, ascorbic acid, β-carotene and tannin content by AOAC (1990), Fe and Ca by aqua-regia method (Jackson 1973) followed by measurement of concentrations using an Atomic Absorption Spectrophotometer (Model-3110, Perkin-Elmer, Boesch, Huenenberg, Switzerland), phytic acid (Haugh and Lantzsch 1983) and trypsin inhibitors (Roy and Rao 1971) were determined. In vitro protein digestibility was studied by digesting the samples using pepsin-pancreatin digest method (Akeson and Stahmann 1964).

The experiments were conducted in triplicate. Analysis of variance was used to determine the variation between the samples cooked by 2 methods as well as between the samples cooked for 3 time periods using Sigma Plot 10-a computer software. Critical difference (C.D.) at 5% was calculated when F-ratio was significant.

Results are presented in Table 1. A reduction ($p \leq 0.05$) in the protein content during boiling of pods was observed with the increase in cooking time as also reported by Adams (1981). There was no significant difference observed in crude fat content during different cooking methods and cooking times. Barampama and Simard (1995) reported similar trend in their study. The crude fibre content of pressure cooked and boiled pods was significantly ($p \leq 0.05$) higher. No significant difference in crude fibre content was observed when pods were cooked for different periods during 2 methods of cooking. A reduction ($p \leq 0.05$) of ash content in cooked samples was observed when compared with raw sample, however, cooking duration in both the methods did not bring any change in ash content. Long cooking periods in both the methods resulted in the reduction of carbohydrates as well as energy content significantly ($p \leq 0.05$). Longer cooking time ie. 3 min pressure cooking and 15 min boiling resulted in a significant reduction in the energy content when compared with raw pods.

Both the cooking methods resulted in a reduction ($p \leq 0.05$) in Fe content when compared to raw pods. Further, the increase in the cooking time also reduced ($p \leq 0.05$) Fe content. Latunde (1990) reported a loss of total Fe when vegetables were cooked for longer periods. Rani and Hira (1993) also observed a reduction ($p \leq 0.05$) in Fe content of faba beans on cooking. The Ca content in cowpea pods reduced ($p \leq 0.05$) during pressure cooking and boiling. Bognar et al. (1998) also showed loss in minerals upon cooking of vegetables.

Ascorbic acid content reduced during pressure cooking and boiling. Higher losses during boiling may be due to

Table 1 Chemical changes in cowpea pods during different cooking methods

	Raw	Cooking methods								CD* (5%)
		Pressure cooking, min				Boiling, min				
		1	2	3	C.D. (5%)	5	10	15	C.D. (5%)	
Moisture,%	5.2	3.4	3.9	4.1	0.49	4.0	4.0	4.6	0.11	0.57
Crude protein,%	7.2	7.2	7.1	7.1	0.41	7.0	6.1	5.3	0.44	NS
Crude fat,%	0.78	0.80	0.80	0.80	NS	0.80	0.78	0.70	0.03	NS
Crude fibre,%	4.2	5.8	5.6	5.5	NS	5.6	5.6	5.6	NS	0.16
Ash,%	2.6	2.4	2.4	2.3	NS	2.4	2.3	2.2	NS	0.16
Carbohydrates,% (by difference)	81.3	80.4	80.2	80.0	0.09	80.1	81.2	81.6	0.69	NS
Energy, kcal/100 g	359	358	357	355	0.27	356	356	354	0.61	3.89
Fe, mg/100 g	4.0	4.0	3.7	3.2	0.05	3.9	3.3	2.8	0.13	0.75
Ca, mg/100 g	60.1	60.3	56.8	55.8	6.1	48.5	47.9	45.4	2.1	3.3
Ascorbic acid, mg/100 g	11.1	6.3	6.2	6.2	0.09	6.2	5.2	4.3	0.21	1.13
ß carotene, mg/100 g	15.6	11.6	9.6	8.4	0.35	5.6	5.2	3.6	0.16	2.23
Phytates, mg/100 g	833.0	722.8	702.7	576.0	3.3	604.0	565.3	474.7	5.54	119.6
Tannins, mg/100 g	718.1	432.1	313.7	272.0	4.5	439.6	324.0	266.2	0.99	139.9
TIA, mg/100 g	12.6	9.0	5.6	2.6	0.67	7.1	4.6	1.7	0.42	4.82
IVPD,%	72.2	85.3	92.8	93.9	4.2	84.8	88.5	91.0	0.6	6.6

($n=3$) TIA: Trypsin inhibitor activity, IVPD: In vitro protein digestibility

The values are on dry matter basis except those of ascorbic acid and β carotene expressed on fresh weight basis

F ratios were not significant between 2 methods of cooking

NS Not significant ($p \geq 0.05$) *CD between raw and cooking methods leaching of ascorbic acid in water as both cooking time and amount of water used was more in boiling as compared to pressure cooking. Moftugil (1986) also reported greater losses of ascorbic acid during boiling than micro-waving, losses being 14.2 and 9.3%, respectively. Prolonged boiling had detrimental effect on this vitamin. There was a reduction ($p \leq 0.05$) in ß–carotene content after cooking. With the increase in cooking time, the losses also increased. Similar results were reported by Nagra and Khan (1988) and Padmavati et al. (1992).

The phytate content of cowpea pods decreased ($p \leq 0.05$) by pressure cooking and boiling, the reduction being higher by pressure cooking. The increase in cooking time in both the methods resulted in a greater ($p \leq 0.05$) decrease in phytate level. Boiling of cowpea resulted in 21% reduction in phytate (Akinyele 1989). Tannins present in cowpea pods reduced ($p \leq 0.05$) during both cooking methods. A prolonged cooking time employed to pods seeds resulted in a reduction ($p \leq 0.05$) in tannins. Laurena et al. (1987) also reported a decrease in tannin content in cowpea seeds after cooking. Trypsin inhibitors reduced ($p \leq 0.05$) during pressure cooking and boiling of cowpea pods. The trypsin inhibitors decreased ($p \leq 0.05$) as the cooking time was increased; the maximum reduction was with boiling for 15 min followed by pressure cooking for 3 min. Sinha et al. (2005) reported that the pressure cooking was the most effective method for reducing trypsin inhibitors in cowpea. The in vitro protein digestibility of cowpea pods increased significantly after pressure cooking and boiling. The increase in cooking time improved ($p \leq 0.05$) protein digestibility, the maximum improvement was observed when pods were pressure cooked for 3 min. Ros and Collins (1992) reported that the heat treatments increased the in vitro protein digestibility primarily due to the destruction of antinutritional factors present in cowpeas. The main effect of heat treatment on the nutritional value is to increase the protein quality. Although as heating time proceeds, protein quality increases to a maximum, primarily due to loss of antinutrients. Another probable reason is that globulins, which make up larger portion of legume proteins are resistant to denaturation and in the relative state, are not readily broken down by digestive enzymes (Antunes and Sgarbieri 1980)

Conclusion

The loss of ascorbic acid was lesser during pressure cooking as compared to boiling. Prolonged boiling had detrimental effect on ascorbic acid. Pressure cooking for 3 min or boiling for 15 min improved in vitro protein digestibility by reducing antinutrients considerably. However, longer cooking durations reduced ascorbic acid and beta carotene significantly.

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