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Original Research Article

Investigation on the Differences in the Quality Traits of Aonla Cultivars and Appropriate for Pickle Making

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Abstract: The aonla (Emblica officinalis Gaertn.) is grown on around 25,000 hectares of land in practically every district in central Uttar Pradesh, producing over 250000 MT of fruits annually (Prasad and Yadav, 2005). Because of aonla fruits' many nutritional and medicinal benefits, its fruit is referred to as a "Wonder Fruit for the Health". However, due of its tannins, which impart an unpleasant and astringent flavor, fruits should not be consumed raw. The purpose of this study is to identify key aonla cultivars that are suitable for pickling and may become more popular as processed fruit products when compared to other processed goods. As a result, the following aonla cultivars were examined: Banarasi, Chakaiya, Kanchan, Krishna, NA-6, NA-7, NA-8, and NA-9. Cultivars were screened using the recipe that was discovered to be optimal for pickle making. Every month, observations on total soluble solids (TSS), browning, acidity, and vitamin "C" were made. Throughout storage, the prepared pickle was also subjected to periodic organoleptic evaluations. Pickle organoleptic ratings showed a progressive deterioration over storage. It was discovered that aonla pickles were suitable for up to nine months. The study determined that the best fruits for preparing high-quality pickles were those of the aonla cultivar NA-7.

Keywords: Organoleptic, Pickles, Aonla, Processed Food, Products, Storage, and Quality.

1. INTRODUCTION

The aonla fruit holds a significant position among India's native fruits. The pectin- and mineral-rich aonla fruits can be used to make pickles and other foods [1]. Because of its astringent and sour flavor, aonla fruit is not a popular dessert fruit. Sadly, not much thought has gone into using this fruit in the processing sector. Fruit's high nutritional and medicinal qualities have created several opportunities for turning the fruit's value into added products that can be sold both domestically and internationally.

The quality of fruit products is influenced by various aspects, one of which is cultivar selection. High-quality processed products can only be produced from high-quality raw materials. According to Singh *et al*., [2], the aonla types NA-6 and NA-9 should have average mineral and vitamin "C" compositions and low fiber and phenol concentrations. Therefore, as compared to other cultivars, these cultivars demonstrate higher appropriateness for the processing industry, notably for pickles. Research conducted by Singh and Kumar [3], revealed that the NA-9 strain of aonla was the most effective for pickling. In their work with aonla, Dahiya and Dhawan [4], found that fresh fruits had a lot of potential for processing.

The mineral and vitamin "C" composition of the aonla variants NA-6 and NA-9 is average, with low levels of fiber and phenols [2]. The best aonla cultivars to use for pickling are Chakaiya [2], and NA-9 [3]. According to Deen [5], pickles from Banarasi, Krishna, Kanchan, Chakaiya, NA-6, NA-7, NA-8, NA-9, and NA-10 were of a higher quality than those from Francis, while pickles from NA-9 received the highest rating, followed by those from NA-6 and Banarasi.

A preferable combination for aonla pickle, according to Singh and Kumar [3], would be 1.0 kg of aonla segments, 150 g of salt, 10 g of turmeric, 10 g of red chili powder, 30 g of fenugreek, 10 g of nigella seeds, and 300 ml of mustard

oil. Aonla pickle can be made with 1 kilogram of aonla fruit, 150 g salt, 10 g of turmeric powder, 10 g of nigella seeds, 10 g of chilli powder, 30 g of fenugreek, 5 headless cloves, and 350 ml of mustard oil, according to Srivastava and Kumar (2002).

Anand and Johar [6], revealed that in order to make pickles, brining is a crucial step. According to him, the material can be kept in good condition by combining 10% sodium salt with 0.3–0.5% acetic acid and, in some situations, around 0.5% turmeric powder.

Aonla fruits have a lot of processing potential while they are fresh [4]. Aonla segment pickles are said to have a marginally better flavor and overall acceptance than whole fruit pickles [7]. Unfortunately, there hasn't been enough focus on making greater use of the fresh aonla fruit in processed fruit items like pickles.

A more nutrient-dense alternative to other items that are readily available and widely distributed in our nation is the processing of fruit into pickles. Because high-quality processed aonla products can only be made from high-quality raw materials, cultivar selection is one of the key factors that affects the quality of fruit products. Therefore, in order to ensure that aonla production is a profitable enterprise, it is imperative to investigate the possibility of using aonla fruits for process product preparation. This characteristic has led to an attempt to evaluate pickles made from fruits of various aonla cultivars in the current experiment.

2. MATERIAL AND METHODS

The study was conducted at Janta College's Department of Horticulture in Bakewar, Etawah, Uttar Pradesh. Eight cultivars of aonla fruits, namely Banarasi, Chakaiya, Kanchan, Krishna, NA-6, NA-7, NA-8, and NA-9, were chosen and obtained for pickle preparation from the experimental farm of Janta College, Bakewar, Etawah. The fruits were mature, uniform in size, and free of disease.

2.1. Materials

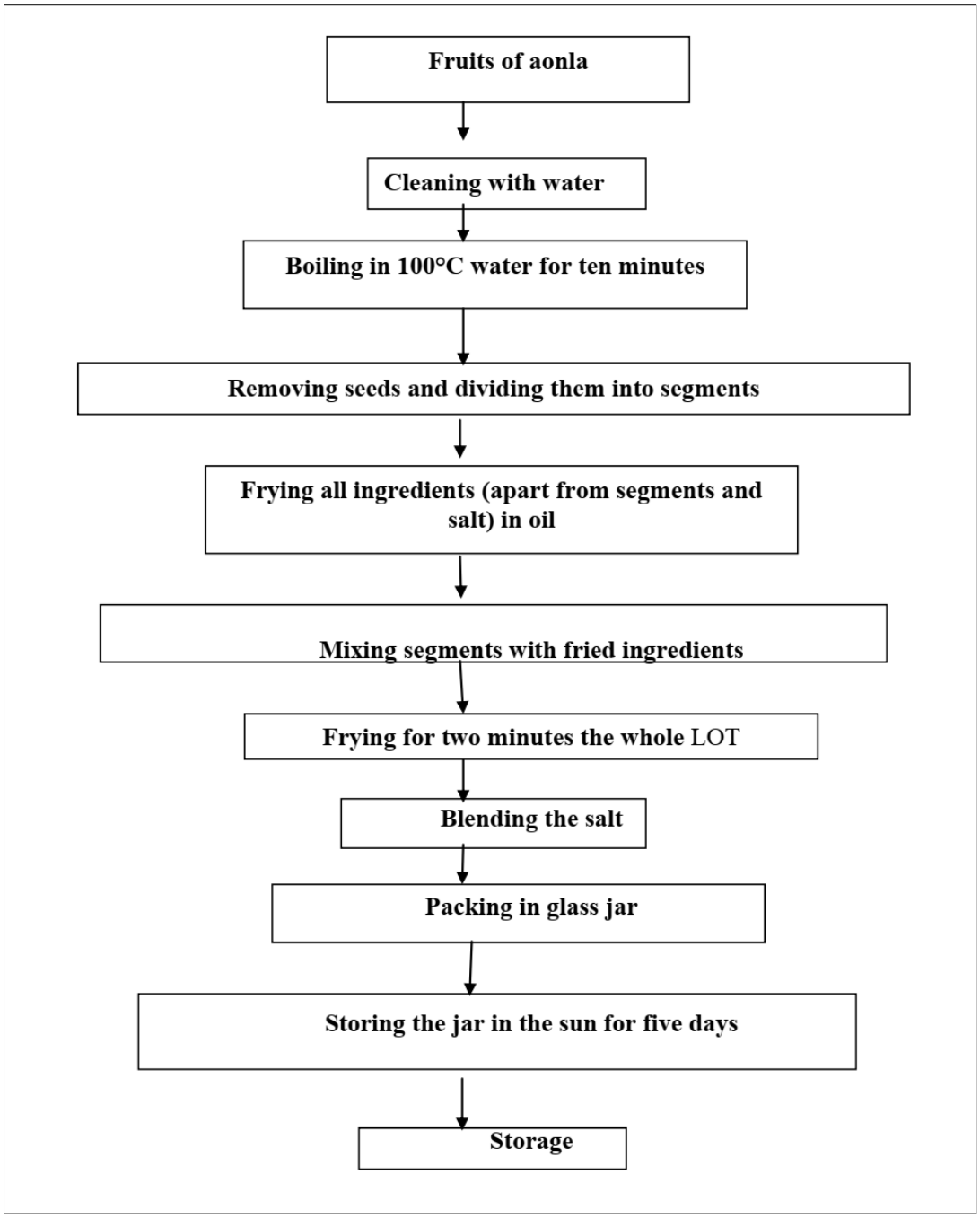
1 kilogram of aonla segments, 125 grams of salt, 10 grams each of red chili powder, turmeric powder, and fenugreek, 10 grams of nigella seed, and 300 milliliters of mustard oil.

2.2. Process of Pickle Preparation

One kilogram of thoroughly cleaned Aonla fruits were cooked in water for ten minutes. After that, the stones were taken out, and the portions were saved for further use. Salt was the only component that was cooked in oil before being combined with the segments. Everything was fried for two minutes once again. Following the salt mixture, the pickle was placed in wide-mouth bottles that had been disinfected, placed in the sun for five days, and then preserved for later research. Flow chart 1 shows the pickle-making procedure.

2.3. 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: The method used to make aonla pickles

3. RESULTS

3.1 The Aonla Cultivars' Composition

3.1.1 Physical Composition

Current research indicates that aonla cultivars differ greatly in terms of their physical makeup. The range of the average fruit weight was 29.82 to 48.18 g (Table 1). The highest weight was achieved by NA-7, followed by NA-8 and Krishna. An average fruit weight of 43.51 g was also noted by Ghorai and Sethi [9], in aonla. Aonla fruits weighed an average of 38.25 g, as reported by Singh and Pathak [10]. The fruit pulp content of Aonla cultivars varied, ranging from 90.30 to 94.62%. The highest fruit pulp found with NA-7 was followed by Baranasi and Chakaiya. Different aonla cultivars had varying percentages of seed and fiber, ranging from 4.19 to 7.61% and 1.12 to 2.51%, respectively. In addition, a number of researchers have noted variations in the physical composition of Aonla cultivars [11, 12]. These variations may result from variations in the genetic makeup of the cultivars, soil, cultural methods, and meteorological factors.

Table 1: Physical composition

Cultivars	Weight (g)	Fruit pulp (%)	Seed (%)	Fibre (%)
Banarasi	29.82	93.48	4.62	1.89
Chakaiya	30.16	93.81	4.19	2.10
Kanchan	29.84	90.69	6.82	2.51
Krishna	44.63	93.19	4.91	1.92
NA-6	35.73	93.12	5.12	1.78
NA-7	48.18	94.62	4.28	1.12
NA-8	46.61	90.30	7.61	2.03
NA-9	42.58	93.89	4.32	1.79
C.D. at 5%	1.10	0.40	0.30	0.10

3.1.2 Chemical Composition

A variety of heterogeneity was observed in the moisture content, total soluble solids (TSS), acidity, and vitamin C of aonla cultivars according to studies on their chemical composition (Table 2). The moisture content varied between 81.59% and 85.62%. The maximum moisture content (85.62 %) was recorded with Chakaiya followed by NA-6 (85.62 %) and NA-7 (84.70 %). The ranges of the total soluble solids (TSS), acidity (1.69 - 2.31%), and vitamin C (690.91 - 881.82 mg/100 g) were recorded. Maximum acidity (2.3%) and maximum vitamin C (881.8 mg/100 g) were found in cultivar Banarasi and NA-9, respectively, whereas maximum total soluble solids (14.3%) were recorded with cultivar Krishna. Total soluble solids (TSS) ranged from 13.5-25.5%, acidity from 2.11 to 2.31%, and vitamin "C" from 709.34 to 802.53 mg/100 g, according to Pathak (1988). The agroclimatic circumstances under which the different kinds were cultivated and the ripeness of the fruits may potentially be variables contributing to the variations in the chemical composition of the current findings.

Table 2: Chemical composition

Cultivar	Moisture (%)	Total soluble solids (%)	Acidity (%)	Vitamin 'C' (mg/ 100g edible portion)
Banarasi	82.63	13.32	2.31	726.42
Chakaiya	85.62	9.90	1.79	789.51
Kanchan	82.90	11.31	2.21	711.43
Krishna	83.41	13.89	2.02	783.81
NA-6	84.78	11.70	1.89	788.12
NA-7	84.70	11.81	1.69	867.20
NA-8	81.59	13.07	2.01	690.91
NA-9	83.69	12.72	2.19	881.82
C.D. at 5%	1.00	0.90	0.20	8.30

3.2 Screening of Suitable Cultivars for Pickle Making

A product's color, look, texture, and taste were considered when evaluating its organoleptic quality. It is clear from the data in Table 3(a) and the statistical analysis of those data in Table 3(b) that pickles made from different cultivars have organoleptic ratings ranging from 7.0 to 9.0. Additionally, the data showed that NA-7 had a much higher rating than other cultivars; it had the highest recorded score of 9.02, followed by NA-9 (8.12) and NA-6 (8.01). There was negligible variation in the organoleptic score of pickles made from the Banarasi (7.81), Chakaiya (7.02), Kanchan (7.22), Krishna (7.34), and NA-8 (7.43) cultivars.

Table 3(a): Organoleptic quality

Cultivars	Organoleptic quality	
	Score	Rating
Banarasi	7.81	Like moderately
Chakaiya	7.02	Like moderately
Kanchan	7.22	Like moderately
Krishna	7.43	Like moderately
NA-6	8.01	Like very much
NA-7	9.02	Like extremely
NA-8	7.43	Like moderately
NA-9	8.12	Like very much
C.D. at 5%	0.81	

Table 3(b): Analysis of Variance of Pickle

source of variance	d.f.	Mean sum of squares	F Calculated
		Pickle	
Replication	6	0.17	0.331
Treatment	7	3.36	6.034
Error	42	0.56	

3.3 Qualitative Changes During Storage

The information in Table 4 showed the following qualitative changes that occurred while the aonla pickle was being stored:

3.3.1. Vitamin 'C' (Ascorbic Acid)

With 100% retention, the vitamin C content was measured during production and found to be 67.98 mg per 100g of product. Throughout the storage time, this content dropped. This amount was 26.51 mg with a retention of 38.90% after nine months of storage.

3.3.2. Total Soluble Solids (T.S.S.)

The TSS content of the pickle progressively dropped. When pickle was produced, its TSS was 21.10; however, it ultimately decreased to 17.22. Pickles therefore displayed a TSS decline of -18.11% overall.

3.3.3. Acidity

There was 1.59 percent acidity at the time of storage, which progressively dropped to 1.31 percent. Additionally, pickle acidity was raised for three months before steadily declining for the remainder of the storage time.

3.3.4. Browning

The pickle's O.D. browning grew steadily as it was being stored. The first three months of storage had the least amount of browning (1.10), whereas the final three months saw the most (1.52). During storage, there was a 36.37% rise in browning.

3.3.5 Organoleptic Score:

Aonla pickles were found to be edible for up to nine months, however their organoleptic score dropped over time.

Table 4: Qualitative changes during storage

Storage Period (Month)	vitamin 'C'*		TSS*	Acidity (%) *	Browning*	Organoleptic**	
	Quantity (mg/100g)	Retention	Quantity (mg/100g)	Quantity (mg/100g)	Quantity (OD)	Score	Rating
0	67.98	100.00	21.10	1.59	1.11	9.0	Like very much
1	63.31	92.96	20.99	1.79	1.19	9.0	Like very much
2	58.69	86.19	20.01	2.21	1.21	8.8	Like very much
3	55.32	81.21	20.89	2.39	1.31	8.4	Like very much
4	51.12	75.12	20.01	1.78	1.33	8.4	Like very much
5	47.89	70.31	20.00	1.61	1.41	7.3	Like moderately
6	44.71	65.64	19.51	1.60	1.42	7.3	Like moderately
7	41.32	60.66	19.02	1.52	1.51	7.2	Like moderately
8	35.13	51.55	18.53	1.43	1.51	7.1	Like moderately
9	26.51	38.90	17.22	1.31	1.52	7.0	Like moderately

** 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.

4. DISCUSSION

The studies on variability suggested that choosing the best cultivar for processing businesses is possible. Chakaiya, which had the lowest seed content (4.19%), NA-9 and NA-7 (4.32% & 4.28 % respectively), and NA-7 (48.18 g) having the highest average fruit weight, length, width, and pulp contents (94.62%), along with small seeds, mild TSS, and vitamin "C" with the lowest fiber and acidity content. As a result, NA-7 cultivars demonstrated greater potential to gain popularity as processing industrial cultivars.

In the current investigation, the NA-7 cultivar received the best rating for producing pickles of exceptional quality out of all the varieties. On the other hand, Singh *et al*., [2], found that the aonla cultivars NA-6 and NA-9 have low fiber

and phenolic contents along with moderate vitamin "C," and as a result, they are advised for the propagation of preserves, candies, jam, and pickles. One of the key elements in producing high-quality products is cultivar selection, as high-quality processed goods can only be produced from high-quality raw materials. Thus, the tested cultivars demonstrated a high degree of potential for commercial cultivation in the processing industry.

The findings also show that pickles' vitamin "C" level steadily dropped as storage times increased. The outcome is consistent with research by Singh *et al*., [2], who also reported ascorbic acid loss during aonla storage. Dehydro ascorbic acid is formed when trapped oxygen in a container undergoes oxidation, which could be the cause of the vitamin "C" reduction. Aonla pickle also showed signs of ascorbic acid loss [11-5].

After being stored for two months, the pickle's total soluble solids (TSS) value began to decrease. Pathak's [11], results corroborate the current findings, which claim that total soluble solids rose for two months during aonla pickle storage before beginning to decline.

Pickles' acidity level rose for the first three months of storage before falling off. The results support the observations of Pathak [11-5], who also observed a comparable trend in acidity in aonla pickle.

According to the current findings, pickle browning increased gradually over the storage period. This may be primarily caused by non-enzymatic reactions, like the oxidation of phenols or the reaction of ascorbic acid with sugar, which produce brown pigments. Work on aonla pickle provides support for the current findings [11-5].

Throughout storage, the aonla pickle's organoleptic score steadily decreased. Aonla pickle's acceptable quality was preserved for a full nine months. It is evident that items lose their organoleptic quality and storage stability after a given amount of time. The formation of off-flavor and discolouration in items, which disguise their original color and flavor, are caused by certain biochemical changes that temperature plays a significant role in producing. Aonla pickles have also shown signs of decreased organoleptic quality [3]. Aonla pickle exhibits a comparable decrease [11-5].

5. CONCLUSIONS

The average fruit weight's variability was demonstrated by the study. The results showed that Kanchan had the lowest fruit weight and NA-7 the highest. NA-7 has the highest reported pulp content as well. Whereas acidity was lowest in NA-7, TSS was highest in Krishna. The most ascorbic acid (vitamin "C") was found in NA-9. TSS increased first and then reduced while the pickle was being stored. Vitamin "C" also decreased. Gradually, the acidity also decreased. During storage, the amount of browning on aonla pickle progressively rose. When the aonla pickle was stored, its oraganoleptic score also steadily decreased. Up to nine months was the allowed shelf life for aonla pickle. When it comes to pickle preparation, the NA-7 cultivar was shown to be optimal. Aonla pickles were found to have changed and lost quality overall while being stored.

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