Mysore J. Agric. Sci., 53 (4) : 99-106 (2019)

Physico Chemical Parameters and Shelf Life Study of Murabba, Developed from Mango Ginger (*Curcuma amada*)

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ABSTRACT

Mango ginger (*Curcuma amada*) is rhizomatous aromatic herb of the family *Zingiberaceae*. The fresh cut rhizomes have the flavor and the color of mango and resemble ginger in morphology hence the name mango ginger. The rhizomes are sweet, sour aromatic and bitter. Mango ginger is valued for their medicinal properties. It is used in the treatment of anorexia, dyspepsia, flatulence, colic, bruises, wounds, chronic ulcers, skin diseases, fever, constipation, cough, bronchitis, sprains, gout, halitosis, and inflammations. Hence, the present study was undertaken to standardize the process of *murabba* development and study its shelf life. Among four variations MGM1 (Control), MGM2 (12.5 %), MGM3 (25 %) and MGM4 (37.5 %) with different levels of mango ginger incorporation. MGM4 was best accepted with overall acceptability of 8.02. MGM1, MGM3 and MGM4 were kept in glass jars and sensory characteristics, physico-chemical parameters and microbial population was studied on initial, 30th and 60th day of storage. Sensory score of control increased from 7.85 to 7.88 and MGM4 decreased from 8.02 to 8.00. Among physic chemical parameters pH in control decreased from 2.79 to 2.38 and MGM4 3.10 to 2.90. TA increased from 0.49 to 0.83 and 0.21 to 0.29 in control and MGM4, respectively. TSS decreased from 73.0 to 72.5 in Control and 77.0 to 76.5 in MGM4. Microbial study revealed that yeast population decreased from 2×10^2 cfu to nil in MGM4. Moulds increased from nil to 1.05×10^2 cfu. *Coliforms* were not observed throughout study. Hence, value added product with good shelf life can be developed from mango ginger.

Keywords: Mango ginger, Murabba, Shelf life and Aromatic herb

MANGO ginger (*Curcuma amada*) is rhizomatous aromatic herb of the family *Zingiberaceae*. The fresh cut rhizomes have the flavor and the color of mango and resemble ginger in morphology hence the name mango ginger. It originated in Indo-malayan region, and is cultivated throughout India, Sri Lanka, Bangladesh and in many South-East Asian countries for its rhizomes (Ravindran *et al.*, 2004). It is found wild in parts of West Bengal and is cultivated in Gujarat, Uttar Pradesh, Kerala, Karnataka, Tamil nadu and north eastern states. The rhizomes are sweet, sour aromatic and bitter (a mixture of tastes, starting from sweet initially, turning to a sour aromatic and then bitter sensation).

Mango ginger is valued for their medicinal properties. It is used as an appetizer, carminative, digestive, stomachic, demulcent, febrifuge, alexeteric, aphrodisiac, laxative, diuretic, expectorant, anti-inflammatory and antipyretic and used in the treatment of anorexia, dyspepsia, flatulence, colic, bruises, wounds, chronic ulcers, skin diseases, pruritus, fever, constipation, hiccough, cough, bronchitis, sprains, gout, halitosis and inflammations. A whole mango ginger plant paste with crushed long peppers (*Piper longam*) is reported to be effective for the treatment of piles, and a decoction of the rhizome with common salt is an effective treatment for colds and coughs and is used to improve blood quality. The antioxidant activity of mango ginger has shown to suppress multiple signaling pathways and inhibit cell proliferation, invasion, metastasis, and angiogenesis (Kunnumakkara *et al*., 2008). Its safety combined with its low cost, and multiple targeting potential makes C. *amada* an ideal agent to be explored for prevention and treatment of various cancers and fits very well as a candidate for chemo prevention by edible phytochemicals (Aggarwal, 2008).

It is used in South Asian and South East Asian as well as Far East Asian cuisines and, most commonly, in Thai cooking. In India, it is most widely used in chutneys and pickles. It is prepared for use in cooking like fresh ginger. Hence, present study was undertaken to develop *murabba* (fruit preserve) out of mango ginger and study its shelf life.

Material and Methods

Procurement

Mango ginger rhizomes were procured from local market, Malleshwaram, Bengaluru. They were thoroughly washed under running water to remove dirt and mud.

Product development

Washed fresh mango ginger rhizomes were peeled and grated into small pieces and *murabba was* prepared by incorporating at different levels with mango.

Mango ginger *murabba*

Three variations of mango ginger *murabba* containing different levels of fresh peeled and grated mango ginger (12.5, 25 and 37.5 per cent) were prepared as indicated in figure 1 and quantity of ingredients used are represented in Table 1. *Murabba* prepared with only grated mango, without any incorporation of grated mango ginger was considered as the control.

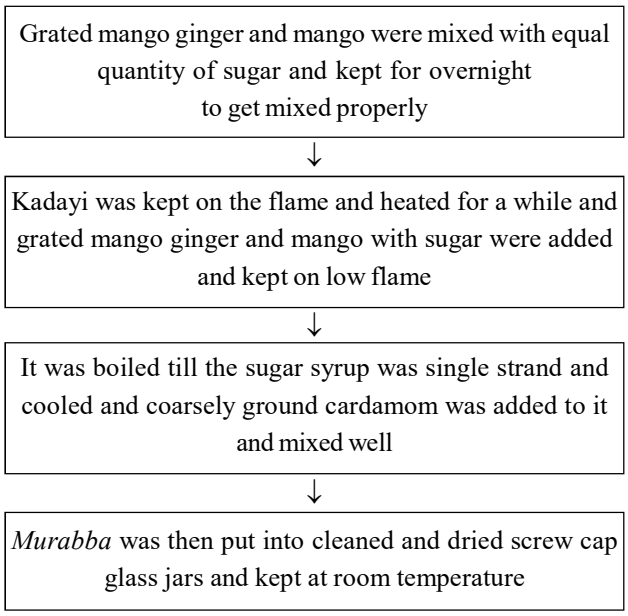


Fig.1: Procedure for preparation of mango ginger *murabba*

Table 1

Development of mango ginger *murabba*

Ingredients (g)	Quantity			
	MGM1 (Control)	MGM2	MGM3	MGM4
Peeled and grated mango	50	37.50	25	12.50
Peeled and grated mango ginger	-	12.50	25	37.50
Sugar	50	50	50	50
Cardamom (No.)	1	1	1	1
Total	100	100	100	100

MGM1- Mango ginger *murabba* 1 (Control), MGM2- Mango ginger *murabba* 2, MGM3- Mango ginger *murabba* 3, MGM 4- Mango ginger *murabba* 4

Sensory evaluation

All the variations of mango ginger *murabba* along with control were given for evaluation to 21 semi trained panelists. 9-point hedonic scale was used for evaluation.

Nutrient composition of the developed products

Nutrient composition of the best accepted *murabba* variation and control was computed based on the nutritional composition of the ingredients (Gopalan *et al*., 2009 and Longvah *et al*., 2017)

Shelf life studies

Three variations of mango ginger *murabba* (Control, 25% and 37.5%) were stored in 9 different screw cap glass jars. on the day of preparation and kept at room temperature for 60 days. The stored samples were analyzed for organoleptic characteristics, physic-chemical parameters and microbial population on initial, 30th and 60th day according to standard protocol.

Result and Discussion

Sensory evaluation of mango ginger *murabba*

Mango ginger *murabba* MGM4 was best accepted with sensory scores of 8.04, 7.71, 7.88, 7.00, 8.07, 7.97 and 8.02 for appearance, consistency, texture,

sweetness, sourness, taste, flavor and overall acceptability respectively. Mean sensory scores of *murabba* are depicted in Table 2 and figure 2.

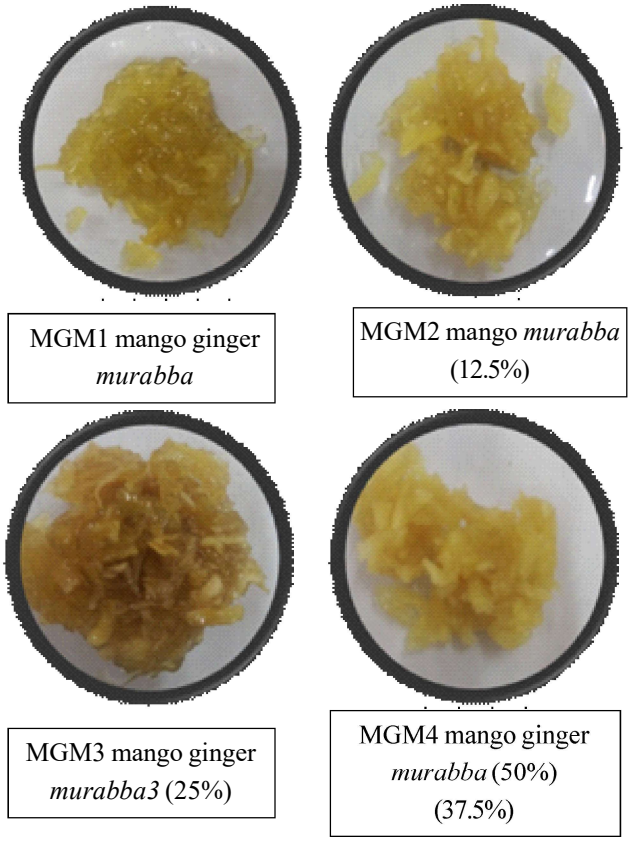


Plate 1: Mango ginger *murabba*

MGM1 (Control) scored 7.71, 7.80, 7.66, 7.57, 7.16, 8.07, 7.95 and 7.85 for appearance, texture, consistency, sweetness, sourness, taste, flavor and overall acceptability respectively. Sensory evaluation scores for overall acceptability showed that MGM4 (8.02), followed by MGM1 (7.85), MGM2 (7.71) and MGM3 (7.47) was scored least. The statistical analysis showed that there was a significant difference in mean sensory scores for texture, sweetness, taste and flavor, whereas, appearance, consistency, sourness and overall acceptability showed non significant difference at 5 per cent level of significance among the variations.

MGM4 made up of 37.5 per cent mango ginger *murabba* scored higher than control. It might be due to yellow color of mango ginger giving brighter appearance, possess mango as well as ginger aroma and flavor.

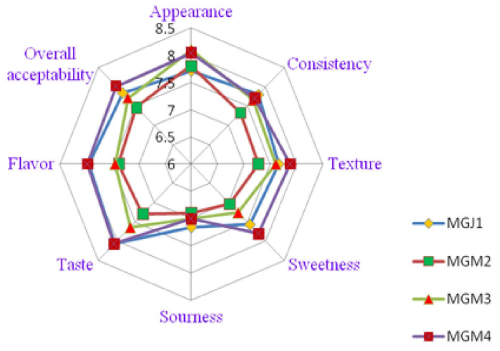
Similar results were obtained by Inam *et al*. (2012) who developed mixed fruit marmalades from malta, mango and pineapple juices at different ratios. Sample containing malta juice: mango juice: pine-apple juice in the ratio of 2:1:1 scored higher among other variations 8.417 for color, 8.083 for flavor, 8.167 for texture, 7.917 for overall acceptability.

TABLE 2

Mean scores for sensory attributes of mango ginger *morabba*

Products	Sensory attributes							
	Appearance	Consistency	Texture	Sweetness	Sourness	Taste	Flavor	Overall acceptability
MGM1	7.71	7.80	7.66	7.57	7.16	8.07	7.95	7.85
MGM2	7.80	7.33	7.28	7.04	6.90	7.30	7.38	7.47
MGM3	8.09	7.66	7.61	7.26	7.00	7.64	7.45	7.71
MGM4	8.04	7.71	7.88	7.80	7.00	8.07	7.97	8.02
F value	NS	NS	*	*	NS	*	*	NS
SEm±	0.181	0.245	0.195	0.250	0.277	0.182	0.174	0.704
CD at 5%	-	-	0.549	0.704	-	0.512	0.489	-

* Significant at 5% and NS- Non significant at 5%
MGM1- Mango ginger *murabba*1 (Control), MGM2Mango ginger *murabba*2(12.5%), MGM3Mango ginger *murabba*3(25%), MGM3Mango ginger *murabba*4(37.5%)



MGM1- Control MGM2-12.5 % MGM3-25 % MGM4-37.5 %

Computation of nutritional composition of the developed products

Macronutrient and micronutrient composition of the control and best accepted variation of murabba is computed and represented in Table 3 and Table 4.

Murabba had lower moisture content (84.20 %) and higher protein, fat and ash (0.67, 0.52 and 0.75 g/ 100 g) and lower energy 51.90 Kcal when compared with control which has 84.84 per cent, 0.28, 0.43, 0.35 g/100g and 58.33 Kcal moisture, protein, fat, ash and energy respectively.

Shelf life study of the developed products

Sensory evaluation

In control there was no significant difference in consistency and flavor throughout the storage period. But there was significant decrease in appearance and texture from 7.71 to 7.23 and 7.66 to 7.62 respectively. However there was increase in scores for sweetness (7.57 to 7.63), sourness (7.16 to 7.18), taste (8.07 to 8.23) and overall acceptability (7.8 to 7.88).

In MGM3 there was no significant difference for sourness, taste, flavor and overall acceptability throughout storage period of 60 days whereas there was significant decrease in appearance (8.09 to 7.96) and consistency (7.66 to 7.54) and there was significant increase in sweetness (7.26 to 7.32). But mean score of all attributes showed that values were in between 7.00 to 8.09 showing that *murabba* was acceptable in the range between moderately like to like very much on till 60th day of the storage.

In MGM4 there was no significant difference in sweetness, sourness, taste, flavor and overall acceptability but, there was significant decrease in appearance, consistency and texture and this might be due to slight crystallization of sugar. Similar findings were reported by Anna *et al*. (2018) who reported that for consistency, aroma and flavor the score of 5.00 throughout the storage period of 12 months. However, there was increase in appearance and color (4.6 to 5.0) of gooseberry jam stored at 20 °C which were not in line with present study. This may be

TABLE 3

Macro nutrient composition of developed products (per 100g)*

Products		Moisuture %	Protein (g)	Fat (g)	Total ash (g)	Crude fiber (g)	Carbohydrate (g)	Energy (Kcal)
Murabba	Control	84.84	0.28	0.43	0.35	1.21	12.92	58.33
	MGM4	84.2	0.67	0.52	0.75	2.26	10.74	51.90

*- Computed values

TABLE 4

Macro nutrient composition of developed products (per 100g/ml)*

Products		Vitamin C (mg)	Calcium (mg)	Magnesium (mg)	Potassium (mg)	Phosphorus (mg)	Sodium (mg)	Iron (mg)
Murabba	Control	6.35	37.90	53.28	391.68	45.33	9.44	3.26
	MGM4	2.92	33.27	37.26	370.98	66.90	5.37	3.62

*- Computed values

TABLE 5

Mean sensory score for shelf life studies of Mango ginger *murabba*

Products	Sensory Attributes								
	Duration	Appearance	Consistency	Texture	Sweetness	Sourness	Taste	Flavor	Overall acceptability
MGM1	Initial	7.71	7.80	7.66	7.57	7.16	8.07	7.95	7.85
Control	30th day	7.50	7.63	7.63	7.65	7.20	8.20	7.96	7.89
	60th day	7.23	7.48	7.62	7.63	7.18	8.23	7.95	7.88
	F value	*	NS	*	*	*	*	NS	*
	SEm±	0.010	0.193	0.008	0.008	0.006	0.008	0.006	0.006
	CD at 5%	0.035		0.029	0.029	0.021	0.029		0.021
MGM3	Initial	8.09	7.66	7.61	7.26	7.00	7.64	7.45	7.71
	30th day	7.99	7.62	7.58	7.30	7.03	7.67	7.45	7.73
	60th day	7.96	7.54	7.57	7.32	7.02	7.65	7.45	7.72
	F value	*	*	NS	*	NS	NS	NS	NS
	SEm±	0.006	0.006	0.010	0.010	0.008	0.012	0.006	0.008
	CD at 5%	0.021	0.021		0.035				
MGM4	Initial	8.04	7.71	7.88	7.80	7.00	8.07	7.97	8.02
	30th day	8.02	7.66	7.85	7.80	7.00	8.05	7.96	8.00
	60th day	7.99	7.62	7.81	7.78	7.00	8.03	7.94	8.00
	F value	*	*	*	NS	NS	NS	NS	NS
	SEm±	0.008	0.011	0.010	0.008	0.006	0.010	0.008	0.008
	CD at 5%	0.029	0.040	0.035					

*- Significant at 5 per cent and NS-Non significant
MGM3 - Mango ginger murabba 3 (25 %), MGM4- Mango ginger murabba 4 (37.5 %)

because in the present study the *murabba* was stored at room temperature (33 ± 2 °C).

Shelf life study by physico chemical parameters

Physico-chemical parameters like pH, titrable acidity and total soluble solids of best accepted variations of mango ginger *murabba* and mango ginger *tokku* along with control were analyzed. For *murabba* the analysis was done on the initial, 30th and 60th day and for mango ginger *tokku*, it was done on initial, 4th day and 8th day of storage.

In control sample pH was decreased from 2.79 to 2.38. In MGM3 the decrease was from 2.95 to 2.63 and In MGM4 the decrease was from 3.10 to 2.90. pH and TA seem to be very close with values reported by Inam *et al*. (2012) who noted decrease of pH of mixed fruit marmalade from 2.87 to 2.73 within 90 days of storage period and increment of TA 0.74 to 0.84.

Titrable acidity of all three variations of mango ginger *murabba* (contol, MGM3 and MGM4) increased significantly from initial day to 60th day of storage. Rise in titrable acidity was from 0.49 to 0.83 in control, 0.38 to 0.43 in MGM3 and 0.21 to 0.29 in MGM4 and this may be due to decrease in pH.

Similar observations were reported by Brandao *et al*. (2018) who noted that titrable acidity of mixed cerrado fruit jam increased from 0.41 to 1.2 per cent during a storage period of 140 days.

TABLE 6

Physico-chemical parameters of mango ginger *murabba* at different intervals on storage

Physico-chemical parameters	Products	Duration (days)			
		Initial	30th day	60th day	Mean
pH	Control	2.79	2.50	2.38	2.557
	MGM3	2.95	2.67	2.63	2.750
	MGM4	3.10	2.95	2.90	2.983
	Mean	2.947	2.707	2.637	
		F value	SEm±		CD at 5%
	Treatment	*	0.006		0.019
	Duration	*	0.006		0.019
	T×D	*	0.011		0.032
		Initial	30th day	60th day	Mean
TA	Control	0.49	0.68	0.83	0.667
	MGM3	0.38	0.42	0.43	0.410
	MGM4	0.21	0.23	0.29	0.243
	Mean	0.36	0.44	0.51	
		F value	SEm±		CD at 5%
	Treatment	*	0.005		0.015
	Duration	*	0.005		0.015
	T×D	*	0.009		0.026
		Initial	30th day	60th day	Mean
TSS	Control	73.00	73.00	72.50	72.83
	MGM3	72.50	72.00	72.00	72.00
	MGM4	77.00	76.00	76.50	73.82
	Mean	74.16	73.66	73.66	
		F value	SEm±	CD at 5%	
	Treatment	*	0.054	0.163	
	Duration	*	0.054	0.163	
	T×D	*	0.094	0.282	

*-Significant, NS- Non significant

MGM3 - Mango ginger *murabba*3 (25 %), MGM4 - Mango ginger *murabba*4 (37.5 %)

Total soluble solids in control decreased slightly from 73.00 per cent to 72.5 per cent and from 72.5 to 72 per cent in MGM3 and decreased more in MGM4 from 77.00 to 76.50 in *murabba*. It can be due to utilization of sugar by yeast. Similarly decrease in TSS was reported by Rababah *et al*. (2014) in Cherry jam which increased from 66.80 (%) to 66.30 (%) during storage period of 15 days.

Shelf life study by microbial population

Microbial population was estimated for yeast, mould and *coliforms* by standard plate count method. The yeast population increased from 1.65×10^2 cfu/gm to 2.00×10^2 cfu/gm, whereas yeast population decreased from 1.66×10^2 cfu/gm to 0.16×10^2 cfu/gm in MGM3 and 2.00×10^2 cfu/gm to nil in MGM4. Yeast population might have decreased because of decrease in available sugar.

TABLE 7

Microbial population of mango ginger *murabba* at different intervals of storage

Organisms	Products	Duration			
		0 day	30th day	60th day	Mean
Yeast (× 10^2CFU/ g)	Control	1.65 (1.466)	1.65 (1.466)	2.00 (1.581)	1.504
	MGM3	1.66 (1.469)	0.66 (1.077)	0.16 (0.812)	1.119
	MGM4	2.00 (1.581)	0.22 (0.848)	0.00 (0.707)	0.712
	Mean	1.505	1.130	1.033	
		F-value	SEm±		CD at 5%
	Treatment	*	0.000		0.001
	Duration	*	0.000		0.001
	T×D	*	0.001		0.002
		0 day	30th day	60th day	Mean
Mould (× 10^2CFU/ g)	Control	0.00 (0.707)	0.00 (0.707)	2.25 (1.658)	1.024
	MGM3	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.707
	MGM4	0.00 (0.707)	0.00 (0.707)	1.05 (1.244)	0.886
	Mean	0.707	0.707	1.203	
		F-value	SEm±		CD at 5%
	Treatment	*	0.000		0.001
	Duration	*	0.000		0.001
	T×D	*	0.001		0.002
		0 day	30th day	60th day	Mean
Coliforms (× 10^2CFU/ g)	Control	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.707
	MGM3	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.707
	MGM4	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.707
	Mean	0.707	0.707	0.707	
		F-value	SEm±		CD at 5 %
	Treatment	NS	0.00		-
	Duration	NS	0.00		-
	T×D	NS	0.00		-

*-Significant, NS- Non significant
MGM3-Mango ginger *murabba*3 (25%), MGM4- Mango ginger *murabba*4 (37.5 %)
Values in parenthesis indicate $(\sqrt{x+0.5})$

There were no mould colonies reported in control, MGM3 and MGM4 till 30 days of storage. Mould population of 2.25×10^2 cfu/gm in control and MGM3 and 1.05×10^2 cfu/gm in MGM4 respectively was observed on 60th day and this might be due to decrease in pH.

There were no *coliforms* colonies reported till 60 days of storage in all three variations. The water was not used in the preparation of *murabba* and this may be the reason for no *coliform* colonies. As per the report of Venugopalan *et al*. (2014) hexane, ethyl acetate, dichlorometane and acetone extracts of *Curcuma amada* were effective against *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*.

Mango ginger *murabba* can be developed as value added product and can be stored for 60 days with acceptable sensory scores, microbial population and physic-chemical parameters. MGM 4 was best accepted than control.

References

Aggarwal, B. B., 2008, The past, present and future of multi-targeted cancer treatment naturally: Food for thought. *Cancer Lett*., **269** (2) : 187 - 8.

Anna, B., Anna, K. and Jaroslaw, K., 2018, Texture, color, and sensory features of low-sugar gooseberry jams enriched with plant ingredients with pro-health properties. *J. Food Qual*., **2018** : 1 - 12.

Brandao, T. M. , Carmo Do, E. L., Elias, H. E. S., Carvalho De, E. E. N., Borges, S. V. and Martins, G. A. S., 2018, Physicochemical and microbiological quality of dietetic functional mixed cerrado fruit jam during Storage, *Scientific World Journal*, 2018, pp. : 1 - 6.

Gopalan, C., Ramashastri, B. V., Balasubramanian, S. C., Rao, N, S. B., Deosthale, G. Y. and Pant, C. K., 2009, Nutritive value of Indian foods. *National institute of nutrition*, ICMR, Hyderabad.

Inam, A. K., Inam, M. S., Hossain, M. S., Siddiqui, A. A. and Easdani, M., 2012, Studies on the Development of Mixed Fruit Marmalade. *J. Environ. Sci. & Natural Resources*, **5** (2) : 315 - 322.

Kunnumakkara, A. B., Anand, P. and Aggarwal, B. B., 2008, Curcumin inhibits proliferation, invasion, angiogenesis and metastasis of different cancers through interaction with multiple cell signaling proteins, *Cancer Lett*., **269** (2) : 199 - 225.

Longvah, T., Anthan, R., Bhaskarachary, K. Venkalah, A.N., 2017, Indian Food composition tables, National institute of nutrition publiction, Hyderabad.

Rababah, T. M., Al-Udatt, M. and Al-Mahasneh, M., 2014, Effect of Jam processing and storage on phytochemicals and physiochemical properties of cherry at different temperatures. *J. F. Process and Preserv*., **38** (1) : 247 - 254.

Ravindran, P. N., Geetha, S. P. and Nirmal Babu, K., 2004, Handbook of Herbs and Spices, **2** : 583 - 600

Venugopalan, P., Soumya, M. and Deepthi T. V., 2014, Biochemical studies on *Curcuma amada* extracts, *Arch. Appl. Sci., Res.,* **6** (2) : 18 - 23.

(*Received :* September, 2019 *Accepted :* October, 2019)