

## Quality Changes and Shelf Stability of Turkey Gizzard Pickle at Room Temperature Storage ( $32\pm 5^{\circ}\text{C}$ )

M. Anna Anandh\* and A. S. Sobana

Tamil Nadu Veterinary and Animal Sciences University (TANUVAS),  
Department of Livestock Products Technology,  
Veterinary College and Research Institute, Tirunelveli – 627 358, Tamil Nadu, India

\*Corresponding Author E-mail: [drannaanandh@gmail.com](mailto:drannaanandh@gmail.com)

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### ABSTRACT

Pickle from turkey gizzard prepared and was stored at room temperature ( $32 \pm 5^{\circ}\text{C}$ ). The samples were evaluated for various physico-chemical parameters, microbial quality and sensory attributes at on regular intervals of 0, 15, 30, 45, 60, 75 and 90 days of storage. A significant ( $P<0.05$ ) decline in pH, titrable acidity, free fatty acids and TBA values were observed on day 75 of storage. However, moisture values of turkey gizzard pickle were significantly ( $P<0.05$ ) decreased on day 60 of storage. Total plate counts of turkey gizzard pickle were increased with the advancement of storage period and yeast and mould counts of turkey gizzard pickle were deducted only on day 75 and 90 of storage. However, pathogenic microorganisms not deducted throughout the storage period and all microbial counts deducted were within the acceptable limits of cooked meat products. Turkey gizzard pickle was rated acceptable sensory quality up to 60 days and thereafter sensory acceptability scores of turkey gizzard pickle were significantly ( $P<0.05$ ) reduced. Thus, the present study indicates that turkey gizzard pickle had better acceptability up to 60 days at room temperature without significantly affecting the physico-chemical and microbiological qualities.

**Keywords:** Turkey, Gizzard, Pickle, Storage, Quality, Shelf life, Shelf stability

### INTRODUCTION

Turkey (*Meleagris gallopavo*) occupies an important position next to chicken, duck, guinea fowl and quail. Turkeys are reared and slaughtered mainly for meat, the by-products that are emanated from slaughtered turkey birds are also good value. Gizzard is one of the principal edible by-product of turkey and it

accounts for 4.5 % of slaughter weight of turkey (Anna Anandh et al., 2019). Texture of gizzard is tough and rubbery due to their characteristic muscular construction (Chen and Stinson, 1983). Gizzard usually less preferred by the consumer due to its peculiar flavor and texture (Wani and Majeed, 2014).

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Highly perishable nature and tougher texture of turkey gizzards need proper technology for efficient utilization. Effective utilization of this by-product for production of value added meat products is one way to realize maximum returns from poultry sector. In this perspective, it is necessary to evolve appropriate technologies to convert the tough, less palatable and more perishable turkey gizzard into convenience, attractive and more acceptable novel products. Pickling of perishable foods in vinegar or edible oil with added salt, spices and condiments provide ready to eat product with good shelf stability at ambient temperature. Pickling help to improve desirable characteristics like taste, flavour and texture along with preservative effect (Gadekar et al., 2010). Recently, in order to diversify the available product range, the cost effective recipe for turkey gizzard pickle were standardized and it has been reported that pickle from turkey gizzard had better acceptability (Anna Anandh et al., 2019). The purpose of present study, therefore, was to study the shelf stability of turkey gizzard pickle at room temperature ( $32 \pm 5^\circ\text{C}$ ).

## MATERIALS AND METHODS

### Turkey gizzard

Fresh turkey gizzards were purchased from a local retail poultry processing unit. The fat and adhering extraneous materials on the surface of gizzards were removed by hand and it was cut in to small cubes ( $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ ). The turkey gizzard cubes were used for preparation of pickle.

### Gizzard pickle formulation

The gizzard pickle formulation consisted of pressure cooked gizzard pieces 100.0%, spice mixture - 2.0% , red chilli powder – 3.0%, garlic paste – 5.0%, ginger paste – 5.0%, roasted jeera powder - 1.0%, mustard seeds powder – 1.0%, asafoetida powder – 1.0%, roasted fenugreek seeds powder – 1.0%, salt – 3.0%, turmeric - 2.5%, vinegar – 20.0% and gingili oil 50 % (Anna Anandh et al., 2019). Spices mix was prepared by using dry spices viz. aniseed (10%), black pepper (10%), capsicum (8%) caraway seed (10%),

cardamoms (5%), cinnamon (4%), cloves (1%), coriander (20%), cumin seed (22%) and turmeric (10%) were cleaned to remove the extraneous materials and dried in oven at  $50^\circ\text{C}$  for 4 hr. The ingredients were ground in a grinder and sieved through a fine mesh. For preparation of condiments mix, fresh garlic and ginger were procured from the local market and were peeled of the external covering. The required quantities were cut in to small bits and mixed in a laboratory blender to a fine paste.

### Preparation of turkey gizzard pickle for storage studies

The washed turkey gizzard cut in to small cubes ( $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ ). After dipping in vinegar: water mixture (1:1 v/v) for 1 hr, the gizzard pieces were pressure cooked at 15 psi for 10 min. The pressure cooked turkey gizzard pieces were mixed with turmeric powder and marinated for 1 hr at  $5 \pm 2^\circ\text{C}$  for uniform dispersion and then the gizzard pieces were used for preparation of pickle. The pressure cooked turkey gizzard pieces were deep fried in heated gingili oil till golden brown colour appeared and were kept separately. The mustard seeds powder, roasted fenugreek seeds powder, asafoetida powder condiments, red chilli powder and spice mix were shallow fried in the remaining gingili to get the “golden brown stage”. Salt and fried turkey gizzard pieces were added to it and allowed to boil for 2 min. Then, vinegar was added to make a broth and heated with high constant stirring till boiling started. The pickles were allowed to cool to room temperature. After cooling the gizzard pickle were packed in the polyethylene terephthalate (PET) 250 gm bottles and stored at  $32 \pm 5^\circ\text{C}$ . Likewise four batches of turkey gizzard pickle were prepared. The turkey gizzard pickle were evaluated for various physico-chemical parameters, microbial profile and sensory attributes on a 9 - point hedonic scale at an interval of 0, 15, 30, 45, 60, 75 and 90 days of storage at room temperature ( $32 \pm 5^\circ\text{C}$ ).

### Physico - chemical characteristics analysis

The pH of the stored turkey gizzard pickle samples were determined by homogenizing 10

gm of sample with 50 ml distilled water with the help of tissue homogenizer for 1 minute. The pH of the suspension was recorded by immersing the combined glass electrode of digital pH meter. The moisture contents of turkey gizzard pickle were determined by standard method using hot air oven (AOAC, 1995). Titrable acidity of stored turkey gizzard pickle was measured according to the method described by APHA (1984) and expressed as % acetic acid. Free fatty acids were determined as per procedures outlined by AOAC (1995) and expressed as % oleic acid. The procedure of Witte *et al.*, (1970) was followed to estimate thiobarbituric acid value (TBA). Trichloroacetic acid extracts of each sample was used for measuring the absorbance at 532 nm. TBA value was calculated as mg malonaldehyde per kg sample by referring to a standard graph prepared using known concentration of malonaldehyde.

#### Microbial analysis

Total plate, coliform, yeast and mold and staphylococcal counts of stored turkey gizzard pickle samples were determined by the methods described by APHA (1984). Readymade media (Hi-media Laboratory Pvt. Ltd., Mumbai, India) viz. plate count agar, violet red bile agar, potato dextrose agar and baird parker agar were used for enumeration total plate, coliform, yeast and mold and staphylococcal counts, respectively. Preparation of samples, serial dilutions and plating were done near the flame in a horizontal laminar flow apparatus which was presterilized by ultraviolet irradiation by observing all possible aseptic precautions. Following incubation, plates showing 30-300 colonies were counted. The average number of colonies for each species was expressed as log<sub>10</sub> cfu / gm sample.

#### Sensory evaluation

Sensory evaluation was conducted with semi-trained panelists. Stored turkey gizzard pickle was served to the panelists. The sensory attributes like appearance and colour, flavour, juiciness, tenderness, saltiness, sourness and overall palatability were evaluated on 9 - point descriptive scale (where in 1 - is extremely

undesirable and 9 - is extremely desirable) as suggested by Keeton (1983).

#### Statistical analysis

The data generated from each storage period were analyzed statistically by following standard procedures (Snedecor and Cochran, 1989) for Analysis of Variance (ANOVA) comparing the means and to determine the effect of treatment by using SPSS-16 (SPSS Inc., Chicago, IL., USA). The level of significant effects, least significant differences were calculated at appropriate level of significance ( $P < 0.05$ ).

## RESULTS AND DISCUSSION

### Changes in physico – chemical characteristics

The mean values for changes in physico - chemical characteristics of turkey gizzard pickle during room temperature storage are presented in Table 1. The pH values of turkey gizzard pickles were non significantly increased with increasing storage period up to 60 days. Thereafter, a significant ( $P < 0.05$ ) increase in the pH was recorded. Pickled products are acceptable up to a pH of 5 and the pH value below 5.0 is considered critical for storage stability of pickles (Dziezak, 1986). In our present study, the pH values of turkey gizzard pickle were increased above 5 after 60 days of storage and that might be an indication of loss of quality of turkey gizzard pickle after 60 days storage at room temperature. Similar increasing trend in pH throughout storage was also reported by Pal and Agnihotri (1992) in chevon meat pickle and Khade *et al.*, (2019) in spent hen meat pickle. No significant differences in moisture content values of turkey gizzard pickle were observed on day 0 to 45 of storage. However, moisture content values of turkey gizzard pickle was significantly ( $P < 0.05$ ) decreased on day 60 of storage as compared to on day 45 of storage. Our present findings are indicated comparatively higher moisture loss of turkey gizzard pickle during advancement of storage. It might be due to excessive drying and poor binding of water in turkey gizzard. A

significant ( $P < 0.05$ ) increase in titrable acidity values of turkey gizzard pickle were observed with increasing storage period. However, decrease in titrable acidity values of turkey gizzard pickle between on day 0 and 60 and between on day 75 and 90 of storage did not turn out to be statistically significant. The increase in titrable acidity of turkey gizzard pickle might be due to loss of moisture during storage, which in turn could have increased titrable acidity of turkey gizzard pickle during storage (Khade et al., 2019). Free fatty acids values of turkey gizzard pickle were increased significantly ( $P < 0.05$ ) with increasing storage period. However, increase in free fatty acids value of turkey gizzard pickle between on day 0 to 60 of storage did not turn out to be statistically significant. Significant ( $P < 0.05$ ) increase in free fatty acids values of turkey gizzard pickle were observed on day 75 of storage and was an indication of bio chemical and microbial spoilage of the product during advancement of storage. Jayanthi et al., (2008) also reported similar increase in free fatty acid values in spent hen meat pickle during storage at room temperature. A significant ( $P < 0.05$ ) and progressive increase in TBA values of turkey gizzard pickle were observed with increase in storage period. But the values remained well within the threshold limit of 1-2 mg malonaldehyde / kg of pickled product during the entire storage period (Watts, 1962). The increase in TBA values particularly at the end of storage is indicative of oxidative rancidity (Khade et al., 2019). A positive correlation between microbial load and TBA value were reported by many workers (Gadekar et al., 2010). Increase of microbial load in turkey gizzard pickle could have caused increased oxidative changes. These oxidative changes might be attributed to increase in TBA value (Jay, 1996). The present results are in conformity with those of Jayanthi et al (2008) and Pal and Agnihotri (1994) who reported increase in TBA value in spent hen meat pickle and chevon meat pickle, respectively during storage at room temperature.

### Changes in microbial quality

The mean values for changes in microbial characteristics of turkey gizzard pickle during room temperature storage are presented in Table 2. A significant ( $P < 0.05$ ) and progressive increase in total plate counts were observed in turkey gizzard pickle with increasing storage period and increase in total plate counts between on day 15 to 60 and 75 to 90 of storage were found to be non significant. However, total plate counts were not detected in turkey gizzard pickle on day 0 of storage. Yeast and mould counts were not detected in turkey gizzard pickle between on day 0 to 60 of storage. However, significant ( $P < 0.05$ ) increase in yeast and mould counts were observed in turkey gizzard pickle between on day 75 to 90 of storage. Coliform and staphylococcus not deducted throughout storage period in turkey gizzard pickle. Jayanthi et al., (2008) reported the inhibitory effect of pickling on pathogenic microbial growth during storage of spent hen meat pickle. Our present study, during the storage period, microbiological counts were well below the standards for cooked products Jay (1996).

### Changes in sensory attributes

The mean values for changes in sensory characteristics of turkey gizzard pickle during room temperature storage are presented in Table 3. The overall means for appearance and colour, flavor, juiciness, saltiness and sourness scores were decreased in turkey gizzard pickle with increasing storage period. No significant difference was observed for appearance and colour, flavor, juiciness, saltiness and sourness scores between on day 0 and 45 and thereafter decreased significantly ( $P < 0.05$ ) with increasing storage period. Overall acceptability scores of turkey gizzard pickle ranged from  $8.3 \pm 0.05$  to  $6.1 \pm 0.06$  and decreased in overall acceptability scores were observed with increasing storage period. Overall acceptability scores of turkey gizzard pickle were significantly ( $P < 0.05$ ) decreased on day 60 of storage. However, decrease in overall acceptability scores of turkey gizzard pickle between on day 0 to 45 and 75 to 90 of

storage did not turn out to be statistically significant. The present findings revealed that in spite of a marginal decline in sensory scores of turkey gizzard pickle with advancement of storage, the turkey gizzard pickle sensory attributes were rated very acceptable up to 60 days of storage thereafter only marginally

acceptable. Significant reduction in organoleptic scores of chevon meat pickle (Pal and Agnihotri, 1994), spent hen meat pickle (Jayanthi et al., 2008) and chicken gizzard pickle (Wani and Majeed, 2014) were also reported during advancement of storage at room temperature.

**Table 1: Changes in physico-chemical characteristics of turkey gizzard pickle during storage at room temperature (32±5°C)**

Parameters	Storage period in days						
	0	15	30	45	60	75	90
<b>Physico – chemical characteristics*</b>							
pH	3.64 ± 0.10 <sup>a</sup>	3.99±0.12 <sup>a</sup>	4.18±0.14 <sup>a</sup>	4.30±0.12 <sup>a</sup>	4.80±0.12 <sup>a</sup>	5.18±0.10 <sup>b</sup>	5.60±0.12 <sup>b</sup>
Moisture (%)	63.10 ± 0.11 <sup>b</sup>	63.52±0.13 <sup>a</sup>	63.70±0.12 <sup>a</sup>	62.92±0.10 <sup>a</sup>	60.78±0.12 <sup>b</sup>	58.40±0.14 <sup>c</sup>	56.50±0.12 <sup>d</sup>
Titration acidity (% acetic acid)	0.63 ± 0.10 <sup>a</sup>	0.67±0.12 <sup>a</sup>	0.70±0.11 <sup>a</sup>	0.73±0.10 <sup>a</sup>	0.79±0.13 <sup>a</sup>	1.12±0.14 <sup>b</sup>	1.18±0.12 <sup>b</sup>
Free fatty acids (% oleic acid)	0.57 ± 0.22 <sup>a</sup>	0.69±0.20 <sup>a</sup>	0.70±0.17 <sup>a</sup>	0.71±0.18 <sup>a</sup>	0.73±0.16 <sup>a</sup>	1.57±0.20 <sup>b</sup>	1.69±0.18 <sup>b</sup>
TBA value (mg malonaldehyde / kg)	0.74 ± 0.15 <sup>a</sup>	0.81±0.15 <sup>a</sup>	0.89±0.17 <sup>a</sup>	0.91±0.14 <sup>a</sup>	1.37±0.17 <sup>a</sup>	1.44±0.18 <sup>b</sup>	1.57±0.15 <sup>b</sup>

\*Number of observations: 4

Means bearing same superscripts row-wise do not differ significantly (P<0.05).

**Table 2: Changes in microbial profile of turkey gizzard pickle during storage at room temperature (32±5°C)**

Parameters	Storage period in days						
	0	15	30	45	60	75	90
<b>Microbial profile (log 10 cfu/gm) **</b>							
Total plate count	ND	1.30±0.12 <sup>a</sup>	1.50±0.16 <sup>a</sup>	1.52±0.11 <sup>a</sup>	1.60±0.15 <sup>a</sup>	2.78±0.14 <sup>b</sup>	2.90±0.12 <sup>c</sup>
Coliform count	ND						
Yeast and mould count	ND	ND	ND	ND	ND	1.30±0.13 <sup>a</sup>	2.50±0.10 <sup>b</sup>
Staphylococcal count	ND						

\*\*Number of observations: 4

Means bearing same superscripts row-wise do not differ significantly (P<0.05).

**Table 3: Changes in sensory characteristics of turkey gizzard pickle during storage at room temperature (32±5°C)**

Parameters	Storage period in days						
	0	15	30	45	60	75	90
<b>Sensory attributes***</b>							
Appearance and colour	8.5 ± 0.05 <sup>a</sup>	8.5 ± 0.05 <sup>a</sup>	8.2 ± 0.0 <sup>a</sup>	8.0 ± 0.08 <sup>a</sup>	7.0 ± 0.04 <sup>b</sup>	6.0 ± 0.05 <sup>c</sup>	6.0 ± 0.05 <sup>c</sup>
Flavour	8.0 ± 0.04 <sup>a</sup>	8.0 ± 0.06 <sup>a</sup>	8.0 ± 0.05 <sup>a</sup>	8.0 ± 0.05 <sup>a</sup>	7.0 ± 0.06 <sup>b</sup>	6.0 ± 0.05 <sup>c</sup>	6.0 ± 0.05 <sup>c</sup>
Juiciness	8.0 ± 0.05 <sup>a</sup>	8.0 ± 0.05 <sup>a</sup>	8.0 ± 0.06 <sup>a</sup>	8.0 ± 0.05 <sup>a</sup>	7.0 ± 0.06 <sup>b</sup>	6.0 ± 0.04 <sup>c</sup>	6.0 ± 0.05 <sup>c</sup>
Saltiness	8.5 ± 0.05 <sup>a</sup>	8.5 ± 0.08 <sup>a</sup>	8.0 ± 0.07 <sup>a</sup>	8.0 ± 0.10 <sup>a</sup>	7.0 ± 0.10 <sup>b</sup>	6.0 ± 0.05 <sup>c</sup>	6.0 ± 0.04 <sup>c</sup>
Sourness	8.5 ± 0.07 <sup>a</sup>	8.5 ± 0.07 <sup>a</sup>	8.0 ± 0.09 <sup>a</sup>	8.0 ± 0.05 <sup>a</sup>	7.0 ± 0.06 <sup>b</sup>	6.0 ± 0.07 <sup>c</sup>	6.0 ± 0.05 <sup>c</sup>
Over all acceptability	8.3 ± 0.05 <sup>a</sup>	8.3 ± 0.06 <sup>a</sup>	8.0 ± 0.06 <sup>a</sup>	8.0 ± 0.06 <sup>a</sup>	7.0 ± 0.06 <sup>b</sup>	6.0 ± 0.05 <sup>c</sup>	6.0 ± 0.06 <sup>c</sup>

\*\*\*Number of observations = 32.

Sensory attributes were evaluated on a 9-point descriptive scale (wherein, 1 = extremely undesirable; 9 = extremely desirable).

Means bearing same superscripts (lowercase letters) row-wise do not differ significantly (P< 0.05).

## CONCLUSION

Significant changes were observed in physico-chemical, microbial and sensory characteristics of turkey gizzard pickle between on day 60 to 90 of storage at room temperature ( $32\pm 5^\circ\text{C}$ ). Turkey gizzard pickle had very acceptable sensory quality up to 60 days as compared to 90 days of storage at room temperature ( $32\pm 5^\circ\text{C}$ ) without significantly affecting physico-chemical and microbial qualities.

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