

STUDIES ON THE COMPOSITION AND PROCESSING OF BAUHINIA SPECIES (KACHNAR)

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Abstract. Freshly harvested samples of Bauhinia were analysed for moisture, protein, ascorbic acid and ash before and after dehydration and during 270 days storage of dehydrated product. White variety showed higher drying rates, lower final moisture content and higher rehydration ratios as compared to the purple 'Kachnar'. Subjective evaluations for colour, flavour and appearance confirmed the superiority of white over purple variety. Though ascorbic acid, sulphur dioxide content and rehydration ratios gradually decreased during 270 days storage of the dehydrated samples, the product remained acceptable uptill the termination of the experiment.

The immature and closed flower buds of *B. variegata* L. and *B. purpurea* L. locally known as 'Kachnar' containing moisture (75.0%), proteins (5.2%), fat (0.4%), ash (1.8%) and ascorbic acid (176 mg/100g)¹ are available in the market and consumed as a vegetable. These are cooked alone or with minced meat.

'Kachnar' is available in large quantities during a very short period from second week of February to third week of March. It would be appropriate to preserve this delicious vegetable during this period. Investigations were carried out on the chemical composition, protein quality, dehydration, rehydration characteristics and storage stability of the two varieties of 'Kachnar'.

Material and Methods

The samples of white and purple 'Kachnar' were obtained from the experimental gardens of the PCSIR Laboratories, Peshawar. Both the samples were analysed for moisture,² protein (Nx6.25),² ash,² and ascorbic acid content.³

Amino Acid Composition of 'Kachnar' Proteins. Dried, powdered, defatted and weighed material was repeatedly extracted with 5% trichloroacetic acid at 60°. In this way most of the saccharide material was removed. The residual portion, consisting chiefly of proteins, was dried and hydrolysed in a sealed tube with 6N hydrochloric acid at 110° for 20 hr. The hydrolysate was filtered, the acid was removed in vacuo and the material was taken up in 10% isopropanol for its preservation and further analysis. The amino acids were determined by buffered filter paper chromatography.⁴ Amino acids were identified by referring to their R_f value or relative positions. The individual spots were eluted with 75% alcohol, containing 0.1% CuSO₄ to

enhance the colour density, and a photoelectric colorimeter was used to measure the optical density of the colour in different spots.

Processing of 'Kachnar'. Blanching time was determined by checking the peroxidase activity by the method of Masure and Campbell.⁵ The samples were steam blanched for 2.5 min, dipped in 1.0% sodium sulphite solution at 60° for 50 to 60 sec, loaded on to trays at the rate of 8 kg/m², and placed in a cabinet type dehydrator (Model No. 6298/59-Manchester). The optimum drying conditions were determined after a series of preliminary experiments, and the drying schedule followed is given in Table. 1

The results of averages of triplicate observations of these experiments are reported in Table 2.

Drying Rate Calculations. Average weight of the two trays from each sample was used for drying rate calculations. Net weight of the samples was determined initially and at 30 min intervals during whole of drying operation. Drying rates were calculated as described by Van Arsdel and Copley.⁶

Quality Evaluation and Chemical Analysis of Dehydrated Samples. Processed samples were packed in polyethylene pouches, stored at ambient temperature upto 270 days. The samples were periodically drawn and analysed for moisture,² ascorbic acid,³ sulphur

TABLE 1. DEHYDRATION SCHEDULE OF 'KACHNAR'.

Drying temperature dry bulb °C	Drying time (min)
90	30
80	30
70	30
60	270

* PCSIR Laboratories, Lahore.

TABLE 2. TIME-TEMPERATURE DETERMINATION OF DEHYDRATION OF 'KACHNAR'.

Experiment No.	Drying temperature dry bulb °C	Drying time (min)	Moisture (%)	Quality of* dehydrated product
1	90	200	7.8	Unacceptable
2	80	300	7.2	Unacceptable
3	70	400	7.6	Acceptable
4	60	500	7.7	Acceptable

*Rehydrated samples were organoleptically evaluated for their colour, flavour and appearance by a panel of expert judges.

dioxide content,⁷ and rehydration characteristics. The samples were rehydrated by boiling them in water for 6 min⁸ and rehydration ratios were calculated.⁹ The rehydrated samples were subjectively analysed along with their frozen controls for colour, flavour and appearance. At the beginning of the experiment a portion each of both white and purple samples was blanched and frozen stored in polyethylene pouches at 20⁰, which served as control. The judges were requested to arrange the samples in order of preferences.

Results and Discussion

Determination of Optimum Drying Conditions. Preliminary experiments were conducted on white variety of 'Kachnar' to determine suitable drying temperatures resulted in a prolonged, rather uneconomical drying time (Table 2). Consequently such a drying schedule was established (Table 1), which in shortest possible time produced a finished product of acceptable quality, desired final moisture content and of better

rehydration characteristics.

Effect of Variety on Drying Rates of 'Kachnar'. White variety had higher drying rate as compared to the purple 'Kachnar' despite lower initial moisture of fresh purple variety. This trend was maintained upto a dehydration period of 360 min. However, the difference was reduced towards the completion of drying process. This phenomenon might either be due to varietal characteristics of 'Kachnar' or maturity (toughness) of the flower buds.

Effect of Processing and Storage on the Quality of 'Kachnar'

(a) *Moisture Content.* Fresh white and purple varieties of 'Kachnar' were found to contain 62.51% and 56.33% moisture content (Table 3) respectively. The final moisture content of processed 'Kachnar' was higher in case of purple (7.42%) than white (6.53%). Lower moisture content of fresh and higher final moisture content of dehydrated purple 'Kachnar' indicated higher maturity level of this variety.

At the termination of storage investigations white

TABLE 3. EFFECT OF PROCESSING AND STORAGE ON VARIOUS CONSTITUENTS OF 'KACHNAR'.

Constituents estimated	Variety	Fresh 'Kachnar'	Dehydrated 'Kachnar'	Storage time (days)		
				90	180	270
Moisture (%)	white	62.51	6.53	6.65	6.69	6.72
	purple	56.33	7.42	7.48	7.52	7.55
Protein (%)	white	5.87 (15.66*)	15.62	15.58	15.57	15.57
	purple	6.08 (13.92*)	13.85	13.81	13.79	13.80
Ascorbic acid (mg/100g)	white	130.2 (347.3*)	235.9	200.0	175.4	156.8
	purple	113.7 (260.4*)	198.5	169.9	140.3	125.4
Ash content (%)	white	1.18 (3.15*)	3.12	3.12	3.13	3.12
	purple	1.20 (2.75*)	2.78	2.78	2.77	2.77
Sulphur dioxide (ppm)	white	—	685	572	542	514
	purple	—	668	554	522	492

*Dry matter basis.

variety showed 3.2% increase in moisture level, while the increase in case of purple 'Kachnar' was 2.9%. It indicates that higher is the final moisture content of dehydrated 'Kachnar', lower is the increase in moisture level during 270 days storage at ambient temperature, and vice-versa.

(b) *Protein*. Protein content of 'Kachnar' were found to be lower (Table 3) than figures reported in literature.¹ The difference in the protein values of white (15.66%) and purple (13.92%) varieties may be due to varietal characteristics or cultural differences such as irrigation, application of fertilizer etc.

Dehydration and storage of dehydrated product for 270 days did not show significant effect on the protein content of both the varieties of 'Kachnar' (Table 3).

(c) *Amino Acid Composition of Kachnar Protein*: Analysis of 'Kachnar' protein showed that it contained fourteen amino acids, eight of them were essential (Table 4). Lysine was present in higher amounts followed by arginine and threonine. Arginine is essential for developing child and is dominant in 'Kachnar'. It may, therefore, be concluded that 'Kachnar' protein is valuable both qualitatively as well as quantitatively.

(d) *Ascorbic Acid*. White 'Kachnar' retained 67.91% of original ascorbic acid on dehydration, while purple variety showed a higher retention (76.21%) than the white (Table 3). At the termination of experiment white variety showed 45.16% retention of ascorbic acid and purple 'Kachnar' could retain 48.15%. Purple variety showed comparatively higher losses during latter stages and the gap between the percent retention

of ascorbic acid in the two varieties narrowed towards the end of storage.

(e) *Ash Content*: White variety contained higher amount of mineral matters as compared to the purple 'Kachnar'. These values did not change significantly during processing and storage (Table 3).

(f) *Sulphur Dioxide Content*: White variety showed comparatively higher amount of sulphur dioxide content as compared to the purple 'Kachnar', though both varieties received the same sulphiting treatment. This difference was maintained during 270 days storage at ambient temperature. Sulphur dioxide content decreased in both the varieties during storage. However, maximum loss occurred during first storage interval, while minimum change was observed during the last analysis (Table 3).

(g) *Rehydration Ratios (RR)*: White 'Kachnar' samples showed higher R.R. values as compared to the purple variety. This was obviously due to the difference of the maturity (hard tissues) of the flower buds. A gradual but insignificant decrease in R.R. was observed during 270 days storage in both the varieties. However, white samples maintained their superior rehydration characteristics through out the storage of dehydrated product (Table 5).

(h) *Organoleptic Evaluation of Dehydrated 'Kachnar'*

(i) *Colour Evaluations*: Control samples (frozen) ranked higher than the dehydrated 'Kachnar' of both the varieties. White variety was evaluated to be better in colour both in control as well as processed samples. Purple variety developed somewhat dull-purple colour

TABLE 4. AMINO ACIDS OF THE PROTEIN OF 'KACHNAR'

Amino acid	White variety		Purple variety	
	Amino acids from Total protein (g)	Amino acids from Total protein (g)	Amino acids from Total protein N (g)	Amino acids from Total protein N (g)
Alanine	7.63	1.22	6.00	0.96
Arginine*	10.57	1.69	11.25	1.80
Aspartic acid	3.83	0.61	9.71	1.55
Glutamic acid	2.80	0.45	1.70	0.27
Glycine	1.84	0.29	2.63	0.42
Isoleucine*	2.80	0.45	2.87	0.46
Leucine*	4.50	0.72	6.00	0.96
Lysine*	11.83	1.89	11.83	1.89
Phenylalanine*	3.22	0.52	2.84	0.45
Proline	2.15	0.34	0.85	0.14
Serine*	2.10	0.34	2.60	0.42
Threonine*	5.28	0.84	2.67	0.43
Tyrosine	6.15	0.98	5.53	0.88
Valine*	4.80	0.77	4.98	0.80

*Essential amino acids.

TABLE 5. REHYDRATION RATIOS OF DEHYDRATED 'KACHNAR'.

Variety	Storage time (days)			
	0	90	180	270
White	2.87	2.63	2.59	2.58
Purple	2.68	2.59	2.54	2.52

on processing, which decreased its acceptability as compared to the white samples. Frozen (control) samples scored better than the dehydrated buds indicating the adverse effect of dehydration on the colour of both the varieties. Rank order of the samples did not change during storage (Table 6).

(ii) *Flavour Evaluation*: Variety and processing by dehydration did not show a significant difference in rank order for flavour. Amongst the dehydrated samples, white variety ranked better than the purple 'Kachnar' throughout the storage investigations. White control scored lower than purple control except during first storage (0 days) interval where it was ranked the best (Table 6). However, with the advancement of storage the frozen controls developed off-flavour and ranked lower than the dehydrated samples. Thus indicating active hydrolytic rancidity in the frozen samples due to the presence of moisture. Lipolytic enzymes, found in many tissues and seeds, attack the fatty material with the liberation of free fatty acids causing hydrolytic rancidity.¹⁰

(iii) *Appearance Evaluation*: Dehydrated samples (on rehydration) scored better than control samples (frozen) when subjectively analysed after processing as well as during 270 days storage. This may be due to the adverse effect of freezing on the structure of buds. White variety ranked better than purple 'Kachnar' amongst the dehydrated samples except during one storage interval, while purple 'Kachnar' scored higher than white variety in frozen (control) samples (Table - 6). Rank order in appearance of the samples remained almost unchanged during 270 days storage.

Conclusion

From the overall results, it may be concluded that, under the conditions these studies were conducted, white variety had an edge over the purple during processing by dehydration and storage of dehydrated 'Kachnar'. Organoleptic evaluations also lead to the conclusion that dehydrated 'Kachnar' had better acceptability as compared to the frozen buds.

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TABLE 6. EFFECT OF PROCESSING AND STORAGE ON SUBJECTIVE EVALUATION OF 'KACHNAR'.

Variable tested	Storage time (days)											
	0			90			180			270		
	Sample rank	Total rank	Mean* rank	Rank order	Sample	Total rank	Mean* rank	Rank order	Sample	Total rank	Mean* rank	Rank order
Colour	B	6	1.2	1	B	7	1.4	1	B	8	1.6	1
	D	9	1.8	2	D	8	1.6	2	D	9	1.8	2
	A	15	3.0	3	A	17	3.4	3	A	15	3.0	3
	C	20	4.0	4	C	18	3.6	4	C	18	3.6	4
Flavour	B	8	1.6	1	A	9	1.8	1	A	8	1.6	1
	A	12	2.4	2	D	11	2.2	2	C	11	2.2	2
	C	14	2.8	3	C	14	2.8	3	D	14	2.8	3
	D	16	3.2	4	B	16	3.2	4	B	17	3.4	4
Appearance	A	9	1.8	1	C	7	1.4	1	A	8	1.6	1
	D	11	2.2	2	A	9	1.8	2	C	10	2.0	2
	C	13	2.6	3	D	15	3.0	3	D	14	2.8	3
	B	17	3.4	4	B	19	3.8	4	B	18	3.6	4

* Average of five judgements, A=White dehydrated, B=White frozen (control), C=Purple dehydrated, D=Purple frozen (control).

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