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Utilization of pumpkin (*Cucurbita moschata*) for product development

Anju K. Dhiman, Sabeera Muzaffer and Surekha Attri
Directorate of Extension Education
Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan-173 230, India.

Abstract

The ripe pumpkin (*Cucurbita moschata*, Duch.ex.Poir) fruits used for the study were yellow to golden yellow in colour having pulp: skin: seed ratio of 23:6:1. Pulp and seed oil recovery was 76.66 and 35.71 per cent, respectively. Pumpkin fruits contained moisture, TSS, ascorbic acid and β-carotene content of 86.20 per cent, 9.20° Brix, 14.49 mg per 100 g and 11.22 mg per 100 g, respectively. Fruit firmness was recorded to be 21.30 ± 0.11lbs/inch^2. The β-carotene content in pickle was lower than that of raw pumpkin (11.22 mg/100g) with highest value for T_1 (without blanching) as 8.69 mg/100g. Among different treatments, the pickle prepared from cubes of T_3 showed maximum retention of β-carotene. Ascorbic acid was found to be maximum in T_3 (3.99 mg/100 g) followed by T_1 (3.92 mg/100 g). Pickle prepared from pumpkin cubes of treatment T_3 (steam blanching for 4 minutes + 1.50 per cent citric acid dip for 20 minutes) was awarded significantly higher overall acceptability scores though the scores for rest of the treatments were also well above the acceptable limits. On the basis of different quality attributes T_3 was found to be the best. It was concluded that pickle of excellent quality can be prepared from ripe pumpkins.

Introduction

Pumpkin (*Cucurbita* sp.) is one of the important cucurbitaceous vegetables widely grown all over India. *Cucurbita moschata* and *Cucurbita maxima* are commonly grown species. Pumpkin fruits are sweet when fully grown and possess yellow or orange flesh. These serve as a valuable source of carotenoids which have major role in the form of pro-vitamin A, when used at the ripening stage or after storage. Pumpkin is considered to be one of the important crops where immature and mature fruits, tender leaves and flowers are processed in one or the other form (Choudhury, 1967). Besides, being nutritionally rich the fruits also possess many medicinal properties. Such as diuretic, tonic and allay thirst. The pulp of fruit is considered as sedative, emolient and refrigerant. In India, these are mostly consumed in fresh vegetable preparations with the exception of their use in vegetable sources where pumpkin is added as thickening agent. Fruits are also utilized for the preparation of various value added products viz. pies, frozen or canned, dried and pickled products in other countries. Pumpkin has a vast scope for diversification and can be utilized in the production of processed products. Yet the literature on processing of pumpkin is scanty, therefore, the present investigation was conducted to analyze the fruit for physico-chemical characteristics and to develop and standardize the technology for pickle preparation. Such product development can help to use this underutilized nutrition crop in a better way and can prove remunerative to the growers as well as to the processors and at the same time can add variety to common man's diet.

Material and Methods

The studies were conducted in the Department of Postharvest Technology, Dr Y.S. Parmar UHF, Nauni (H.P.) India during 2005-06. Fully matured ripe pumpkins were procured from the local market. Fruits were washed, cut in to slices, peeled and after removing the fluffy portion and seeds, slices were cut into cubes of uniform size. The cubes were subjected to different treatments to retain the texture. The different treatments were T_1 = without blanching, T_2= Steam blanching for 4 minutes, T_3 = steam blanching for 4 minutes + 1.5% citric acid dip for 20 minutes and T_4 = steam blanching for 4 minutes + 1.0 % $CaCl_2$ dip for 2 hrs.

Pickles of different treatments were prepared. The ingredients used for the recipe developed and standardized were Pumpkin cubes (1000 g), sugar (100 g), salt (50 g), ginger (50 g), garlic (50 g), red chilies power (10g) *rai* powder (7.5 g), black pepper (5 g), cumin seeds (5 g), large cardamom (4 g), fenugreek seeds (2 g), fennel seeds (3 g), clove (1 g), cinnamon (1 g), mustard oil (150 ml), acetic acid (12 ml) and sodium benzoate (0.2 g). The method developed for preparation of pumpkin pickle is depicted in figure.

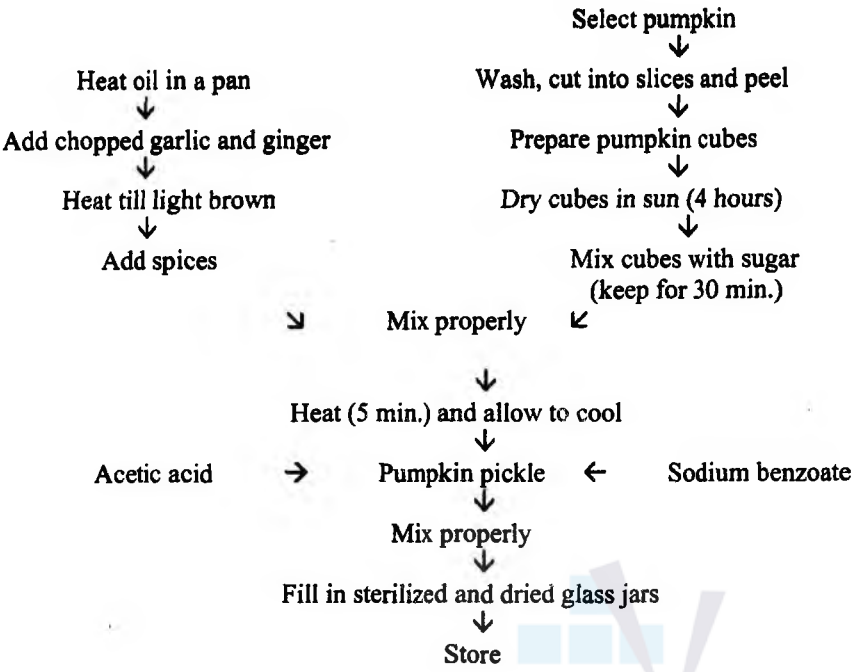


Fig. Flow sheet for preparation of pumpkin pickle

Raw fruits were analyzed for various physico-chemical characteristics. Pumpkin pickles of different treatments were analyzed for chemical as well as sensory characteristics. For physico-chemical characteristics ten randomly selected fruits were selected. Fruit weight was recorded with the help of top pan balance. Length and diameter were measured by using thread and scale. Pulp recovery was calculated by subtracting the weight of peel/seed/core/ fluffy portion from the pulp and expressed as per cent. Pulp, skin and seeds were weighed separately for calculating their ratio. The colour of fruits was evaluated visually. Fruit firmness was measured with Effigi penetrometer model (FT327) and seed oil recovery was determined by Soxhlet apparatus (Rangana, 1997). TSS was determined with the help of hand refractometer. AOAC (1984) methods were followed for moisture content, ash and per cent titrable acidity. Determination of total sugars, reducing sugars, carotenoids, protein, ascorbic acid, pectin and salt was done according to methods given by Rangana (1997) while, fiber content was determined by the method of Gould (1978). Nine point hedonic scale was followed for conducting sensory evaluation of pickle. A mean score of 6.0 and above was considered acceptable.

Results and Discussion

Physico-chemical characteristics of ripe pumpkin

On an average length and diameter of pumpkin was found to be 32.56 $\pm$ 2.32 and 69.10 $\pm$ 2.05 cm, respectively (Table 1). The average weight of fruit was 3730 $\pm$ 67.71 g and flesh colour ranged from yellow to golden yellow. Almost similar results have been reported by Anju (2000). The pulp (76.66 $\pm$ 0.006%) and seed oil (35.71 $\pm$ 0.003%) recovery was in conformity with the findings of Pawar *et al.* (1985) and Anonymous (1950). Fruit firmness was recorded to be 21.30 $\pm$ 0.11lbs/inch^2. The moisture content (86.20 $\pm$ 0.07%) and TSS

(9.20 ± 0.06^0 Brix) were in accordance with the results of Wills *et al.*, (1987) and Teotia (1992). The total sugars (3.90 ± 0.01%),

Table 1. Physico-chemical characteristics of ripe pumpkin

Characteristics	Pumpkin (Mean ± S.E)
Physical	
Length (cm)	32.56 ± 2.32
Diameter (cm)	69.10 ± 2.05
Weight (g)	3730 ±67.71
Colour	Yellow to golden yellow
Pulp recovery (%)	76.66 ± 0.006
Pulp : Skin: Seed	23:6:1
Firmness (lbs/inch^2)	21.3 ± 0.11
Percent seed oil recovery	35.71 ± 0.003
Chemical	
Moisture (%)	86.20 ± 0.07
TSS (°B)	9.20 ± 0.06
Total sugars (%)	3.90 ± 0.01
Reducing sugars (%)	2.07 ± 0.02
Titrable acidity (%)	0.07 ± 0.003
pH	4.51 ± 0.003
β-carotene (mg/100g)	11.22 ± 0.007
Ascorbic acid (mg/100g)	14.49 ± 0.03
Pectin (%)	1.18 ± 0.01
Crude Fibre (%)	0.66 ± 0.003
Ash (%)	0.52 ± 0.003

reducing sugars (2.07 ± 0.02%) and titrable acidity (0.07 ± 0.003%) in pumkin were similar to the observations as reported by Muthukrishna *et al.* (1976) and Anju (2000). Ascorbic acid (14.49 ± 0.03 mg/100g) and β-carotene (11.22 ± 0.007 mg/100 g) were within the range given by Eades (1994), Danilchenko *et al.*, (2000). Whereas, the results for pectin (1.18 ± 0.01 %), crude fibre (0.66 ± 0.003%) and ash (0.52 ± 0.003 %) were quite close to the values noticed by Egbekun *et al.*(1998), Choudhury (1967) and Anonymous (1950), respectively. The pH (4.51) of fruit was within the range given by Anju (2000). However, any variations in different values in the present study to that of earlier findings may be attributed to varied agro climatic conditions and varietal differences.

Chemical and sensory evaluation of pumpkin pickle

The data (Table 2) revealed that different treatments had significant effect on total sugars, reducing sugars and per cent titrable acidity of the pickle. Among treatments, highest total sugar content (12.19%) was recorded in T_1 and lowest (12.01%) in T_2. Reducing sugars were also highest in T_1 (5.65%) followed by T_3 (5.56%). T_2 and T_4 obtained identical value of 5.55 per cent. The β-carotene content in pickle was lower than that of raw pumpkin (11.22 mg/100g) with highest value for T_1 (8.69 mg/100g). The results indicated significant losses of β-carotene. However, the losses were more in treated cubes (T_2, T_3 and T_4) as compared to untreated (T_1). Among different treatments, the pickle prepared from cubes of T_3 showed maximum retention of β-carotene. Datta *et al,* (2006) have also observed an increased β-carotene content retention in citric acid treated papaya slices as compared to sodium hydroxide treated ones.

Table 2. Effect of different treatments on chemical evaluation of pumpkin pickle

Treatments	Total sugars (%)	Reducing sugars (%)	β-carotene (mg/100g)	Ascorbic acid (mg/100g)	Titrable acidity (%)	Salt (%)	Sugar/ acid ratio
T_1	12.91(3.59)	5.65 (2.38)	8.69	3.92	1.14 (1.068)	5.180 (2.276)	11.32
T_2	12.01 (3.47)	5.55 (2.36)	8.41	3.80	1.09 (1.044)	5.170 (2.274)	11.01
T_3	12.15 (3.49)	5.56 (2.36)	8.61	3.99	1.19 (1.091)	5.171 (2.274)	10.21
T_4	12.34 (3.51)	5.55 (2.36)	8.47	3.85	1.10 (1.049)	5.175 (2.275)	11.22
C.D.(P=0.05)	0.01	0.02	0.001	0.07	0.002	0.0002	

Figures in parentheses are transformed values

T_1 (without blanching), T_2 (steam blanching for 4 minutes, T_3 (steam blanching for 4 minutes + 1.5 % citric acid dip for 20 minutes), T_4 (steam blanching for 4 minutes + 1.0 % $CaCl_2$ dip for 2 hrs)

Further, Padmavati and Udipi (1992) reported losses in β-carotene content in almost all the preparation of 12 raw vegetables. Similar lower value has also been noticed by Sweeny and Marsh (1971) after cooking or canning of yellow pumpkin. Reduction in ascorbic acid content was also observed in pickles of different treatments as compared to raw pumpkin. The highest value was recorded in T_3 (3.99 mg/100g) followed by T_1 (3.92 mg/100 g), T_4 (3.85 mg/100g) and T_2 (3.80 mg/100 g). The reduction may be attributed to the fact that ascorbic acid is heat liable and losses might have taken place during preparation process. Titrable acidity was highest in T_3 (1.19%) and lowest in T_4 (1.10%). Highest per cent titrable acidity in T_3 may be due to the effect of treatment as the cubes were treated with citric acid. The sugar/acid ratio was highest in T_1 (11.32) followed by T_4 (11.22), T_2 (11.01) and T_3 (10.21). Slight changes were also observed in salt content of pickle prepared from different treatments.

Sensory evaluation (Table 3) of pumpkin pickles showed that treatments had significant effect on colour, taste, texture and overall acceptability of the product.

Table 3. Effect of different treatments on sensory evaluation of pumpkin pickle

Treatments	Colour	Taste	Texture	Overall acceptability
T_1	9.00	8.00	8.00	8.20
T_2	7.50	8.00	7.50	7.60
T_3	8.50	9.00	9.00	8.80
T_4	8.00	8.50	8.50	8.30
C.D.(P=0.05)	0.03	0.04	0.09	0.05

T_1 (without blanching), T_2 (steam blanching for 4 minutes, T_3 (steam blanching for 4 minutes + 1.5 % citric acid dip for 20 minutes), T_4 (steam blanching for 4 minutes + 1.0 % $CaCl_2$ dip for 2 hrs)

Colour of pickle of treatment T_1 got highest rating (9.00) followed by T_3 (8.50), T_4 (8.00) and T_2 (7.50). As regards the taste T_3 got the highest score (9.00) reflecting that the preferences of the panelists were to the pickle with lowest sugar/acid ratio (Table 2). T_4 obtained the score of 8.50 while, identical score of 8.00 was awarded for both T_1 and T_2. The pickle of treatment T_3 was awarded highest rating (9.00) for texture indicating that treatment helped in retaining the texture of cubes. The scores for rest of the treatments in descending order were 8.50 (T_4), 8.00 (T_1) and 7.50 (T_2). A perusal of data also revealed that steam blanching alone was not found effective as the results for various parameters were even lower than that of untreated cubes. On the basis of overall acceptability, treatment T_3 was adjudged as the best with an average score of 8.80. However, the scores awarded to rest of the treatments were also well above the acceptable limits.

Conclusion

It can be concluded from the study that pumpkins contain considerable amounts of β-carotene along with other chemical constituents. Pickle of an excellent quality can be prepared from ripe pumpkins as is revealed by the chemical and sensory evaluation of pickle of different treatments. The pickle prepared from the cubes of treatment T_3 (steam blanching for 4 min. + 1.5% citric acid dip for 20 minutes) was found to be the best on the basis of different quality attributes which indicated that citric acid helped in retaining the overall acceptability of the product. Moreover, the product of this treatment contained the lowest sugar/acid ratio which might have been liked by the panelists.

References

Anju B 2000. Development and evaluation of tomato based sauces. M Sc thesis, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (unpublished).

Anonymous 1950. Wealth of India, Central Scientific Industrial Research, pp. 393-395.

AOAC 1984. Official methods of analysis of the association of official analytical chemists,

Hortwits W (ed). Association of Official Analytical Chemists, Washington, D.C. USA.

Choudhury B 1967. *Vegetables*. National Book Trust, New Delhi, 162p.

Danilchenko H, Paulauskiene A, Dris R and Niskanen R 2000. Biochemical composition and processability of pumpkin cultivars. Acta Hort. **510**: 493-497.

Datta D, Ghosh D, Chaudhuri UC and Chakravorty R 2006. Retention of B carotene in Papaya during low tempereture storage. J. Fd. Sci. Tech. **43** (5):544-548.

Eades MO 1994. Doctor's complete guide to vitamin B and minerals. Canadian J. **31**: 18-25.

Egbekun MK, Suleiman N and Akinyeye O 1998. Utilization of fluted pumpkin fruit (*Telfairia occidentalis*) in marmalade manufacturing. Plant Fds. Human Nutr. **52** (2):171-176.

Gould WA 1978. *Food quality assurance*. AVI Publishing Company, Westport Connecticut, pp.178-180.

Muthukrishna CR, Sunderrajan PK and Peter KV 1976. Variety and composition of pumpkins. Indian J. Agric. Sci. **50** (12): 925.

Padmavati K and Udipi SA 1992. Effect of different cooking methods on β-carotene content of vegetables. J. Fd. Sci. Tech. **29** (3): 137-140.

Pawar VD, Patil DA, Khedkar DM and Ingle V 1985. Studies on drying and dehydration of pumpkin. Indian Fd. Packer **39** (4):58.

Ranganna S 1997. *Handbook of analysis and quality control for fruit and vegetable products*, 2nd ed. Tata McGraw Hill Publishing Company Limited, New Delhi, India, 1112 p.

Sweeny SJ and Marsh AC 1971. Effect of processing on pro-vitamin A in vegetables. J. American Dietet. Assoc. **59** (3): 238-243.

Teotia· MS 1992. Advances in chemistry and technology of pumpkins. Indian Fd. Packer **46** (1): 9-31.

Wills RBH, Lim JSK and Greenfield H 1987. Composition of Australian foods: vegetable fruits. Fd. Tech. Australia **39**: 488-491.

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