International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(2): 2033-2037

Received: 12-01-2018
Accepted: 15-02-2018

Saroj
Department of Horticulture, School of Agriculture Sciences, Career Point University, Kota, Rajasthan, India

Krishan Kumar Singh
Department of Horticulture, School of Agriculture Sciences, Career Point University, Kota, Rajasthan, India

Correspondence
Krishan Kumar Singh
Department of Horticulture, School of Agriculture Sciences, Career Point University, Kota, Rajasthan, India

Standardization of recipe and method for mango pickle

Saroj and Krishan Kumar Singh

Abstract
Four recipes of mango pickle i.e. dried pickle, sweet pickle, oily pickle, & salty water pickle were standardized for preparation of mango pickle. The pickle sample were analysed for different parameter vis, PH, acidity, Ascorbic acid, total susar, reducing sugar, moisture, Browning & organoleptic quality. Different pickles prepared were subjected to sensory evaluation after 0,30,60,90 days of storage by a panel of judges. The products were evaluated for color, flavor, Consistency, texture, taste & overall acceptability. Various recipes & storage period significantly affected organoleptic quality of pickle. Among all type of mango pickles, sweet pickle was liked best & were found to be organoleptic acceptable due to their higher acidity, sugar content & overall acceptability. Finding showed that with the advancement of storage period, the organoleptic quality like flavor, texture, consistency, & taste improved but color decrease, which might be due to increased browning. Mango oil pickle also scored higher which might be due to their gravy formation & dried pickle scored less due to its dryness.

Keywords: Mango pickle, PH, acidity, ascorbic acid, moisture, total sugar

Introduction
Mango (*Mangifera indica* L.) is an important tropical fruit, belongs to the family Anacardiaceae. Mango known as the king of tropical fruits because of its high palatability, excellent taste & exemplary nutritive value, in India mango occupies the top position with an annual production of about ten million tones, which accounts for about 65% of the total world production i.e. 14.63 million Tones. Mango classified as climacteric fruit, ripen quite rapidly after harvest. Disease problems, sensitivity to low temperature storage and perishable nature of the fruit limit the transport of fresh fruit from the site of harvest to distance places. These losses can be minimized by utilizing green fruits for making pickle or chutney or as a sundried acidifying condiment (AMCHUR), whereas ripe fruit is used for preserve, jam, sauces etc.

Pickles are made from various fruits & vegetables like mango, lime, jackfruit, cauliflower, turnip, carrot & bamboo shoots. Among them mango pickle rank first & is mostly used throughout the country. Mango pickle are traditional export item from India, with increasing awareness of the food value & dietary role of various food constituents. Pickle is an edible product preserved in common salt, vinegar, & spices.

In Indian homes these are usually prepared in oil i.e., mustard, rapeseed, or sesame, However some pickle are prepared in lime juice & vinegar only. Study of relevant literature reveals that a much work has been done on preservation of mango pickle but there is no standard recipe for preparation of mango pickle. Hence an attempt was made to find out best recipe & to study physico chemical changes in mango pickle, & to standardize the method along with best recipe for preservation of mango pickle. The initial composition of raw mango is given in table. 1

Table 1: Physico-chemical (proximate composition) composition of unripe mango fruit

PH	2.87
Acidity (%)	2.50
Ascorbic acid (mg/100g)	128.00
Total sugar (%)	4.85
Reducing sugar (%)	3.98
Moisture (%)	79.80

Material & Method

Mature but unripe mango fruit was obtained from horticulture Field of CCS Haryana Agriculture University Hisar & all ingredients like sugar, salt, spices etc. were procured from the local market. Unripe mature green mango of Desi verity was used for the preparation of pickle. The fruit were thoroughly cleaned, washed in water & were dried by wiping with muslin cloth. Four recipes for mango pickle were standardized. Fruits were cut into small pieces of about 1 x 0.75 x 0.5 cm size. All spices were grinded coarsely. In case of sweet pickle, sugar was also added along with spices. Sliced fruit were filled into bottles & the bottles were capped tightly. In case of oil pickle, previously heated & cooled mustard oil was poured into bottles to cover the pickle completely. Bottles were kept in sun for a week & were shaken at least two to three times daily. Pickle prepared by using different recipes were analysed at 0, 30, 60 & 90 days for their physico chemical composition ie. PH, acidity % (Ranganna 2002) [19], Ascorbic acid (mg/100g) (AOAC 1990) [1], Moisture % (AOAC 1990) [1] Total sugar (%) (Yemm & Willis 1954) [25], Reducing sugar (%) (Nelson 1994) [3], Browning OD at 440nm (Ranganna 1977) [18] & organoleptic quality. The result were analysed statistically by completely randomized design. The various recipes followed for the preparation of mango pickle were outlined in Table-2.

Table 2: Recipe for Mango Pickle Preparation

Ingredients	Recipes			
	Recipe-I	Recipe-II	Recipe-III	Recipe-IV
Unripe mango pieces	1 kg	1 kg	1 kg	1 kg
Turmeric	25 g	25 g	25 g	25 g
Mustard seed	50 g	50g	50g	50g
Ani seed	20 g	20 g	20 g	20 g
Black pepper	15 g	15 g	15 g	15 g
Asafoetida	5 g	5 g	5 g	5 g
Methi	75 g	75 g	75 g	75 g
Nigella	10 g	10 g	10 g	10 g
Red chilli powder	20 g	20 g	20 g	20 g
Fennel seeds	10 g	10 g	10 g	10 g
Cardamom	15 g	15 g	15 g	15 g
Cumin seed	10 g	10 g	10 g	10 g
Fenugreek powder	20 g	20 g	20 g	20 g
Salt	150 g	150 g	150 g	250 g
Mustard oil	50 ml	---	500 ml	250 ml
Sugar	---	500 g	---	---

R-I : Dried mango pickle
R-II : Sweet mango pickle
R-III : Oily mango pickle
R-IV : Salty water mango pickle

Result and Discussion

Four recipes i.e., dried pickle, sweet pickle, oily pickle & salty water pickle were standardized for preparation of mango pickle, out of which sweet pickle was found best, all of these recipes were found to be organoleptic acceptable after three month of storage (90 days) PH value of mango pickles decreased significantly with the increase in storage period irrespective of pickle type. The PH of dried mango pickle showed maximum value where as it was minimum in sweet pickle. Decrease in PH can be attributed to increase in acidity. Similar results were obtained by Muhammad Auwal Ibrahim (2016) [10] in Some Selected Fruit Juices (Pineapple, Pawpaw and Watermelon).

Acidity increase in pickles due to lactic acid fermentation, fermentation has been know to decrease PH and increase acidity in several foods (Gupta 1998) [7]. Similar results with rapid drop in PH with corresponding rise in acidity were reported by Panwar (1996) [15] in karonda pickle, & Sharma (2002) [21] in lime pickle. Significant increase in % acidity was observed during 90 days of storage period, irrespective of recipe used. Maximum acidity was reported in sweet pickle, and it was minimum in dried pickle. Sweet pickle having higher acidity as compared to other recipes which might be due to addition of higher amount of sugar. Flemming (1982) [5] concluded that increased concentration of reactive sugar can increase acidity because of increase in lactic acid fermentation process, similar result were obtained by Bansett (1992) [3] in bottled carrot pickle. The increase in acidity with increase in storage period might be due to lactobacilli bacteria, present in pickles during fermentation, which converted sugar into lactic acid (Srivastva *et al*, (2002) [22], Rekha (2004) [20] in Kachari pickle. The obtained results were in concordance with those found by Stella *et al*. (2011) [23] in orange nectars, Likewise, Touati *et al*. (2013) [24] in fruits beverages. These results were in line with those reported by Noureddine Touati, Francisco José Barba, Hayette Louaileche, Ana Frigola, Maria José Esteve **(**June 2016) [14] in Effect of Storage Time and Temperature on the Quality of Fruit Nectars. Table-4.

Table 3: Effect of different recipes and storage period on pH of mango pickles

Storage period (days)	Recipes				Mean
	R_I	R_{II}	R_{III}	R_{IV}	
0	3.02	2.67	2.83	2.87	2.85
30	2.61	2.37	2.49	2.53	2.50
60	2.35	2.27	2.31	2.39	2.33
90	2.10	2.06	2.22	2.14	2.13
Mean	2.52	2.33	2.46	2.48	

CD at 5%, Recipes: 0.08, Storage period: 0.08, Recipes x Storage period: 0.16

Table 4: Effect of different recipes and storage period on acidity (%) of mango pickle

Storage period (days)	Recipes				Mean
	R_I	R_{II}	R_{III}	R_{IV}	
0	3.00	3.53	2.74	2.67	2.98
30	3.13	3.67	3.18	3.19	3.29
60	3.25	3.76	3.31	3.32	3.41
90	3.41	3.87	3.89	3.47	3.64
Mean	3.16	3.71	3.28	3.18	

CD at 5%, Recipes: 0.13, Storage period: 0.13, Recipes x Storage period: 0.26

Ascorbic acid content decreased continuously in all the pickles during the entire storage period. This loss of ascorbic acid content might be due to the leaching loss by the osmotic action of added salt & sugar and also its conversions into dehydro ascorbic acid by oxidation, as saline solution enhance rate of oxidation of ascorbic acid. Dried pickle showed maximum ascorbic acid than that of other recipes, which might be due to lesser physico chemical changes at lower moisture content. (Premi *et al*, 2002) [16] & less leaching loss of tannins (Ghorai 1991) [6] These results were in line with those reported by Zulueta *et al*. (2010) [26] in orange-based beverages.

Table 5: Effect of different recipes and storage period on ascorbic acid content (mg/100g) of mango pickle

Storage period (days)	Recipes				Mean
	R_I	R_{II}	R_{III}	R_{IV}	
0	62.74	52.54	58.60	42.61	54.12
30	43.51	25.50	29.61	24.05	30.66
60	25.62	15.45	19.40	20.26	20.18
90	18.40	12.12	16.51	12.41	14.86
Mean	37.57	26.40	31.03	24.83	

CD at 5%, Recipes: 0.36, Storage period: 0.36, Recipes x Storage period : 0.71

In stored mango pickle both the sugar i.e., reducing sugar & total sugar increased significantly during 90 days of storage irrespective of recipe used. Sweet pickle showed maximum sugar content due to addition of sugar. Whereas dried & oily pickle have less sugar content. Increase in sugar might be due to conversion of polysaccharide into monosaccharide & hydrolysis of starch into sugar & conversion of acids into sugar Gupta 1998 [7], Aruna *et al* 1997 [2]. The obtained results were in concordance with those found by Dinesh Rajak, P.D. Sharma and Kumar Sanjeev (2014) [4] in litchi fruits under different temperatures.

Table 6: Effect of different recipes and storage period on total sugar content (%) of mango pickle

Storage period (days)	Recipes				Mean
	R_I	R_{II}	R_{III}	R_{IV}	
0	5.19	12.44	6.04	5.11	7.19
30	5.70	13.25	6.25	5.90	7.77
60	6.25	13.85	6.83	6.70	8.40
90	6.89	14.17	7.15	7.08	8.82
Mean	6.00	13.43	6.57	6.20	

CD at 5%, Recipes: 0.17, Storage period: 0.17, *Recipes x Storage period: NS*

Table 7: Effect of different recipes and storage period on reducing sugar content (%) of mango pickle

Storage period (days)	Recipes				Mean
	R_I	R_{II}	R_{III}	R_{IV}	
0	4.01	9.27	4.45	4.06	5.45
30	4.15	9.30	4.73	4.29	5.68
60	4.48	9.85	4.94	4.54	5.95
90	4.83	10.04	5.13	4.91	6.23
Mean	4.36	9.58	4.81	4.45	

CD at 5%, Recipes: 0.48, Storage period: 0.48, Recipes x Storage period: N.S.

All mango pickle showed considerably decreased in moisture content throughout the storage period. Kalra and Tandon (1983) [9] concluded that the reduction in moisture content was due to addition of more salt & sugar, which causes osmosis. So the salty water pickle showed considerable decrease in moisture content, & sweet pickle also showed maximum reduction in moisture content, where as dried pickle showed more decreased in moisture content table-8 Which might be due to its already dryness, similar result were obtained by Narayana (1986) [11] in sweet turnip pickle.

Table 8: Effect of different recipes and storage period on moisture content (%) of mango pickle

Storage period (days)	Recipes				Mean
	R_I	R_{II}	R_{III}	R_{IV}	
0	59.70	68.57	76.32	75.02	69.89
30	52.44	60.23	66.25	66.23	61.28
60	46.48	56.54	62.13	62.65	56.95
90	43.11	52.36	60.13	56.94	53.14
Mean	50.42	59.42	67.71	63.68	

CD at 5%, Recipes: 0.07, Storage period: 0.07, Recipes x Storage period : 0.14

During 90 days of storage period browning value of mango pickle increased continuously, irrespective of recipe used. Maximum browning was noticed in sweet pickle followed by salty water pickle. This might be due to higher concentration of sugar & salt. Dried pickle, sweet pickle & salty water pickle showed maximum browning than that of oily pickle. This might be due to the absence of a covering film of oil among these recipe, which resulted in formation of more fatty acid & increased peroxides value with the increased storage period. The obtained results were in concordance with those found by Qiang He and Yaguang Luo (2007) [17] in his study about Enzymatic browning and its control in fresh-cut produce.

Table 9: Effect of different recipes and storage period on browning (OD at 440 nm) of mango pickles

Storage period (days)	Storage period (days)				Mean
	R_I	R_{II}	R_{III}	R_{IV}	
0	0.225	0.311	0.123	0.241	0.225
30	0.304	0.401	0.215	0.427	0.337
60	0.374	0.481	0.275	0.487	0.404
90	0.464	0.572	0.365	0.527	0.482
Mean	0.342	0.441	0.245	0.421	

CD at 5%, Recipes: 0.037, Storage period: 0.037, Recipes x Storage period: NS

Similar results were obtained by Narayana *et al* (1989) [12] in sweet tunip pickle. Overall acceptability of pickles increased significantly with the increased in storage period. Taste, flavor, texture, consistency showed improvement in their quality but color showed decreasing trend which might be due to increase browning. Sweet pickles have the highest score with respect to their overall acceptability than that of other recipes. Mango oil pickle also scored higher which might be due to their gravy formation & dried pickle scored less due to its dryness. The increase in organoleptic quality in pickle throughout the storage period can be attributed to conversion of insoluble fraction of pectin to soluble form. Which might have resulted into softening of pickles. Similar result were obtained by Gupta (1998) [7] in oil less mango pickle, Sharma 2002 [21] in lime pickle & Rekha 2004 [20] in Kachari pickle, Jiang Y. (2004) [8], Qiang He and Yaguang Luo (2007) [17] in harvested litchi fruit.

Table 10: Effect of different recipes and storage period on organoleptic quality of mango pickle (on 9 Hedonic point scale)

Storage period (days)	Recipes				Mean
	R_I	R_{II}	R_{III}	R_{IV}	
Taste					
0	6.3	7.3	7.0	6.6	6.8
30	7.0	7.5	7.3	7.0	7.2
60	7.5	8.1	8.0	7.6	7.8

90	8.2	8.5	8.3	7.9	8.2
Mean	7.3	7.8	7.6	7.2	
CD at 5%	Recipes = 0.30; Storage period = 0.30; Recipes x Storage period = N.S.				
Flavour					
0	6.3	7.3	7.0	6.3	6.7
30	6.5	7.5	7.1	6.8	7.0
60	7.2	8.0	7.7	7.1	7.5
90	8.1	8.6	8.1	7.7	8.1
Mean	7.1	7.8	7.4	7.0	
CD at 5%	Recipes = 0.27; Storage period = 0.27; Recipes x Storage period = N.S.				
Texture					
0	6.7	7.6	8.7	7.1	7.1
30	7.0	8.3	8.4	7.7	7.8
60	7.3	8.6	8.4	8.0	8.1
90	7.9	8.9	8.7	8.3	8.4
Mean	7.2	8.3	8.5	7.8	
CD at 5%	Recipes = 0.19; Storage period = 0.19; Recipes x Storage period = N.S.				
Colour					
0	8.7	8.2	8.5	8.0	8.3
30	8.3	8.0	8.2	7.8	8.1
60	8.1	7.7	8.0	7.6	7.8
90	8.0	7.6	7.8	7.0	7.6
Mean	8.3	7.8	8.1	7.6	
CD at 5%	Recipes = 0.08; Storage period = 0.1; Recipes x Storage period = 0.17				
Consistency					
0	7.3	8.0	7.5	7.0	7.4
30	7.6	8.1	7.6	7.2	7.7
60	7.6	8.5	8.1	7.3	7.8
90	7.8	8.8	8.4	7.3	8.0
Mean	7.6	8.6	7.9	7.2	
CD at 5%	Recipes = 0.22; Storage period = 0.22; Recipes x Storage period = N.S.				
Overall acceptability					
0	7.0	8.0	7.6	7.3	7.5
30	7.5	8.6	8.5	7.6	8.0
60	7.8	8.7	8.7	8.3	8.4
90	8.0	8.8	8.7	8.4	8.5
Mean	7.5	8.5	8.4	7.9	
CD at 5%	Recipes = 0.21; Storage period = 0.21; Recipes x Storage period = N.S.				

Conclusion

Thus it may be concluded that mango is a fair source of Vit. C. Unripe mature green mango fruit may be used for the preparation of mango pickle and mango chutney. Among pickles, sweet pickle was observed best than that of others, and was found to be organoleptically acceptable due to their higher acidity, sugar content and overall acceptability than other, and finding showed that with the advancement of storage period the organoleptic quality improved in mango pickle.

References

1. AOAC. Official methods of analysis 18th Ed., Association of Official Analytical Chemists, Washington, Q.C., 1990.
2. Aruna K, Vimla V, Giridhar N, Rao DG. Studies on preparation and storage of nectar prepared from papaya (*Carica papaya* L.). Bev. Fd. World. 1997; 24(1):29-32.
3. Basnett B. Standardization and nutritional evaluation of some carrot products. M.Sc. Thesis, CCS Haryana Agricuyltural University, Hisar, 1992.
4. Dinesh Rajak, Sharma PD, Kumar Sanjeev. Effect of total soluble solid during storage of litchi fruits under different temperatures 1Department of Processing and Food Engineering, College of Agricultural Engineering, Pusa, India 3 Stat Department, Basic Science, Rajendra Agricultural University, Pusa, India Pelagia Research Library Advances in Applied Science Research, 2014; 5(2):117-121.
5. Fleming HP. Vegetable fermentation. Economic Microbiology. Academic Press Inc., London, England, 1982, Vol. 7.
6. Ghorai K. Studies on the quality improvment of Aonla (*Phyllanthus emblica* L.) pickle. M.Sc. Thesis, Indian Agricultural Research, New Delhi, 1991.
7. Gupta GK. Standardizatio of concentration of additives for development and processing of oilless mango pickle. *Ind. Fd. Packer*. 1998; 52:15-20.
8. Jiang Y. Advances in understanding of enzymatic browning in harvested litchi fruit. Food Chemistry 2004; 88:443-446.
9. Kalra SK, Tandon DK. Biochemical evaluation of mango pulp (cv. Dashehari) during storage. Submitted in J. Fd. Sci. and Technol.- India, 1983.
10. Muhammad Auwal. Effect of Different Storage Condition on pH and Vitamin C Content in Some Selected Fruit Juices (Pineapple, Pawpaw and Watermelon) Department of Food Science and Technology, Kano University of Science and Technology (KUST), Wudil, Kano, Nigeria Ibrahim1International Journal of Biochemistry Research & Review. 2016; 11(2):1-5. Article no.IJBCRR.23462 ISSN: 2231-086X, NLM ID: 101654445 SCIENCEDOMAIN international www.sciencedomain.org

11. Narayana CK. Studies on quality improvement of sweet turnip (*Brassica campestris* var. rapa L.). Pickle, M.Sc. Thesis, IARI, New Delhi, 1986.
12. Narayana CK, Maini SB. Effect of pretreatment on the quality of sweet turnip pickle. J. Fd. Sci. Technol. 1989; 26(6):351-353.
13. Nelson N. A photometric adoption of the Somogyi method of determination of glucose. J. Biol. Chem. 1994; 153:375.
14. Noureddine Touati, Francisco José Barba, Hayette Louaileche, Ana Frigola, Maria José Esteve. Effect of Storage Time and Temperature on the Quality of Fruit Nectars: Determination of Nutritional Loss Indicators Journal of food quality. 2016; 39(3):209-217.
15. Panwar Deepa. Studies on the nutritional evaluation and utilization of processed Karonda [*Carissa carandas* Linn]. M.Sc. Thesis, CCS Haryana Agricultural University, Hisar, 1996.
16. Premi BR, Sethi V, Geeta Bisaria. Preparation of instant oil less pickle from Aonla (*Emblica officinalis* Gaertn.). *Ind. Fd. Packer.* 2002; 56(3):72-74.
17. Qiang He, Yaguang Luo. Stewart Postharvest Review An international journal for reviews in postharvest biology and technology © 2007 Stewart Postharvest Solutions (UK) Ltd. Online ISSN:1945-9656 www.stewartpostharvest.com Enzymatic browning and its control in fresh-cut produce. The Department of Food Science and Engineering, Sichuan University, Chengdu, PR China 2 Produce Quality and Safety Laboratory, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland, USA He and Luo / Stewart Postharvest Review, 2007; 6:3.
18. Rangana S. Manual of Anaysis of fruits and vegetables products. Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1977.
19. Ranganna S. Manual of anlaysis of fruit and vegetables product. Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2002.
20. Rekha. Studies of development of processed products from Kachri (*Cucumis callosus*). M.Sc. Thesis, CCS Haryana Agricultural University, Hisar, 2004.
21. Sharma Arti. Studies on preservation of products of sour lime (*Citrus aurantifolia* Swingle). M.Sc. Thesis, CCS Haryana Agricultural University, Hisar, 2002.
22. Srivastava RP, Sanjeev Kumar. Fruit and vegetable preservation, principle and practices (IIIrd revised and enlarged eds.). Lucknow (India), 2002, pp. 467.
23. Stella SP, Ferrarezi AC, Dos Santos KO, Monteiro M. Antioxidant activity of commercial ready-to-drink orange juice and nectar. J. Food Sci. 2011; 76:C392-C397.
24. Touati N, Chaalal M, Kadji H, Louaileche H. Screening of phytochemical content of commercial apricot- and orange-based beverages and its relationship with antioxidant capacity. Int. Food Res. J. 2013; 20:3177-3184.
25. Yemm EW, Willis AJ. The estimation of CH2O5 in plant extracts anthrone. Biochem. J. 1954; 57:508-517.
26. Zulueta A, Esteve MJ, Frigola A. Ascorbic acid in orange juice-milk beverage treated by high intensity pulsed electric fields and its stability during storage. Innov. Food Sci. Emerg. Technol. 2010; 11:84-90.