

Standardization and Sensory Evaluation of Pickle made from Manali Tamarind

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ABSTRACT: The present study was intended to develop the Manali tamarind pickle and to assess the acceptability through sensory evaluation. Pickles always plays an important role which adds taste, flavour and makes food palatable. It is made in different ways based on the location where southern parts prepare with spices, condiments and sesame or groundnut oil as preservative and northern parts prepare sweet pickles using vinegar and mustard oil. During the fermentation process, that brings desirable changes which enhances the nutritional, sensory and keeping quality parameters of the pickle. Different combinations (10% to 70%) were made by incorporating with fresh arils. The best accepted combination sensorially was P3 i.e., 30%. Due to the fruit's seasonality, there was a limited supply and difficulty for obtaining the raw ingredient.

Keywords: Manali tamarind, pickles, fermentation, sensory evaluation and health benefits.

INTRODUCTION

Pickling is an age-old culinary art form that dates back to 2400 BCE and involves preserving food in vinegar, brine and spices. All groups and civilizations around the world have a deep-rooted tradition of pickling. Fruits, vegetables, roots, and tubers can all be pickled. Although fish and meat have been a century-old tradition, the ancient Mesopotamians were also expected to master the skill of fruit preservation (Kawahara *et al.*, 2010). Pickling was a method of food preservation utilized by ancient civilizations by Chinese, Egyptians, and Indians (Chakraborty and Roy 2018; El Sheikha *et al.*, 2018).

Pickling is the process of preserving food in a high acid environment that allows it to last longer than two years without refrigeration. On the basis of the fermenting process, there are various pickle varieties like fermented (spices and oil) and unfermented ones (brine or vinegar) (Fellows, 1997).

The most commonly made pickles in southern parts of India were mango, amla, tomato and cauliflower in northern parts cabbage, radish, cucumber, caperberries, carrot, eggplant and beans (Behera *et al.*, 2020).

Place of pickles in Indian Diet: Mango pickle is the staple one in the normal Indian diet, especially for those in the middle and lower economic groups due to limited purchasing power. Adding a bit of pickle to food gives

it vitality, and some people might not consider a meal to be complete without it (Bulla *et al.*, 2012).

Pithecellobium dulce (Manali tamarind) is widespread in rural India and is discovered to have a wide range of medicinal characteristics. It contains a combination of different nutrients and antioxidants and is an excellent example of a bioactive food. *Pithecellobium dulce* (Roxb.) Benth, a member of the Leguminosae family, is indigenous to tropical America and is also found in large quantities throughout India (Nagmoti *et al.*, 2012). Despite the fact that these trees are common along Indian roadways, few people were aware of their culinary potential. It is frequently referred to as Manali Tamarind and has a tamarind-like flavor. It is a delectable organic fruit that is frequently utilized in cooking. It offers a wide range of health advantages which includes antibacterial, antifungal and adulticidal properties and high nutritional value. It is not only a practical alternative to expensive pharmaceuticals used in hospitals and rehabilitation centers, but it is also more affordable (Katekhaye and Klæ 2012).

MATERIALS AND METHODS

The present study was conducted at Department of Foods and Nutrition, Post Graduate and Research Center (PG&RC), Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad, Telangana (India).

Procurement of Raw Materials: Manali tamarind, fenugreek, mustard seeds, garlic, salt, chilli powder and oil were procured from local markets of Hyderabad.

Preparation of Pickle: Mustard and fenugreek seeds were cleaned and roasted, fresh arils were cleaned and seeds were removed. Oil was heated and seasoned with mustard, cumin seeds and garlic paste. It was kept aside to cool down. Then chilli powder, salt and roasted mustard and fenugreek powders were added to it and

then arils were added and mixed well and stored in a dry clean glass jar.

Standardization of Pickle: Different combinations were prepared using 10.0 to 70.0% fresh aril as shown in Table 1. The combinations were labelled as (P01) for control, (P34) for P₁, (P54) for P₂, (P84) for P₃, (P62) for P₄, (P42) for P₅, (P72) for P₆ and (P96) for P₇ for sensory evaluation shown in Fig. 2.

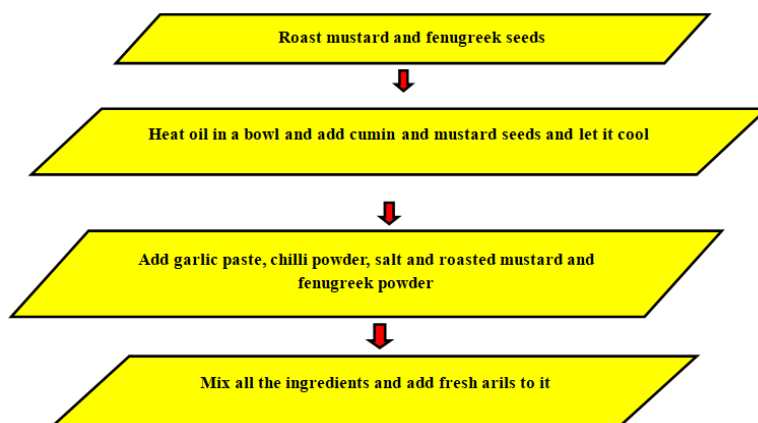


Fig. 1. Flow chart of pickle preparation.

Table 1: Formulations of pickle prepared by 10% to 70% incorporation of fresh aril.

Sr. No.	Ingredients	Control	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
1.	Chilli powder	30.0g	27.0g	24.0g	21.0g	18.0g	15.0g	12.0g	9.0g
2.	Salt	15.0g	13.5g	12.0g	10.5g	9.0g	7.5g	6.0g	4.5g
3.	Mustard	10.0g	9.0g	8.0g	7.0g	6.0g	5.0g	4.0g	3.0g
4.	Fenugreek	5.0g	4.5g	4.0g	3.5g	3.0g	2.5g	2.0g	1.5g
5.	Oil	35 ml	31.5 ml	28 ml	24.5 ml	21 ml	17.5 ml	14 ml	10.5 ml
6.	Garlic paste	5.0g	4.5g	4.0g	3.5g	3.0g	2.5g	2.0g	1.5g
7.	Fresh aril		10.0g	20.0g	30.0g	40.0g	50.0g	60.0g	70.0g

Control: No aril incorporation coded as (P01)

P₁ (10%): 10% aril; P₂ (20%): 20% aril; P₃ (30%): 30% aril; P₄ (40%): 40% aril; P₅ (50%): 50% aril; P₆ (60%): 60% aril; P₇ (70%): 70% aril



Fig. 2. Formulations of pickles.

Sensory Evaluation. It was carried out at Department of Foods and Nutrition (PG&RC), PJTSAU, Hyderabad. The products were coded and subjected to sensory evaluation by 15 semi trained panelists and the organoleptic parameters were evaluated using 9-point hedonic scale.

Statistical Analysis. The sensory scores were subjected to ANOVA and correlation using statistical procedure.

RESULTS AND DISCUSSION

Sensory scores of pickles with 10% to 70% fresh aril incorporation and other ingredients like chilli powder, salt, fenugreek, mustard powder and salt were varied. The formulations P₁ (10%), P₂ (20%), P₃ (30%), P₄ (40%), P₅ (50%), P₆ (60%) and P₇ (70%) were subjected to sensory evaluation and results given in Table 2.

Table 2 : Mean sensory scores of Pickles with 10 to 70% aril incorporation.

Sample	Appearance	Color	Texture	Flavour	Taste	Overall acceptability
Control	7.93 ^b ±0.25	8.00 ^{ab} ±0.37	8.13 ^{ab} ±0.51	7.53 ^{de} ±0.51	7.66 ^c ±0.48	7.53 ^{cd} ±0.51
P ₁ (10%)	8.26 ^a ±0.45	8.20 ^{ab} ±0.41	8.40 ^a ±0.50	7.80 ^{bc} ±0.41	7.80 ^c ±0.50	7.86 ^{bc} ±0.51
P ₂ (20%)	8.06 ^{ab} ±0.45	8.06 ^{ab} ±0.45	8.20 ^{ab} ±0.56	7.93 ^{bc} ±0.45	7.93 ^{ab} ±0.45	8.13 ^{ab} ±0.51
P ₃ (30%)	8.20 ^{ab} ±0.41	8.26 ^a ±0.46	8.26 ^{ab} ±0.45	8.26 ^a ±0.45	8.20 ^a ±0.41	8.33 ^a ±0.46
P ₄ (40%)	8.20 ^{ab} ±0.56	8.20 ^b ±0.41	8.40 ^a ±0.50	8.06 ^{ab} ±0.45	8.13 ^{ab} ±0.51	8.20 ^{ab} ±0.56
P ₅ (50%)	8.00 ^b ±0.37	8.20 ^{ab} ±0.41	8.26 ^{ab} ±0.45	7.86 ^{bc} ±0.35	7.93 ^{ab} ±0.45	8.00 ^{ab} ±0.53
P ₆ (60%)	8.00 ^{ab} ±0.53	7.93 ^b ±0.45	8.06 ^b ±0.45	7.73 ^{cd} ±0.45	7.86 ^{bc} ±0.35	7.86 ^{bc} ±0.51
P ₇ (70%)	7.20 ^c ±0.41	6.86 ^c ±0.35	6.73 ^c ±0.45	7.33 ^e ±0.48	7.13 ^d ±0.35	7.26 ^d ±0.45
Mean	7.98	7.96	8.05	7.81	7.83	7.89
SE of Mean	0.048	0.054	0.064	0.047	0.049	0.054
CD	0.27	0.28	0.31	0.32	0.32	0.35
% CV	4.78	4.97	5.44	5.81	5.73	6.20

Note: Values are expressed as mean ± standard deviation of fifteen determinations.

Means within the same column followed by a common letter do not significantly differ at $p \leq 0.05$.

Appearance: The best score for appearance compared to control was for P₁ (10%) (8.26±0.45) and least was for P₇ (70%) (7.20±0.41). The scores of appearance were in the order of P₁>P₃>P₄> P₂>P₅>P₆>P₇.

Table 3: Correlation of appearance for Pickle.

	Control	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Control	1							
P ₁	0.161	1						
P ₂	0.040	0.25	1					
P ₃	0.133	0.829**	0.301	1				
P ₄	0.098	0.334	0.779**	0.123	1			
P ₅	0.731**	0.412	0.00	0.00	0.337	1		
P ₆	0.517*	0.291	0.875**	0.322	0.715**	0.353	1	
P ₇	0.133	-0.301	-0.075	-0.25	-0.184	0.00	0.00	1

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)

n- no. of observations (15); H₀: There is no significant relationship among pickle combinations

Table 3 revealed that there was significant positive relation for P₅ and P₆ with control at ($r = 0.731$, $p < 0.01$), ($r = 0.517$, $p < 0.05$) which indicates that as the quantity of aril increased beyond 40% it has effect on the appearance of the combinations due to the decrease of the other base ingredients like chilli powder, oil, garlic, mustard and fenugreek seeds. P₁ has positive relation with P₃ at ($r = 0.731$, $p < 0.01$) as the acceptance of the product in relation with appearance was high for P₁ than P₃ due to high amounts of base ingredients compared to other combinations. P₄ and P₆ had strong positive relation with P₂ at ($r = 0.779$, $p < 0.01$), ($r = 0.875$, $p < 0.01$) the appearance acceptance was high till 40% incorporation as it do had 60% of

base ingredients in it beyond that incorporation the acceptance had decreased. P₄ had relation with P₆ at ($r = 0.715$, $p < 0.01$) as the organoleptic parameter's evaluation is based on the individual perception it varies from each other. Hence, the null hypothesis was rejected and alternate hypothesis was accepted. However, there was no relation between P₅ with P₂ and P₃, P₇ with P₅ and P₆. P₇ had negative relation with P₁, P₂, P₃ and P₄.

Colour: The highest score for colour was for P₃ (8.26±0.46) and least was for P₇ (6.86±0.35). The scores of colour were in the order of P₃>P₁>P₄> P₅>P₂>P₆>P₇.

Table 4: Correlation of colour for Pickle.

	Control	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Control	1							
P ₁	0.000	1						
P ₂	0.000	-0.075	1					
P ₃	0.412	0.075	0.590*	1				
P ₄	0.000	0.166	0.301	0.452	1			
P ₅	0.456	0.583*	-0.075	0.075	-0.25	1		
P ₆	0.000	0.075	0.704**	0.431	0.075	0.075	1	
P ₇	-0.537	-0.294	0.059	-0.206	0.196	-0.784*	-0.059	1

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)

n- no. of observations (15); H₀: There is no significant relationship among pickle combinations

Table 4 revealed that there was significant positive correlation for P₁ with P₅ at (r = 0.583, p < 0.05) the acceptance of colour for P₅ was high than that of 20% aril incorporated pickles due to less intense colour compared to P₁. There was positive relation for P₂ and P₃ (r = 0.590, p < 0.05) where the acceptance was less for P₁ than that of P₃ and it had highest score compared to the other combinations. P₂ with P₇ (r = 0.704, p < 0.01) had relation that the intensity of the colour decreases as the aril incorporation increases. There was negative relation for P₅ with P₇ as the aril incorporation

was 70% in it which had impact on the colour and appearance of the product. Hence, the null hypothesis was rejected and alternate hypothesis was accepted. However, there was no correlation between P₁, P₂, P₄ and P₅ with control. P₇ has negative relation with control, P₁, P₃ and P₅.

Texture: The highest score for texture was for P₁ (10%) and P₄ (40%) (8.40±0.50) and least was for P₇ (70%) (6.73±0.45). The scores of texture were in the order of P₄>P₁>P₃>P₅>P₂>P₆>P₇.

Table 5: Correlation of texture for Pickle.

	Control	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Control	1							
P ₁	0.054	1						
P ₂	0.148	0.703**	1					
P ₃	0.141	0.738**	0.612*	1				
P ₄	0.054	0.166	-0.050	0.123	1			
P ₅	0.141	0.738**	0.612*	0.659*	0.123	1		
P ₆	-0.040	0.184	0.222	0.250	0.184	0.250	1	
P ₇	-0.141	0.184	-0.055	0.022	0.184	0.022	-0.590*	1

** Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)
n- no. of observations (15); H₀: There is no significant relationship among pickle combinations

Table 5 revealed that there was positive correlation for P₂ (r = 0.703, p < 0.01), P₃ (r = 0.738, p < 0.01), P₅ (r = 0.738, p < 0.01) with P₁ which suggests that 10% aril incorporation had good texture compared to all other combinations. P₂ with P₃ had relation at (r = 0.612, p < 0.05) were scores was good for P₃ compared to P₂. P₃ had strong positive correlation with P₅ at (r = 0.659, p < 0.05) as the as the textural properties were similar for both the combinations where aril was 30% and 50% and the base ingredients were 70% and 50% in it. P₆

had negative relation with P₇ at (r = 0.590, p < 0.05) the 70% aril incorporation had negative effect on texture. There was negative correlation for P₆, P₇ with control, P₃ with P₇. Hence, the null hypothesis was rejected and alternate hypothesis was accepted. However, there was relation among other combinations of pickle.

Flavour: The highest score for flavour was for P₃ (8.26±0.45) and least was for P₇ (7.33±0.48). The scores of flavour were in the order of P₃>P₂>P₂>P₄>P₁>P₆>P₇.

Table 6: Correlation of flavour for Pickle.

	Control	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Control	1							
P ₁	0.200	1						
P ₂	0.161	-0.075	1					
P ₃	-0.040	0.301	0.090	1				
P ₄	-0.161	-0.678**	0.363	-0.090	1			
P ₅	-0.369	-0.196	0.384	0.236	0.059	1		
P ₆	-0.040	-0.301	-0.090	-0.318	0.090	-0.236	1	
P ₇	0.094	0.000	0.106	-0.106	-0.106	-0.138	0.426	1

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)
n- no. of observations (15); H₀: There is no significant relationship among pickle combinations

Table 6 revealed that there was negative correlation for P₄ with P₁ at (r = 0.678, p < 0.01) due to the 40.0% addition of arils in it. Other ingredients like fenugreek, mustard, chilli powder, salt and oil also had significant impact on flavour of the product. P₁ has a relatively lower quantity of arils (10%) compared to P₇ (70%). As the quantity of arils increases in P₇, it is likely to have an impact on the overall flavor profile of the product. Hence, the null hypothesis was rejected and alternate hypothesis was accepted. However, there was relation

among other combinations of pickle. There was no correlation for P₇ with P₁ as the amount of base ingredients decreases and aril incorporation increases it had negative impact on the flavour of the pickle combinations beyond 50% incorporation of arils.

Taste: The highest score for taste was for P₃ (8.20±0.41) and least was for P₇ (7.13±0.35). The scores of taste were in the order of P₃>P₄>P₂>P₅>P₆>P₁>P₇.

Table 7: Correlation of taste for Pickle.

	Control	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Control	1							
P ₁	0.261	1						
P ₂	-0.106	-0.055	1					
P ₃	0.000	0.184	0.075	1				
P ₄	-0.661**	-0.394	0.342	0.200	1			
P ₅	-0.106	-0.334	0.318	0.452	0.342	1		
P ₆	-0.277	-0.144	-0.059	0.196	0.104	-0.059	1	
P ₇	0.277	0.144	0.059	0.294	-0.104	0.059	0.153	1

** Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)
 n- no. of observations (15); H₀: There is no significant relationship among pickle combinations

Table 7 revealed that there was negative correlation for P₄ with control at (r = 0.661, p < 0.01) may be because incorporation of arils which has slight umami taste for it and as the quantity of other ingredients decreases from control to P₄, the taste of P₄ also decreases. As the quantity of arils increases, it may interfere with the parameters of the other ingredients and reduces the taste in P₄ compared to the control. The taste of a product can be influenced by various factors, including the interaction of multiple ingredients, cooking techniques,

and individual preferences. Hence, the null hypothesis was rejected and alternate hypothesis was accepted. However, there was relation among other combinations of pickle. There was no impact of ingredients on taste of P₃ combination when compared with control.

Overall Acceptability: Whereas, the highest score for overall acceptability was for P₃ (30%) (8.33±0.46) and least was for P₇ (7.26±0.45). The scores of overall acceptability were in the order of P₃>P₄>P₂>P₅>P₁>P₆>P₇.

Table 8: Correlation of overall acceptability for Pickle.

	Control	P ₁	P ₂	P ₃	P ₄	P ₅	P ₆	P ₇
Control	1							
P ₁	0.553*	1						
P ₂	0.25	0.339	1					
P ₃	-0.188	-0.094	0.377	1				
P ₄	-0.148	0.098	0.148	0.522*	1			
P ₅	0.000	0.000	0.000	0.273	0.476	1		
P ₆	-0.25	0.196	0.339	0.188	0.345	0.517*	1	
P ₇	-0.040	-0.141	-0.161	-0.426	-0.501	-0.291	-0.141	1

** Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed)
 n- no. of observations (15); H₀: There is no significant relationship among pickle combinations

Table 8 revealed that there was significant positive correlation for P₁ with control at (r = 0.553, p < 0.05) due to the low incorporation of the arils *i.e.*, 10% in it when compared to all other combinations, Whereas, P₄ with P₃ at (r = 0.522, p < 0.05) and P₆ with P₅ at (0.517). The overall acceptability of a recipe was influenced by various factors, including the combination and proportions of ingredients, flavor profiles, texture, and individual preferences. Hence, the null hypothesis was rejected and alternate hypothesis was accepted. However, there was no relation among P₅ with control, P₁ and P₂. There is negative correlation for

P₃, P₄ with control. There was negative correlation for P₇ with all other combinations (10% to 60% aril incorporation) due to high amount of arils incorporated in it.

The sensory parameters were good for the pickle with 30.0% incorporation of fresh arils its color, texture, flavour, taste and overall acceptability were good and was least for pickle with 70% fresh arils incorporated in it. Increase in the content of the arils decreased all the sensory parameters due to its sour and astringent taste and flavour.

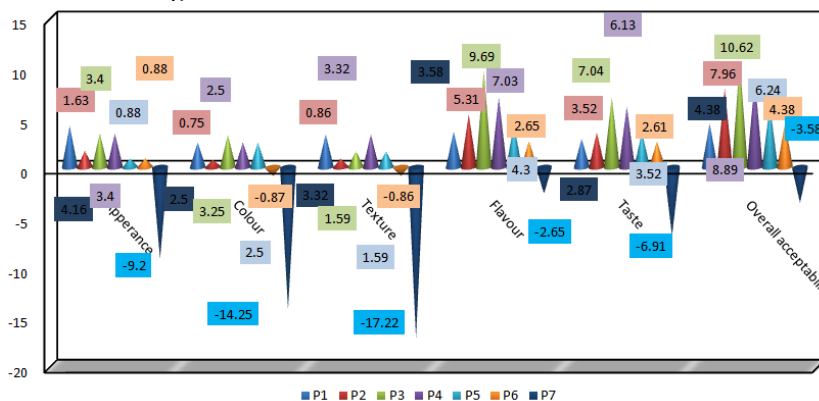
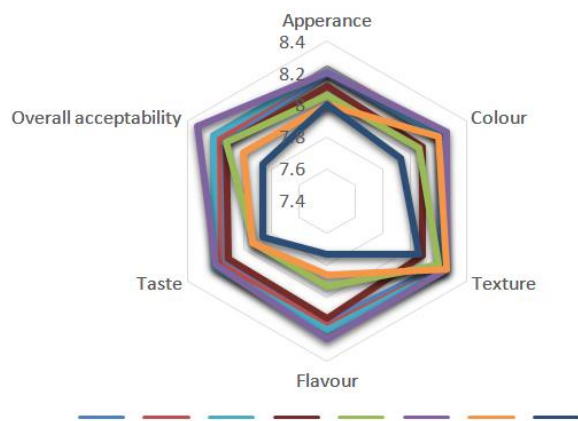


Fig. 3. Percentage change in pickles.

The percentage change in sensory scores with 30% fresh aril incorporated pickles were comparatively higher than control for colour (3.25%), flavour (9.69%), taste (7.04%) and overall acceptability was (10.62%). Whereas, the appearance (4.16%) and texture (3.32%) was highest for 10% incorporated pickle, which was shown in Fig. 3.

Health Benefits: As it was made with combination of different spices they act as probiotic due to the fermentation process helps to improve digestion and prevents minor stomach related issues.



CONCLUSIONS

Without any proper information or understanding of microbial functionality, fermented foods have been a component of the human diet for thousands of years because of changes in their natural form that contribute to enhanced flavor and prominent nutritional characteristics. In the present study pickles were made with 10% to 70% incorporation of fresh arils the acceptability was high for 30% incorporation. As the amount increased beyond it the acceptability scores has decreased which may be due to the dominant taste of the arils which had umami, sour and astringent taste and decrease of the other spices in it.

FUTURE SCOPE

To know potential benefits of the Manali tamarind based value added products like pickles. Further

studies on the preservation methods and packaging material that retains best flavor, color, and nutritional content of powdered fruits and their products needed.

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Conflicts of Interest: None.

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