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Effect of Soaking Sprouting and Cooking on Physico-Chemical Properties of Moth Beans (*Vigna aconitifolia*)

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INTRODUCTION

Legumes are produced and widely consumed throughout the world particularly in tropical and sub-tropical areas of Africa, Asia and Latin America. For people who live in these areas, legumes constitute an important source of protein, B complex vitamins and minerals. India is a major legume producing country accounting for about 27-28 per cent of world legume production. Area under legume cultivation in India is 228.47 lakh hectares yielding an annual production of 130.70 lakh tonnes (India, 2000). Moth beans are one of the legume consumed in Northern India. Before consumption moth beans are soaked over night and then cooked. During this pre-soaking and cooking nutritional quality of legume is affected (Bishnoi, 1991). Apart from improving the nutritional quality of legumes these pre-processing treatments also might help in reducing anti-nutritional factors present in legumes and their by increasing the bio-availability of the legumes.

But no much work has been done so far on the effect of pre-processing treatments on the physico-chemical characteristics PER and FER of the moth beans. So present study was planned to see effect of soaking, sprouting and cooking on the physico-chemical characteristics and PER and FER of soaked, sprouted and cooked moth beans.

MATERIAL AND METHODS

Moth bean (*Vigna aconitifolia*) were procured from the local market of Palampur, Himachal Pradesh. The grains were cleaned manually to get rid of dust and other foreign materials.

Preparation of Samples

Soaking: Legumes grains were steeped in potable tap water for 12 h. Grain to water ratio was 1 : 3. After 12 h grains were dried in a tray drier at 50+3°C for 12 h.

Sprouting: The soaked grains were kept in tray lined with wet sand bed of 2 cm thickness. Covered over with wet filter paper sheet. Grains on sand beds were also covered with filter paper sheet and allowed to germinated at ambient temperature 25±2°C. Grains were sprinkled with water. It took 72 h for grains to germinate. When the sprouts were 1-2 cm long germinated grains were dried in cabinet drier at 50±3°C for 12 h.

Pressure Cooking: Legume samples soaked for overnight were cooked in a pressure cooker with equal amount of water for 45 minutes. The cooked samples were dried in a cabinet tray drier at 50±3°C for 12h.

Milling: The dried samples were milled in Willey Mill, to pass through a 40 mesh sieve. After grinding samples were kept in refrigerator in air tight plastic containers till further analysis was done.

The 100 grains in triplicate from raw soaked, sprouted and cooked samples of moth beans were observed for length and width was estimated using vernier caliper. Weight volume ratio (density) was determined by noting the change in water level after adding hundred grains (weighed). Proximate composition was determined according to AOAC (1990) methods. The nitrogen content was estimated by micro-kjeldhal method (AOAC, 1990) and it was multiplied by factor 6.25 to obtain crude protein value.

Non-protein-nitrogen was determined by the method of Kapoor et al. (1975). True protein was calculated by the following formula :

True protein = (Crude protein nitrogen-Non protein nitrogen) x 6.25

Energy was determined by chromic oxide method of O'Shea and Mayure (1962). Starch was estimated by the method of Clegg (1950).

Animal Experiments

Fourty male Wistar rats aged 28 days weighing 32±5 g were obtained from the Germ-Free Small Animal House of the College of Veterinary Sciences, CCS Haryana Agricultural University, Hisar were equally divided into five groups according to weight and randomly housed in individual cages. Weighed amount of feed and water were provided *ad libitium.* One control group was fed casein diet and three other groups were given raw, sprouted and cooked moth beans. All the diets contained (g/100 g diet) sucrose 10, groundnut oil 10, mineral mixture 4, vitamin mixture 1, cellulose 5, choline chloride 0.02 in addition of specific amount of legume and starch (Table 1). The composition of mineral and vitamin mixture is as recommended by NAS (1972) committee. The ingredients were mixed thoroughly to ensure uniform distribution of vitamin and salt mixture and passed through 70 mesh sieve. Feed efficiency ratio (FER) and protein efficiency ratio (PER) were determined by the method of Chapman et al. (1959). The data were subjected to anlaysis of variance (Snedecor and Cocharen, 1968).

Table 1: Legume and starch content of diets (g/100 g diet)

Ingredient	*Legume*	*Starch*
Casein control	13.00	56.98
Raw legume	45.70	24.28
Sprouted	44.48	25.50
Cooked	44.60	25.38

RESULTS AND DISCUSSION

The weight of the cooked moth beans increased by about 137.61 times. During sprouting increase was only 83.49 times (Table 2). Weight volume ratio (density) decreased in soaked, sprouted and cooked grains as compared to raw samples. Decrease was per cent in cooked grains and in sprouted grain it was per cent significant P<0.05 difference was there in the density of the raw moth bean seeds as compared to soaked, sprouted and cooked grains. The decrease in density might have been due to the physical changes and leaching out of some inorganic matter and total solids. Soaking, sprouting and cooking of kidney bean also resulted in a change in their length and width. Seed length was more in sprouted grains but cooking resulted in a significant (P<0.05) decrease in the length of grain which might have been due to rupturing of seeds and shrinkage due to extraction of tissue water.

Data in Table 2 shows that soaking, sprouting and cooking of kidney bean grain resulted in significant (P<0.05) changes in proximate composition of grains. Moisture content was 21.09 per cent in the cooked samples. Whereas for sprouted and soaked grain it was 11.16 and 15.78 per cent respectively. A 19.88 per cent increase in the ash content of cooked grains and 3.36 per cent increase in soaked grains was there. Increase in ash in cooked grains might have been due to reason that normal tap water was used for cooking and it was not discarded. Whereas Pawar and Ingle (1988) reported a reduction in ash content of cooked grains. A significant (P<0.05) increase in crude fat was observe which might be due to physico-chemical changes going on in the seeds during germination and cooking and also due to breakdown of germ portion as fat is mainly present in the germ portion of seed. A significant decrease (P<0.05) was observed in the crude protein and true protein content of soaked and cooked seeds of moth beans (Table 2). Whereas in sprouted grain slightly higher crude protein and true protein was there which might have been due to synthesis of new protein. Similar results have been reported by Padamshree et al. (1987). There was a decrease in the calorific value of soaked, sprouted and cooked seeds as compared to raw seeds (Table 2). About 19.64 per cent decrease was there in the calorific value of cooked legumes. Similarly starch content decreased to the extent of 20.14 per cent in cooked samples. Whereas decrease in starch content was maximum in sprouted grain in which starch content decreased

Table 2: Physico-chemical changes in raw soaked sprouted and cooked kidney beans

Attributes	*Raw*	*Soaked*	*Sprouted*	*Cooked*	*CD (P<0.05)*
100 Kernal weight (g)	3.27	6.38	6.00	7.77	0.39
Density (wt g/volume ml)	1.64	0.94	1.84	0.22	0.19
Length (mm)	5.13	7.17	8.30	8.37	0.40
Width (mm)	5.15	5.97	6.18	6.27	0.23
Moisture (%)	7.35	6.19	6.53	5.80	0.28
Ash (%)	3.27	3.38	2.90	3.92	0.26
Crude fat (%)	1.29	1.13	1.53	1.49	0.19
Crude fibre (%)	3.83	3.70	3.52	3.51	0.53
Crude protein (%)	21.88	21.15	22.48	20.39	1.44
Non protein nitrogen (%)	0.70	0.54	0.62	0.50	0.16
True protein (%)	17.51	17.75	18.60	17.27	0.60
Energy (Kcal/100 g)	406.59	397.41	346.10	326.75	48.72
Starch (%)	50.25	46.88	41.25	40.13	4.15

by 17.91 per cent table 2. This decrease might have been due to hydrolysis of starch during germination.

Results in table 3 shows that feed intake and protein intake was maximum for casein fed control. Rats fed in cooked moth bean had higher weight gain as compared to rats fed on sprouted group. Similarly feed efficiency ratio and protein efficiency ratio was higher in the group of rats fed on the cooked moth beans. Higher FER and PER in the cooked moth bean might have been due to the improvement of digestibility of moth beans and also due to the reason that anti-nutritional factors present in moth beans might have been destroyed during cooking (Bakr and Gawish, 1991; Modgil and Mehta, 1997).

Table 3: Effect of soaking, sprouting and cooking on the feed efficiency ratio and Protein efficiency ratio

Attributes	*Casein control*	*Untreated*	*Sprouted*	*Cooked*	*CD (P<0.05)*
Feed consumed(g)	270.53	127.93	117.00	143.90	21.10
Protein consumed (g)	27.05	14.39	11.70	12.79	2.10
Weight gain (g)	81.55	24.74	26.30	27.78	1.73
FER	0.32	0.24	0.21	0.24	0.01
PER	3.15	1.71	2.05	2.37	0.14

CONCLUSION

Soaking, sprouting and cooking of moth beans resulted in the changes in the physico-chemical characteristics of grains. *In vitro* studies have shown that soaking and cooking reducing the protein content of moth bean whereas *in vivo* studies revealed that cooking increase the FER and PER of kidney beans.

KEY WORDS Moth Beans. True Protein. Non-protein Nitrogen. Soaking, Sprouting. Cooking. Protein Efficiency Ratio. Feed Efficiency Ratio.

ABSTRACT Effect of soaking sprouting and cooking on the physico-chemical properties of moth beans was seen. Soaking, Sprouting and Cooking resulted in an increase in the 100 kernal weight, length and width of moth beans whereas density (weight volume ratio) decreased. There was decrease in the protein content of soaked, sprouted and cooked grains whereas an increase in PER and FER was observed these were fed to rats. Results have revealed that cooking increase the food efficiency ratio and protein efficiency ratio of grain.

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