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Studies on the variation in qualitative characteristics of aonla cultivars and their suitability for pickle preparation

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A B S T R A C T

Now a days, aonla (***Emblica officinalis Gaertn***.) is cultivated in almost all districts of central U.P. and covering an area of about 25000 hectares with an annual production of around 250000 MT fruits. The aonla fruit is regarded as "Wonder Fruit for the Health" because of fruits are having good medicinal and nutritional properties and but fruits are not eaten freely in fresh form because of fruit tannins, which make fruit taste bitter and astringent. This research aims to know, important cultivars of aonla for its suitability for pickle making, which may get popularity as processed fruit product in comparison with other processed products. Therefore, aonla cultivars as Banarasi, Chakaiya, Kanchan, Krishna, NA – 6, NA – 7, NA – 8, NA – 9 were analyzed. The recipe which is found ideal for pickle preparation was considered for screening of cultivars. Observations at the monthly interval were recorded on acidity, and browning, total soluble solids (T.S.S.) and vitamin 'C'. Periodical organoleptic assessment of the prepared pickle was also performed during storage. Organoleptic scores of pickle indicated gradual decline during storage period. Up to nine months quality of aonla pickle was found to be suitable. In the study the fruits of aonla cultivar NA- 7 were found most suitable for quality pickle preparation.

Keywords: *Aonla, Processed food, Products, Storage, Quality, Organoleptic, pickle*

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INTRODUCTION

The aonla fruit occupies an important place among the indigenous fruits of India. The aonla fruits, rich in pectin and minerals, can be suitable for making pickles, etc. [1].

Aonla fruit is not popular as dessert fruit due to its sour and astringent taste and unfortunately a very little attention has been paid to utilize this fruit in processing industry. The excellent nutritional and therapeutic values of fruit have opened great potentialities for processing value of this fruit into added products, which can get position in domestic and international markets.

Processed product of good quality can be made only from good quality of raw materials; hence cultivar selection is one of the important factors, which affect the quality of fruit products. Singh et al. [2] recommended that aonla varieties NA-6 and NA-9 have low contents of fibre and phenols with average composition of vitamin 'C' and minerals. Hence these cultivars show better suitability for processing industry particularly for pickles as compared to other cultivars. Studies carried by Singh and Kumar [3] disclosed that NA-9 variety of aonla was found most suitable for pickle. Dahiya and Dhawan [4], while working with aonla, reported that fresh fruits have great potentiality for processing.

The aonla varieties NA-6 and NA-9 have low contents of fibre and phenols with average composition of vitamin 'C' and minerals [2]. The aonla cultivar Chakaiya [2] and NA-9 [3] are the most suitable variety for making pickle. Deen [5] reported that the pickle of Banarasi, Krishna, Kanchan, Chakaiya, NA-6, NA-7, NA-8, NA-9 and NA-10 showed acceptable quality than Francis and observed that pickle of NA-9 scored highest followed by NA-6 and Banarasi.
Singh and Kumar [3] suggested for better combination for aonla pickle was 1.0 Kg aonla segments, 150 g salt, 10 g turmeric, 10 g red chillies powder, 30 g fenugreek, 10 g nigella seeds and 300 ml mustard oil. Srivastava and Kumar (2002) reported that combination of 1 kg aonla fruit, 150 g salt, 10 g turmeric powder, 10 g nigella seeds, 10 g chillies powder, 30 g fenugreek, 5 headless clove and 350 ml mustard oil are suitable for making of aonla pickle.

Anand and Johar [6] Brining is an important step in the process of making pickle. 10% sodium salt with addition of 0.3 - 0.5% acetic acid and about 0.5% turmeric powder in certain cases help to preserve the material in sound condition.

The fresh aonla fruits have a great potential for processing [4]. It is reported that pickle prepared from aonla segments has slightly higher flavour and over all acceptability than whole fruit [7]. Unfortunately, proper attention has

not yet been given for better utilization of fresh fruit of aonla into suitable fruit based processed products such as pickles.

The processing of fruit into pickle would be more nutritious other products available in the market and are being sold in large quantity in our country. In order to ensure the aonla production a profitable enterprise, there is dire need to explore the possibility of utilizing the aonla fruits for process products preparation because good quality processed aonla products can be prepared only from good quality of raw materials; hence cultivar selection is one of the important factors, which affect the quality of fruit products.

Keeping in view this fact, in present investigation an attempt has been made to evaluate pickle, prepared from fruits of different aonla cultivars.

MATERIAL AND METHODS

The study was carried out at Department of Horticulture, Janta College, Bakewar, Etawah (U.P.). Matured, uniform sized and disease-free varieties of aonla fruits of eight cultivars *viz.* Banarasi, Chakaiya, Kanchan, Krishna, NA – 6, NA – 7, NA – 8, NA – 9 were selected and procured for pickle preparation from the experimental farm of Janta College, Bakewar, Etawah.

Materials

1 kg aonla segments, 125 g salt, 10 g turmeric powder, 10 g red chillies powder, 25 g fenugreek, 10 g nigella seed, and 300 ml mustard oil.

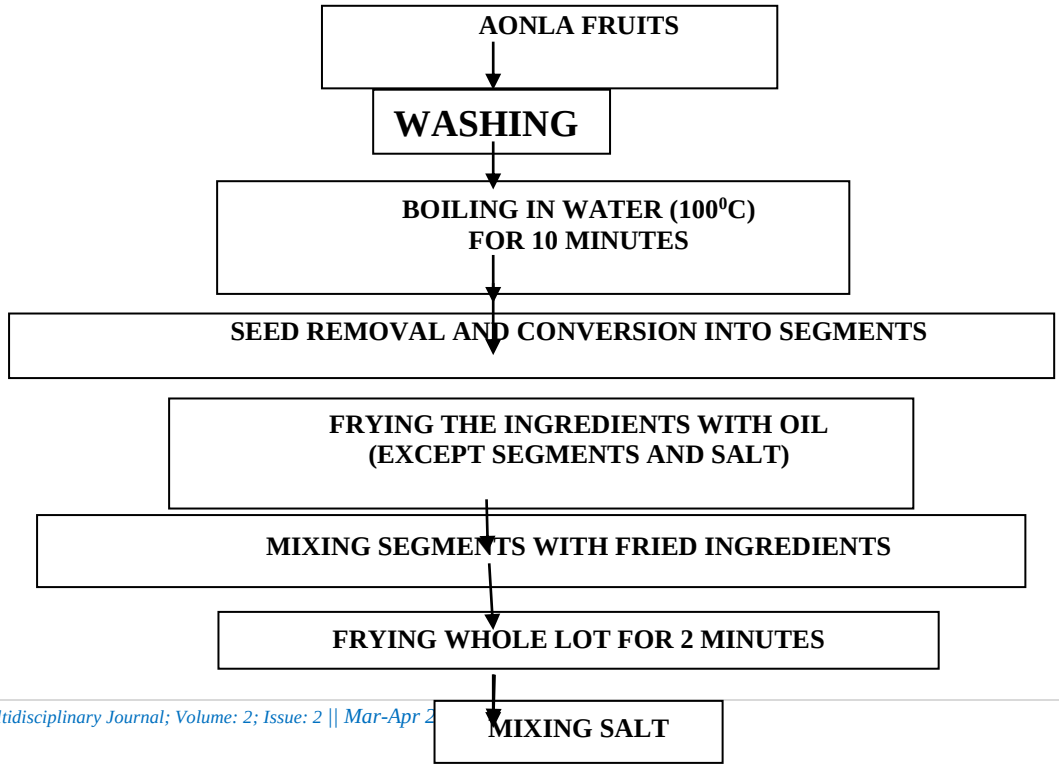
Process of pickle preparation.

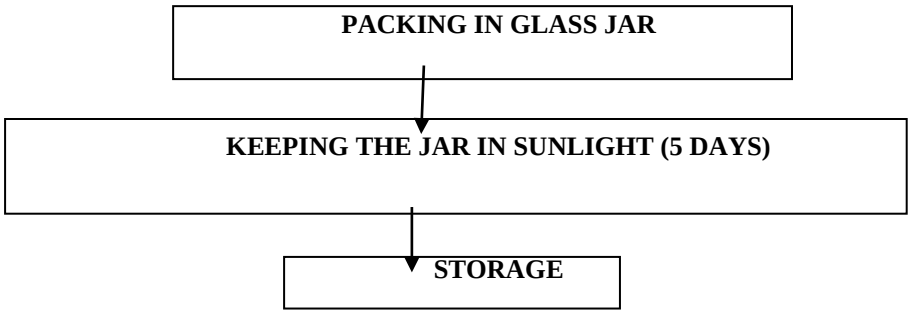
1 kg aonla fruits thoroughly washed, were boiled in water for 10 minutes. The stones were then removed, and segments were kept for further processing. Other ingredients except salt were fried with oil and mixed with segments. The whole lot was again fried for 2 minutes. After mixing the salt, pickle was packed in sterilized, wide mouth bottles and kept in sunlight for 5 days and then stored for further studies. The process of pickle making is depicted in Flow chart 1.

Organoleptic analysis

Organoleptic quality of the pickle was evaluated by panel of 10 judges who scored on a 9-point Hedonic scale [8]. The recipe which has been found ideal for pickle preparation was used for screening of cultivars. The prepared pickle was filled into jars. The jars were capped and kept in sunlight for 5 days and then stored at ambient temperature (20 ± 7^0C) for storage studies. Observations on vitamin 'C' (ascorbic acid), total soluble solids (T.S.S.), acidity, and browning were recorded at the monthly interval. The periodical organoleptic assessment of pickle was also performed during storage.

Flow chart 1: Technique used for preparation of aonla pickle.





RESULTS

Physico-chemical composition of aonla cultivars

Physical composition

Present finding reveals that there is a great variability in physical composition of aonla cultivars. Average fruit weight varied from 29.94 - 48.05 g (Table 1). NA-7 recorded highest weight followed by NA-8 and Krishna. Ghorai and Sethi [9] also recorded an average fruit weight of 43.50 g in aonla. Singh and Pathak [10] mentioned 38.25 g average weight of aonla fruits. The fruit pulp of aonla cultivars varied from 90.70 - 94.60 %. Maximum fruit pulp recorded with NA-7 followed by Chakaiya and Baranasi. The seed and fibre contents of different aonla cultivars varied from 4.20 - 7.60 % and 1.10-2.50 % respectively. Various workers have also reported variability in physical composition of aonla cultivars [11 & 12] which may possibly be due to differences in genetic constitution of cultivars, soil, cultural practices and climatic conditions.

Table 1: Physical composition of aonla cultivars

Cultivars	Fruit size (cm)		Weight (g)	Fruit pulp (%)	Seed (%)	Fibre (%)
	Length	Width				
Banarasi	2.90	3.44	29.83	93.50	4.60	1.90
Chakaiya	3.85	4.38	30.66	93.80	4.20	2.00
Kanchan	3.30	3.53	29.94	90.70	6.80	2.50
Krishna	3.60	4.20	44.66	93.20	4.90	1.90
NA-6	3.60	4.03	35.33	93.10	5.10	1.80
NA-7	3.90	4.65	48.05	94.60	4.30	1.10
NA-8	3.10	3.00	46.91	90.35	7.60	2.05
NA-9	3.75	4.45	42.50	93.90	4.30	1.80
C.D. at 5%	0.20	0.30	1.10	0.40	0.30	0.10

Chemical composition

Studies on chemical composition of aonla cultivars showed a range of variability in moisture content, total soluble solids (TSS), acidity and vitamin C (Table 2). The range of variability of moisture content was 81.60 - 85.60 %. The maximum moisture content (85.60 %) was recorded with Chakaiya followed by NA-6 (84.80 %) and NA-7 (84.70 %). The total soluble solids (TSS) ranged from 10.0 - 14.3 %, acidity from 1.7 - 2.3% and vitamin C from 690.9 - 881.8 mg/100 g. Maximum total soluble solids (14.3 per cent) recorded with cultivar Krishna, whereas maximum acidity (2.3 %) was observed in cultivar Banarasi and maximum vitamin C (881.8 mg/100 g) was observed in NA-9. Pathak (1988) also recorded variability from 13.5 - 15.5 % in total soluble solids (TSS), 2.11 - 2.31 % in acidity, and 709.34 to 802.53 mg/100 g in vitamin 'C'. The differences in chemical constituents of present findings may be also attributed to various factors including agro-climatic conditions in which varieties were grown and the age of fruits.

Table 2: Chemical composition of aonla cultivars

Cultivar	Moisture (%)	Total soluble solids (%)	Acidity (%)	Vitamin 'C' (mg/ 100g edible portion)
Banarasi	82.6	13.3	2.3	726.4
Chakaiya	85.6	10.0	1.8	789.5
Kanchan	82.9	11.3	2.2	711.4
Krishna	83.4	14.3	2.0	783.8
NA-6	84.8	10.8	1.9	788.1
NA-7	84.7	11.8	1.7	867.2

NA-8	81.6	13.0	2.0	690.9
NA-9	83.7	12.7	2.2	881.8
C.D. at 5%	1.0	0.9	0.2	8.3

Screening of suitable cultivars for processing

The organoleptic quality of the product was assessed on the basis of color, appearance, texture and taste. The data given in Table 3(a) and their statistical analysis presented in Table 3(b), it is evident that the organoleptic rating of pickles prepared from various cultivars is varies from 7.0 to 9.0. The data also indicated that the rating of NA-7 was significantly higher as compared to other cultivars, it is recorded highest score (9.0) followed by NA-9 (8.1) and NA-6 (8.0). The difference in organoleptic score of pickle prepared from Banarasi (7.8), Chakaiya (7.0), Kanchan (7.2), Krishna (7.4), and NA-8 (7.4) cultivars was insignificant.

Table 3(a): Organoleptic quality of pickle prepared from aonla cultivars

Cultivars	Organoleptic quality	
	Score	Rating
Banarasi	7.8	Like moderately
Chakaiya	7.0	Like moderately
Kanchan	7.2	Like moderately
Krishna	7.4	Like moderately
NA-6	8.0	Like very much
NA-7	9.0	Like extremely
NA-8	7.4	Like moderately
NA-9	8.1	Like very much
C.D. at 5%	0.8	

Table 3(b): Analysis of Variance of Pickle

source of variance	d.f.	Mean sum of squares	F Calculated
		Pickle	
Replication	6	0.18	0.332
Treatment	7	3.35	6.036
Error	42	0.56	

Qualitative changes during storage of aonla pickle

The data presented in Table 4 revealed qualitative changes during storage of aonla pickle as follows:

Vitamin 'C' (Ascorbic acid)

During the preparation, vitamin C content was recorded at 68.10 mg per 100g of product, with 100% retention. This content decreased during the storage period. After nine months of storage this quantity was 26.50 mg and it registered retention of 38.91%.

Total Soluble Solids (T.S.S.)

The pickle showed gradual decline in TSS content. At the time of preparation, pickle was having 21.00 TSS which gradually decreased to 17.2. Thus, overall, -18.10% decrement in TSS was recorded in pickle.

Acidity

During observation at the time of storages 1.60% acidity was seen which gradually decreased to 1.30 %. The acidity of pickle was also increased up to three months then it decreases continuously up to remaining period of storage.

Browning

Browning in terms of O.D. increased continuously during storage of pickle. The minimum browning was seen in the initial period of storage (1.10) and maximum (1.50) during the last three months of storage. Browning increased by 36.36% during the storage period.

Organoleptic score

Organoleptic score of aonla pickle decreased with the storage period and pickle were found acceptable up to nine months.

Table 4: Qualitative changes during storage of pickle

Storage Period (Month)	QUALITATIVE CHANGES DURING STORAGE OF PICKLE									
	vitamin 'C'*		TSS*		Acidity (%) *		Browning*		Organoleptic**	
	Quantity (mg/100g)	Retention	Quantity (mg/100g)	Increase/ Decrease (%)	Quantity (mg/100g)	Increase/ Decrease (%)	Quantity (OD)	Increase/ Decrease (%)	Score	Rating
0	68.10	100.00	21.0	00.00	1.60	00.00	1.10	00.00	9.0	LV
1	63.30	92.95	21.0	00.00	1.80	+12.50	1.20	09.09	9.0	LVM
2	58.70	86.20	21.0	00.00	2.20	+37.50	1.20	09.09	8.8	LVM
3	55.30	81.20	20.5	-02.38	2.40	+50.00	1.30	18.18	8.4	LVM
4	51.10	75.04	20.0	-04.76	1.80	+12.50	1.30	18.18	8.4	LVM
5	47.90	70.34	20.0	-04.76	1.60	00.00	1.40	27.27	7.3	LM
6	44.70	65.64	19.5	-07.14	1.60	00.00	1.40	27.27	7.3	LM
7	41.30	60.65	19.0	-09.52	1.50	-06.35	1.50	36.36	7.2	LM
8	35.10	51.54	18.5	-11.90	1.40	-12.50	1.50	36.36	7.1	LM
9	26.50	38.91	17.2	-18.10	1.30	-18.75	1.50	36.36	7.0	LM

**** Quantity expressed in mg/100g; Retention expressed in %***

**Organoleptic score 7 and above acceptable

LE = Like extremely. LVM = Like very much.

LM = Like moderately. LS = Like slightly.

DISCUSSION

The variability studies indicated that possibility of selecting an ideal cultivar for processing industries. NA-7 showed highest average fruit weight (48.05 g), length, width, and pulp contents (94.60%), and have small seed and moderate TSS and vitamin 'C' with lowest fibre and acidity content, whereas Chakaiya showed lowest seed content (4.20%) followed by NA-9 and NA-7 (4.30%) Therefore, NA-7 cultivars showed better merits for becoming popular cultivars for processing industry.

In present study NA-7 cultivar recorded highest score among the various cultivars for making an excellent quality of pickle. Contrary to it, Singh et al. [2] observed that aonla cultivar NA-6 and NA-9 have low contents of fibre and phenols with moderate vitamin'C' and therefore recommended for propagation of preserve, candy, jam and pickle. Since, a processed product of good quality can be made only from good quality of raw material, the cultivar selection is one of the important factors in preparation of quality products. Thus, cultivars screened, showed great potentiality for becoming a commercial cultivar for processing industry.

Results also indicate that the vitamin 'C" content of pickle decreased continuously with the increasing storage period. The result corroborates with findings of Singh et al. [2] who also recoded loss of ascorbic acid during storage of aonla. Reduction in vitamin 'C' may be due to oxidation by trapped oxygen in container, which results in formation of dehydro ascorbic acid. Loss of ascorbic acid was also observed in aonla pickle [11 & 5].

The total soluble solids (TSS) value in pickle started declining after two months of storage. The findings of Pathak [11] support present findings the contention that total soluble solids increased up to two months after storage of aonla pickle and then started declining.

The acidity content in pickle increased up to three months and declined towards the end of storage. The findings corroborate with findings of Pathak, [11]; and [5] who also noted similar trend acidity in aonla pickle.

A progressive increase in browning of pickle was observed with the storage period in present findings. This could be mainly due to the non-enzymatic reaction such as ascorbic acid with sugar or oxidation of phenols, which leads to the formation of brown pigments. The present findings get support with work on aonla pickle [11 & 5].

Organoleptic score of the aonla pickle declined continuously during storage. The acceptable quality of aonla pickle was maintained up to acceptable upto nine months. Loss in organoleptic quality and storage stability of products after

certain period is obvious. Temperature plays an important role in inducing certain biochemical changes in the products, which leads to development of off flavour as well as discoloration and thus masking the original colour and flavour of products. Reduction in organoleptic quality has also observed in aonla pickle [3]. Similar reduction is also observed in aonla pickle [11 & 5]

CONCLUSIONS

The study showed the variability in the average fruit weight. NA-7 was found to have highest fruit weight while Kanchan the lowest. Pulp content was also recorded highest in NA-7. TSS was recorded highest in Krishna while acidity lowest in NA-7. Vitamin 'C' (ascorbic acid) content was highest in NA-9.

During the storage of pickle, vitamin “C” decreased, TSS first increased then decreased. Acidity also declined gradually. Browning of aonla pickle increased continuously during storage. Oraganoleptic score of the aonla pickle also reduced gradually during storage. The acceptable quality of aonla pickle was up to nine months. The NA-7 cultivar was found ideal for making pickle preparation. Overall, changes and reduction of quality were found in aonla pickle during storage.

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