Biological Sciences Section

Pakistan J. Sci. Ind. Res., Vol. 31, No. 4, April 1988

INFLUENCE OF VARIETY ON THE QUALITY OF CANNED CAULIFLOWER

Mohammad Rauf Khan, Sherin Iqbal and N.A. Sufi

PCSIR Laboratories, Jamrud Road, Peshawar

(Received December 1, 1987; reivsed April 6, 1988)

Five varieties of cauliflower are grown locally namely Mid-Early, Matra, Gachi, Faisalabad and Swat Local were studied for their chemical composition and suitability for canning. Data on chemical composition has been presented. The cutout examination of canned cauliflower varieties showed that the varieties Matra and Faisalabad had good colour texture and taste. These varieties were rated superior to canned products from other varieties in overall quality besides meeting the requirements of Army Supply Corps. (ASC) specifications for drained weight and disintegration. Ascorbic acid losses in canned cauliflower were 52.2 to 66.9% during 6 months storage and 66.3 to 80.1% during 12 months storage at room temperature (13-35^{O}). Maximum retention of ascorbic acid during processing and storage was observed in Matra and Faisalabad varieties while maximum loss of ascorbic acid was recorded in Swat local, Gachi and Mid-early varieties. On overall basis cultivars Matra and Faisalabad were found suitable for canning.

Key words: Cauliflower varieties, canning.

INTRODUCTION

Cauliflower is canned mainly for supply to the armed forces. It is commonly preserved by canning, freezing and dehydration. Pink discolouration, over softening and disintegration of the product are some of the defects encountered in canning of cauliflower. Treatment with calcium chloride, SO_2 and ascorbic acid have been reported to eliminate these defects [1]. The variety, location and growing conditions are also known to influence the processing quality of a vegetable [1,2]. It is also known that all varieties of vegetables or fruits are not equally suitable for canning and dehydration. Cauliflower variety that produce light compact white heads with relative smooth surface, tender texture and not too stiff floret stalks are desirable for processing [3]. Besides they should also retain good colour, texture, flavour and nutritive value during and after processing. The published information on the screening of different varieties of cauliflower for canning [4] effect of blanching [1,2] on texture and pectin of canned cauliflower is rather scanty. Investigations carried out to assess suitability of different locally grown cauliflower varieties for canning are reported.

MATERIALS AND METHODS

Five varieties of cauliflower, namely, Mid-Early, Gachi, Faisalabad and Swat local were obtained from Agriculture Research Institute Tarnab. All these varieties were grown under identical conditions. After harvesting the cauliflower heads, they were quickly transported to the laboratory the same day and processed.

Methods of analysis. Standard AOAC [4], mehtods were employed for estimating moisture, ash, acidity, reducing sugar, non-reducing sugar, total sugar, fat, proteins, fibre and ascorbic acid. Total soluble solids were directly recorded on Abbe's refractometer.

Canning. Cauliflower heads were vashed thoroughly and cut into 3-4 cm long pieces, each piece having a stalk no longer than 2 cm. in length. The cut pieces were blanched for 15 min. at 70^{O} in 1% $CaCl_2$ solution containing 350 ppm SO_2 and then soaked in 5% $CaCl_2$ for 1 hour, washed and used for canning. In control the cauliflower pieces were blanched in plain water at the same temperature. The water pick up by the pieces (Control sample) was 5.9%. Weighed quantity of blanched cauliflower pieces (both sample) was filled hot into lacquered 2½size cans and covered with hot brine containing 3% salt (NaCl), 0.06% ascorbic acid and 0.05% citric acid. The cans were exhausted to a can centre temperature of 82^{O}, sealed, processed at 10 lbs/sq. inch steam pressure for 20 minutes. They were than immediately cooled in running cold water, wiped dry and stored at room temperature under shade for subsequent storage studies.

Cut-out examination and quality evaluation. Cutout examination of the canned cauliflower was carried out at regular intervals during the storage period (0, 3, 6, 9 & 12 months). Drained weight was determined by draining the contents for 2 min. on sieve (20.3 x 20.3 cm : 8 meshes

per 2.5 cm). Disintegration in the drained product was recorded by weighing the cauliflower pieces which had lost their normal shape, or from which portions had been separated. Organoleptic evaluation of canned cauliflower samples was done by 7 penelists who were familiar with the quality of canned products for the quality attributes colour, texture, taste and overall quality on a 5 point hedonic scale (1 poor, 5 excellent). Since the Warranty period for canned cauliflower as per ASC, specifications, is 9 months, cutout data and quality assessment scores initially after one week of canning and after one year of storage are presented.

RESULTS AND DISCUSSION

The chemical composition of fresh cauliflower varieties used in canning is presented in Table 1. The mean, standard deviation (SD) and coefficient of variation (CV) of the results have also been determined. Wide variations are observed in different parameters of fresh cauliflower varieties. The ascorbic acid ranged from 76.50 mg/100g (lowest) in Faisalabad to 97.20 mg/100g (highest) in Mid-early variety. The cutout examination of canned cauliflower stored at room temperature during regular periods of storage are given in Table 2. The results revealed that

Table 1. Chemical composition of fresh cauliflower varieties

On percent basis	Mid-early	Matra	Gachi	Faisalabad	Swat local	Mean	SD	CV
Moisture	90.93	90.24	91.16	90.46	90.99	90.76	0.35	0.38
Total soluble solids	7.0	7.0	6.5	8.5	7.0	7.2	0.68	9.42
Total ash	0.64	0.65	0.89	0.94	0.76	0.78	0.12	15.73
Total acidity.	0.12	0.11	0.11	0.11	0.18	0.12	0.03	23.15
Reducing sugar.	2.01	2.24	2.47	2.11	2.43	2.25	0.18	7.99
Non-reducing sugar	0.13	0.32	0.15	0.15	0.19	0.19	0.07	36.60
Total sugar	2.14	2.56	2.62	2.26	2.62	2.44	0.20	8.23
Crude fat	0.03	0.04	0.08	0.09	0.05	0.06	0.02	39.92
Nitrogen	0.30	0.35	0.37	0.34	0.22	0.32	0.05	16.81
Crude fibre	0.73	1.04	0.95	0.95	1.17	0.27	0.14	14.85
Ascorbic acid mg/100g	97.20	90.0	90.0	76.5	86.4	88.02	6.74	7.66

SD = Standard deviation., CV = Coefficient of variation.

Table 2.Cut-out examination of canned cauliflower varieties during storage.

Cultivar	Vacuum (inch of Hg)	Drained wt %*	Internal condition of cane	Disintegration %*	Colour of product	Texture of product	Taste of product	Appearance of covering brine
Storage period 0, month								
Mid-early	T 17	56.50	Good	1.2	L. yellow	Firm	Acceptable	Clear
	C 17	56.80	"	1.2	"	Mod	"	"
Matra	T 18.5	61.46	"	Nil	white	Firm	Good	"
	C 18.5	60.10	"	"	"	Mod	"	"
Gachi	T 18.0	56.30	"	2.1	L. yellow	Firm	Fair	"
	C 17.5	55.4	"	2.1	"	Soft	"	"

(Continued.....)

(Table 2 continue)

Faisalabad	T 17.2	61.06	"	Nil	White	Firm	Good	"
	C 17.5	59.50	"	"	"	M. firm	"	"
Swat local	T 16.5	58.30	"	1.5	White	M. firm	Fair	"
	C 15.0	58.10	"	1.5	White	Soft	"	"
Storage period 12 months								
Mid-early	T 12.0	55.95	Slight feathering.	3.5%	Yellow	Firm	Acceptable	Clear.
	C 12.0	55.08	"	3.5%	"	M. firm	"	"
Matra	T 13.5	60.84	Good	Nil	White	Firm	Good	"
	C 13.5	59.34	"	"	"	M. firm	"	"
Gachi	T 12.2	55.63	"	4.1	Yellow	M. firm	Fair	"
	C 12.0	55.10	"	4.1	"	Soft	"	"
Faisalabad	T 13.5	60.12	"	Nil	White	Firm	Good	"
	C 13.5	58.75	"	"	"	M. firm	"	"
Swat local	T 10.5	57.24	"	3.6	"	M. firm	Fair	"
	C 10.2	57.10	"	3.6	"	Soft	Fair	"

T = Treated., C = Control., * = Calculated 4 cans.

vacuum in various cans ranged from 15".0 of Hg to 18.5", Hg immediately after canning and 10.2", Hg to 13.5", of Hg after 12 months of storage, the headspace 0.4 cm, indicating that the processing conditions given have been uniform. While the cans showed good internal condition one week after canning and slight feathering was observed in the Mid-early variety. At the end of the 12 months storage period, the brine in all cases was clear. All the varieties recorded drained weight more than 55% as required under fruit product order (FPO) specifications for vegetables canned in brine. The colour of the product made from Matra, Faisalabad and Swat local varieties was white and received a score of 3.8, 3.65 and 3.3 immediately after canning and 3.5, 3.32 an 3.1 after 12 months storage respectively (Table 4). These varieties were rated superior for the quality attribute. The colour of Mid-early and Gachi was from slight yellow to yellow, immediately after canning and after 12 months storage respectively (Table 2). These varieties scored from 2.0 to 2.5 and 1.85 to 2.2 respectively and were inferior (Table 4). The varieties Mid-early, Matra and Faisalabad gave firm texture whereas the Gachi and Swat local showed moderate firm texture. The varieties Matra and Faisalabad was scored superior because it gave white colour and firm texture. The Mid-early variety gave firm texture but was yellow in colour and was inferior in quality (Table 2). The taste of all the varieties was from acceptable to good and none of the variety was found unacceptable by the panelists. The varieties Matra and Faisalabad were found good in taste and aroma. All the varieties gave percent disintegration in the canned produced below 5%, the maximum permissible under the ASC specifications (Table 2). The less of ascorbic acid during processing ranged from 18.3 to 28.9% (Table 3). There was progressive increase in the loss of ascorbic acid during storage (Table 3). The loss ranged from 30.2 to

Table 3. Losses of ascorbic acid in canned cauliflower varieties during processing and storage at room temperature (13-35°).

Cauliflower variety	Treatment	% Loss during processing	Percent losses of ascorbic acid during storage (months)			
			1	3	6	12
Mid-early	T	28.9	46.1	50.6	60.1	70.8
	C	27.1	45.4	52.2	61.3	74.1
Matra	T	22.3	30.2	42.6	52.2	66.3
	C	18.3	33.5	45.1	50.2	69.2
Gachi	T	27.6	43.8	50.4	61.4	78.4
	C	23.5	48.7	46.7	64.8	80.6
Faisalabad	T	22.6	35.9	45.4	56.1	67.2
	C	20.1	40.1	43.3	55.3	70.1
Swat local	T	25.4	44.5	51.9	62.1	75.5
	C	21.4	46.3	54.1	66.9	80.1

T = Treated., C = Control.

Table 4. Sensory evaluation of canned cauliflower varieties

	Mid-early	Matra	Gachi	Faisalabad	Swat local	Mean	S.D.	C.V.
0 Months storage								
Colour	2.0	3.80	2.5	3.65	3.3	3.05	0.69	22.67
Texture	3.2	3.29	2.14	3.40	2.6	2.93	0.48	16.38
Taste	1.9	3.70	2.45	3.49	3.21	2.95	0.67	22.86
Overall quality	2.0	3.54	2.43	3.54	2.85	2.87	0.61	21.17
12 months storage								
Colour	1.85	3.5	2.2	3.32	3.1	2.79	0.65	23.27
Texture	2.94	3.18	2.0	3.18	2.4	2.74	0.47	17.04
Taste	1.6	3.56	3.1	3.26	2.9	2.68	0.73	27.19
Overall quality	2.1	3.40	2.1	3.3	2.8	2.74	0.56	20.46

S.D. = Standard deviation., C.V. = Coefficient of variation.

46.3% during one months storage, (lowest in Matra), 42.6 to 54.1% during 3 months storage, 52.2 to 66.9% during 6 months storage and 66.3 to 80.1% during 12 months storage (Table 3). The maximum ascorbic acid retention was observed in Matra and Faisalabad during 1, 3, 6 and 12 months storage. Maximum loss of ascorbic acid was recorded in the varieties Mid-early, Gachi and Swat local (Table 3).

No consistent difference in ascorbic acid retention in control and treated lots was noted. The sensory evaluation of canned cauliflower varieties is given in Table 4. The mean, SD and CV of the results have also been recorded. Wide variations are noted in the colour, Texture and taste of different varieties. The overall quality of canned product immediately after canning showed that the panelists did not find any variety unacceptable, though Matra and Faisalabad was found good for canning. The sensory evaluation of canned product after 12 months storage revealed that the panelists rated matra and Faisalabad good and found suitable for canning. On the basis of overall quality evaluation the variety Swat local was also found suitable for canning but the texture of the canned product was soft and was not acceptable to panelists. Therefore, this variety could not be recommended for canning. Similar studies have also been conducted by some workers [5] on other vegetables.

Acknowledgement. The authors are thankful to Mr. Misbahauddin and Mr. Waheeduddin of Agriculture Research Institute Tarnab for Co-operation and providing five varieties of Cauliflower. The authors are also grateful to Mr. Mohammad Yaqub Khan, Junior Technical Officer for assistance during the course of Practical work.

REFERENCES

1. C. Hoogzand and J. Doesburg, J. Fd. Technol. **15**, 160 (1960).
2. C.I. Kalta, O.P. Beerh and J.S. Pruthi, India Fd. Packer, **38**, 42, (1984).
3. R. Rodriguez, B.L. Raina, Er.B. Pantastico and M.B. Bhatti, *Quality of Raw Materials for Processing in Postharvest Physiology, Handling and Utilization of Tropical and Sub-Tropical Fruits and Vegetables.* (AVI Publishing Company, Inc. West Port, Conn, 1975).
4. G. Radhakrishnaiah Setty and S. Ranganna, Indian Fd. Packer, **26**, 5 (1972).
5. *A.O.A.C. Official Methods of Analysis* (Association of Analytical Chemists, Washington D.C., 1975), 12th Ed.
6. M.S. Teotia, C.L. Katra, B.L. Raina and J.S. Pruthi, Indian Fd. Packer **37**, 50, (1983).