

STANDARDIZATION OF RECIPE AND QUALITY EVALUATION OF TURMERIC PICKLE

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Abstract— The study on physical characteristics of different varieties revealed that Salem variety was found to be superior in the desirable characteristics over Pratibha and Cuddappa variety which proves its suitability for preparation of pickle. Among the chemical properties of fresh turmeric varieties (210 days harvesting period) Pratibha variety was found to be significantly superior in carbohydrates, protein and fat content over the Salem and Cuddappa varieties. The most important proximate component of fresh turmeric rhizome is of its fibre and curcumin content with respect to processing and preparation of value added products like pickle. The selected fresh rhizomes of three varieties namely Salem, Pratibha and Cuddappa were used for preparation of pickle. The traditional recipe containing spices, oil and salt were used. Salem variety was found to be highly acceptable.

Key words: Fresh turmeric rhizomes, physico-chemical characteristics, pickle, sensory qualities, chemical composition, standardization of recipe.

INTRODUCTION

India has emerged as the largest producer of turmeric worldwide. Indian turmeric wholly dominates the world production scenario thereby contributing to approximately 78 percent of the world's total production, producing 12.47 lakh tonnes of the produce annually. This year 2012 total crop of turmeric bags come around 1cr. bags (each bag carry around 70 -75Kg). Turmeric's protective effects on the cardiovascular system include lower cholesterol and triglyceride level. Constituents of turmeric block the replication of HIV, stimulate muscle regeneration, enhances wound healing, turmeric volatile oils suppress acute oedema (Jaggi *et al.* 2012).

Post-harvest processing is an essential and integral part of turmeric and lack of such facilities in the state results in huge post-harvest losses. At present, there are no facilities for processing and value addition. Few traditional facilities are available but not time efficient. In absence of post-harvest facilities in the state, it becomes an unattractive option for a farmer to grow turmeric especially for the small and marginal one. Processing of turmeric involves cooking, drying and polishing; drying must be carried out for days and can become tedious. If there would be raining during drying it deteriorates the quality of turmeric. It involves high labour requirement, more processing cost and energy. And hence, there is need for development of technology to utilize the fresh turmeric rhizome which benefits to farmer as it reduces the processing cost and this can be successfully achieved by preparing turmeric pickle from fresh rhizomes having nutraceutical value. (Shrivastav *et al.* 2002)

MATERIALS AND METHODS

The present investigation was carried out in Department of Food Engineering, College of Food Technology, VNMKV, Parbhani during year 2013-14.

A. Materials

Fresh turmeric rhizomes of three different varieties namely Salem, Pratibha and Cuddappa were collected from Agri farm.

Chemicals and Glassware:

Chemicals of analytical grade and glassware's used during study were available in the department of Food Engineering, College of Food Technology VNMKV Parbhani.

B. Methods

Analytical methods

These varieties were analyzed initially for physical characteristic viz. colour, weight, size, peel percentage. Determination of moisture, protein, fat, Fibre, Ash, pH by AOAC method. Determination of carbohydrate by Wankhede (1976). Estimation of curcumin by ASTA (1958) method.

1.Colour: Colour of the Rhizomes were recorded by visual observation.

2.Weight: Fresh Turmeric Rhizomes of each variety were weighed on electronic balance. The average weight of ten fresh turmeric rhizomes were calculated and expressed in grams.

3.Size: The length and breadth of the randomly selected fresh rhizomes of turmeric are measured using Vernier Caliper and average length and breadth were expressed in terms of centimeters.

4.Peel percentage: After removing the skin from fresh turmeric the remaining edible portion was measured by an electronic balance and the reading was taken in gram (g).

5.Moisture: Moisture content was estimated according to the standard A.O.A.C. method (1990). Five grams of sample was taken and kept in hot air oven for 5-6 hours at 100^oc then the sample was transferred to the desiccator until constant weight was obtained. Then the per cent moisture was calculated by estimating the difference in weight of sample.

$$\text{Moisture (\%)} = \frac{I-F}{I} \times 100$$

Where, I = Initial weight of sample

F = Final weight of sample

6. Protein: Protein was determined by Microkjelahl method using 0.2g of ground sample by digesting the same with concentrated sulphuric acid (H₂SO₄) containing catalyst mixture for 3-4 hours at 100°C. Then it was distilled with 40% NaOH solution and liberated ammonia was trapped in 4% boric acid and then it was titrated with 0.1N HCL using mixed indicator (Methyl red: Bromocresol green:: 1:5). The per cent nitrogen was calculated and protein was estimated in the sample by multiplying with factor 6.25. (A.O.A.C. 1990).

7. Fat: 5g ground sample was weighed accurately in thimble and defatted with petroleum ether extract in Soxhlet apparatus for 6-8 hours at 80°C. The resultant ether extract was evaporated, and lipid content was calculated. (A.O.A.C. 1990)

8. Fiber: About 3 to 5 g of moisture and fat free samples were weighted into 500 ml beaker and 200 ml boiling 0.255N (1.25 W/V) H₂SO₄ was added. The mix was boiled for 30 minutes keeping the volume constant by addition of water at frequent intervals. At the end of this period, the mixture was filtered through a filter paper and the residue washed with hot water till free from acid. The material was then transferred to the same beaker and 200 ml of boiling 0.313N NaOH solution added. After boiling for 30 minutes, the mix residue was washed with hot water till free from alkali followed with some alcohol. It was then transferred to a crucible, dried over night at 80- 100 ° c for 2-3 hr. then cooled and weighted again. The difference in the weights represented the weight of crude fiber. (A.O.A.C. 2000)

9. Ash: 5g sample was weighed into crucible, which was heated at low flame till all the material was completely charred and cooled. Then it was kept in muffle furnace for about 4 hours at 600°C. It was again cooled in desiccators and weighed and repeated until two consecutive weights were constant. The percentage of ash was calculated by taking the difference between the initial and final weight. (A.O.A.C. 2000)

10. pH: The pH value of fresh turmeric was determined potentiometrically by means of a glass electrode, a reference electrode and a digital pH meter. The pH meter was operated according to the manufacturer's instructions. First the apparatus was calibrated using buffers of 4, 9 and 7 pH. Grinding of fresh turmeric was done in pestle and mortar and Juice of fresh turmeric was taken in a beaker. The electrodes were immersed in the solution and the pH was measured. (A.O.A.C. 2000)

11. Carbohydrate: This was essentially performed by method suggested by Dubois *et al.* as modified by Wankhede *et al.* (1976). The sample was weighed (0.5g) accurately in test tube and kept in ice water bath for few minutes followed by the addition of cold H₂SO₄ (72%) with gentle stirring the viscous paste was diluted with distilled water to obtain final concentration 2N with respect to acid. It was then refluxed at 98°C for 3-4 hours to achieve complete hydrolysis. The sugar content was estimated by Phenol-H₂SO₄ method, using glucose as standard. The orange yellow colour was read, the

concentration of sugar in hydrolysate was calculated and per cent total sugar in the sample was quantified.

12. Curcumin: Curcumin and oleoresin content was determined by using solvent extraction method and it can be quantified with UV spectrophotometer (ASTA 1958).

Solvent extraction method

ASTA in 1958 reported the method of extraction of curcumin by solvent extraction. The same method was followed in this study. Curcumin was quantitatively extracted by refluxing the material in alcohol and was estimated spectrophotometrically at 425 nm.

Procedure

- [1]. About 0.20 gm of turmeric sample weighted accurately and suitably dropped into conical flask.
- [2]. Then 40 ml of ethyl alcohol was dropped in it and refluxed for 2 ^{1/2} hrs.
- [3]. Then it was cooled and filtered quantitatively into a 100 ml volumetric flask. Then the extracted residue was transferred to the filter wash thoroughly and diluted with 100 ml ethanol.
- [4]. Pipette 1 ml of filtered extracted and transferred into a 100 ml volumetric flask and diluted up to 50 ml volume with ethanol.
- [5]. The absorbance of the extract and standard solution of 425 nm, using 1 cm cells against an alcohol blank was measured by spectrophotometer.

$$\% \text{ curcumin} = \frac{0.00025 \times \text{abs. of sample} \times \text{vol. made up}}{\text{Abs. of stad} \times \text{wt. of sample} \times \text{dilution factor}} \times 100$$

$$= \frac{0.00025 \times A_{425} \times 50}{0.42 \times \text{Wt. of sample (gm)} \times 1} \times 100$$

Since, 0.42 absorbance at 425 nm = 0.00025 g curcumin 10.

Preparation of fresh turmeric pickle

Fresh rhizomes of Salem variety were washed, peeled and cut into shreds. Peeled shredded ginger and lemon juice was added turmeric shreds in a steel container. Shredded turmeric along with salt, ginger and lemon juice was packed tightly into glass bottles and kept for curing. After 10-15 days cured fresh turmeric shreds of three different varieties were taken out and addition of spices as per the procedure.

The recipe of pickle was standardized by varying the proportion of ginger and lemon juice at 10, 15, 20 and 15, 20, 25 per cent respectively. Among these recipes the best pickle was identified on the basis of overall acceptability. The pickle made with 15 per cent ginger and 20 per cent lemon juice was further used for physico-chemical and organoleptic evaluation. The prepared pickle analyzed by 10 panelists for sensory characteristics for suitability of particular variety in pickle preparation.

RESULTS AND DISCUSSION

Physical characteristics of fresh turmeric rhizomes

Physical characteristics of rhizomes play a very important role in development of processing technology and on

variety	Parameters					
	Colour	Length (cm)	Breadth (cm)	Thickness (cm)	Weight (gm)	Peel (%)
Salem	Yellowish brown	9.85	2.82	2.63	75.95	8.85
Pratibha	Reddish yellow	7.90	2.87	2.62	49.55	6.88
Cuddappa	Deep brown	9.67	2.89	2.77	57.50	8.72
SE ±	-	0.694	0.248	0.265	0.943	0.345
CD @ 5%	-	NS	NS	NS	3.258	1.193

quality of final products. The data on physical characteristics of fresh turmeric rhizomes of three different varieties namely Salem, Pratibha and Cuddappa are presented in table 1.

Table 1 Physical characteristics of fresh turmeric rhizomes

It is revealed from table that colour of fresh turmeric rhizomes of three namely Salem, Pratibha and Cuddappa ranges from yellowish brown to deep brown in colour. The variation in colour is due to difference in curcumin content. The rhizome length and breadth ranged from 7.90 to 9.85 and 2.82 to 2.89 cm respectively. The rhizome thickness ranged from 2.62 to 2.77cm. However, the rhizome weight ranged from 57.50 to 75.95gms. The peel percentage was recorded to be highest in Salem variety (8.85%) followed by Cuddappa (8.72%) and lowest in Pratibha (6.88%). The data also revealed that the average weight of rhizomes was 75.95 gm in Salem, 57.50 gm in Cuddappa and 49.55 gm in Pratibha variety respectively. Salem variety was found to be superior in the desirable characteristics like length, weight, and colour over Pratibha and Cuddappa variety which proves its suitability for preparation of pickle

Chemical characteristics of fresh turmeric rhizomes

The data pertaining to chemical characteristics of fresh turmeric from the three varieties are presented in table 2. The results of chemical characteristics fresh turmeric rhizomes revealed that moisture content was found to be highest in Cuddappa (88.6 %) followed by Salem (88.4 %) and Pratibha (80.9 %). The carbohydrate content in Pratibha variety was found to be (13.65%) followed by Salem (8.55%) and in Cuddappa (8.44 %) variety respectively. Protein and fat content in Pratibha variety was found to be more as compared to Salem and Cuddappa respectively. Pratibha variety was found to be significantly superior in carbohydrates. However, the TSS, pH and titratable acidity of three turmeric varieties are statistically non-significant to each other.

The TSS of fresh turmeric rhizomes was found to be 10⁰ brix in Pratibha variety followed by 9.2⁰ brix and 8.2⁰ brix in Salem and Cuddappa variety respectively. Salem variety of 210 days recorded lower Fibre content which was statically significant over the Pratibha while it was at par with Cuddappa. Pratibha variety had higher curcumin content (6.5%) followed by Salem (5.3%) and Cuddappa (3.31%) respectively.

Table 2 Chemical characteristics of fresh turmeric rhizomes

Chemical characteristics	Salem	Pratibha	Cuddappa	SE ±	CD @ 5%
Moisture (%)	88.4	80.9	88.6	0.597	2.063
Carbohydrate (%)	8.55	13.65	8.44	0.488	1.689
Fat (%)	0.91	1.62	0.84	0.049	0.171
Protein (%)	0.83	1.45	0.72	0.056	0.196
Ash (%)	0.61	1.12	1.26	0.050	0.174
Fiber (%)	0.67	1.26	0.77	0.098	0.338
Curcumin(db) (%)	5.3	6.5	3.31	0.171	0.591
T.S.S. (⁰ Brix)	9.2	10	8.9	0.616	NS
pH	7.1	6.6	6.8	0.410	NS
Titratable acidity (%)	0.64	0.70	0.66	0.428	NS

Recipe for preparation of fresh turmeric pickle

The selected fresh rhizomes of three varieties namely Salem, Pratibha and Cuddappa were used for preparation of pickle. The traditional recipe containing

Table 3 Traditional Recipe for Preparation Fresh Turmeric Pickle

Ingredients	Amount
Fresh turmeric	100g
Salt	18g
Groundnut oil	40g
Mustard dal	12.5g
Fenugreek	3g
Cumin	2g
Chilli powder	0.90g
Black pepper	0.25g
Cloves	0.10g

Asafoetida	0.10g
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spices, oil and salt were used. The quantities of ingredients are selected as per the recipe and process given by Rashmi S. Bulla (2010).

Sensory evaluation of fresh turmeric pickle

Fresh turmeric pickles prepared with traditional recipe of three different varieties of turmeric were organoleptically evaluated by 9-point hedonic scale for organoleptic quality attributes which decides the suitability of variety for preparation of pickle. The average scores of organoleptic evaluations of turmeric pickle depicted in table 4. Among the three different varieties, colour of pickle from Salem scored higher (8.20) followed by Pratibha (8.15) and Cuddappa (7.50) respectively. Taste of pickle from Salem was found to be good (7.90) compared to Pratibha (7.34) and Cuddappa (6.25). Pickle from Salem variety obtained highest score for flavour, texture and mouthfeel followed by Pratibha and Cuddappa respectively.

It is also revealed that the pickle prepared from Salem variety was recorded highest score in organoleptic characteristics which make it more acceptable to the judges

Table 4 Sensory evaluation of Fresh turmeric Pickle

Variety	Colour	Flavour	Taste	Texture	Mouthfeel	Overall acceptability
Salem	8.20	7.40	7.90	7.80	8.10	8.00
Pratibha	8.15	7.30	7.34	7.50	7.55	7.50
Cuddappa	7.50	6.40	6.25	7.00	6.80	6.75
SE ±	0.086	0.457	0.252	0.159	0.247	0.041
CD @ 5%	0.299	1.579	0.873	0.552	0.856	0.142

Salem variety was found to be highly acceptable as it has desirable curcumin content and having lower fiber content which improved the colour, taste, texture and mouthfeel of pickle. However, pickle from Pratibha was least acceptable due to sticky mouthfeel and dark colour while in case of Cuddappa it showed intense flavour and slightly bitter taste which is not much liked by the judges recorded lower organoleptic score.

Chemical composition of fresh turmeric pickle

The data regarding the chemical composition of prepared fresh turmeric pickle was tabulated in table 5. The moisture content was found highest quantity (48.32 %) in pickle from Salem followed by Pratibha (44.16 %) and Cuddappa pickle (47.10 %) respectively.

The fat content was found to be in the range of 32.23 to 34.11 %. The fat content of pickle from pratibha was noted to be highest (34.11 %) as compared to Cuddappa (32.35 %) and Salem (32.23 %) respectively.

Table 5 Chemical composition of Fresh Turmeric Pickle

Sample	Parameter				
	Salem	Pratibha	Cuddappa	SE ±	CD @ 5 %
Moisture (%)	48.32	44.16	47.10	0.130	0.449
Fat (%)	32.23	34.11	32.35	0.420	1.451
Ash (%)	1.40	1.82	1.70	0.057	0.199
Fiber (%)	1.59	2.01	1.90	0.059	0.206
Curcumin (%)	5.20	6.45	3.21	0.191	0.661
pH	3.57	3.37	3.47	0.045	0.156
Acidity (% citric acid)	1.47	1.53	1.40	0.031	0.109

The ash content of fresh turmeric pickle in Pratibha (1.82 %) was higher than pickle from Salem (1.40 %) and in Cuddappa (1.70 %). Ash and fibre content was found to be increased as compared to fresh turmeric due to the addition of spices into the pickle.

The curcumin content in pickles were found to be 6.45% in Pratibha followed by 5.20 and 3.21 % in pickle from Salem variety respectively. pH was found to be in the range of 3.47 to 3.57. Highest pH was found in Salem (3.57) followed by Cuddappa (3.47) and Pratibha (3.37) respectively. Acidity was found to be in the range of 1.40 to 1.53. Pratibha variety was found to be statistically significant over Salem and Cuddappa with respect to curcumin content. Moreover, pickle from salem variety was found to be significant over the pickle from Pratibha and Cuddappa with respect to fibre content.

Formulation of recipe of Fresh turmeric pickle (Salem variety)

The data on specific quantity of ingredients for standardization of recipes of fresh turmeric pickle are given in table VI. The variety Salem was selected for further study on the basis addition of ginger (10, 15, 20) and lemon juice (15, 20, 25) to improve the organoleptic quality attributes and also for enhancing the consumer acceptability of pickle. Sample S₃ and sample S₁ scored (7.3) lowest as compared to other two pickle samples. However, sample S₂ recorded a higher score followed by sample S₃ and S₁.

The flavour score significantly lower for pickle sample S₁. Decrease in flavour may be due to decrease in ginger

proportion in sample S₁. The pickle containing 15 per cent ginger proportion was found to be overall acceptable and liked by all sensory panel members. Ginger imparts a slightly pungent taste and its flavour which will compensate for the bitter taste and intense flavour of turmeric rhizomes.

Table 6 Formulation of recipe by variation of ginger and lemon juice proportions in fresh turmeric pickle

Ingredients	Pickle		
	S ₁	S ₂	S ₃
Fresh turmeric	100g	100g	100g
Ginger	10g	15g	20g
Lemon juice	15 ml	20 ml	25ml
Salt	18g	18g	18g
Groundnut oil	40g	40g	40g
Mustard dal	12.5g	12.5g	12.5g
Fenugreek	3g	3g	3g
Cumin	2g	2g	2g
Chilli powder	0.90g	0.90g	0.90g
Black Pepper	0.25g	0.25g	0.25g
Cloves	0.10g	0.10g	0.10g
Asafoetida	0.10g	0.10g	0.10g

Effect of Ginger proportion on sensory evaluation of fresh turmeric pickle

The data on organoleptic evaluation of fresh turmeric pickle prepared with various levels (10, 15, 20 per cent) of ginger are presented in table 7.

Table 7 Effect of Ginger proportion on sensory evaluation of fresh turmeric pickle (Salem variety of turmeric)

Sample code	Colour	Flavour	Taste	Texture	Mouthfeel	Overall acceptability
S ₁	7.5	7.8	7.9	7.3	7.4	7.5
S ₂	8.5	8.7	8.3	8.2	8.1	8.5
S ₃	8.1	8.2	8.0	7.8	7.8	8.0
SE ±	0.057	0.057	0.081	0.050	0.083	0.081

CD @5%	0.199	0.199	0.282	0.172	0.289	0.282
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S₁- Addition of 10% Ginger S₂- Addition of 15% Ginger

S₃- Addition of 20% Ginger

The results in table revealed that the sample S₂ recorded highest score in all sensory properties and found to be overall acceptable over the sample S₁ and S₃ However sample S₃ was also found to be statistically significant over the sample S₁ which retains lowest score in all sensory properties. The taste of turmeric pickle was influenced by the addition of ginger.

The sample containing 15 per cent ginger was extremely liked for its taste attribute with highest score value for sample S₂ (8.20) followed by sample S₃ (8.0) and S₁ (7.9) respectively. The sample S₂ scored highest for textural properties while it was just par However, sample S₃ containing 20g ginger was not much liked by panelists as it gives more pungent taste and also acceptable to the judges. Among the rest two samples the sample S₃ with 25 per cent lemon juice was found to be superior for flavour, taste, texture and mouthfeel characteristics over the sample S₁ with 15 per cent lemon juice.

Table 8 Effect of lemon juice proportion on sensory evaluation of fresh turmeric pickle

Sample code	Colour	Flavour	Taste	Texture	Mouthfeel	Overall acceptability
S ₁	7.4	7.3	7.2	7.1	7.1	7.2
S ₂	8.5	8.4	8.5	8.3	8.4	8.7
S ₃	8.6	8.1	8.3	8.2	8.2	8.3
SE ±	0.057	0.062	0.057	0.050	0.062	0.057
CD@5%	0.199	0.215	0.199	0.175	0.215	0.199

S₁- Addition of 15% lemon juice S₂- Addition of 20% lemon juice

S₃- Addition of 25% lemon juice

It is seen from the table that sample S₂ containing 20 per cent of lemon juice was found to be statistically significant over the sample S₁ and recorded highest overall acceptability whereas it was statistically at par with sample S₃ containing 25 per cent lemon juice. However, sample S₁ containing 15 per cent lemon juice recorded a lower score in all the organoleptic attributes which proved that the addition of more than 15 per cent lemon juice resulted in superiority of pickles in all attributes. It is also

seen that the color score of S₃ was slightly more, as addition of lemon juice improved the colour of pickle.

Standardization of recipe for fresh turmeric pickle (1 kg)

The data on ingredients in specific quantities for standardization of recipe for fresh turmeric pickle are given in table IX. The recipe for preparation of fresh turmeric pickle was standardized by considering the results obtained in the organoleptic evaluation of turmeric pickle with different level of ginger and lemon juice proportion

Table 9 Standardized recipe for fresh turmeric pickle

Ingredients	Per 100 gm	Amount
Fresh turmeric	100g	472
Ginger	15g	71
Lemon juice	20ml	95ml
Salt	18g	85
Groundnut oil	40g	189
Mustard dal	12.5g	59
Fenugreek	3g	14
Cumin	2g	9.3
Chilli powder	0.90g	4.2
Black Pepper	0.25g	1.2
Cloves	0.10g	0.45
Asafoetida	0.10g	0.45

which was reported in table number 7 and 8. The fresh turmeric pickle prepared with 15 per cent ginger and 20 per cent lemon juice was found to be highly overall acceptable and this formed the basis for standardization of recipe for fresh turmeric pickle keeping the other ingredients constants.

CONCLUSION

Salem variety was found to be highly acceptable as it has desirable curcumin content and having lower fiber content which improved the colour, taste, texture and mouthfeel of pickle as compared to other varieties. The variety Salem was selected for further study on the basis of physico-

chemical analysis and organoleptic evaluation. Further the recipe was formulated and standardized by addition of ginger (10, 15, 20 %) and lemon juice (15, 20, 25%) The sample S₂ containing 15% ginger, and 20 % lemon juice was found to be highly overall acceptable. It was found that 15% ginger and 20% juice, keeping the other ingredients constant are used to improve the organoleptic quality attributes and also enhanced the consumer acceptability.

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