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STORAGE QUALITY AND SHELF-LIFE OF CHICKEN PICKLE INCORPORATED WITH AMLA, GINGER AND GARLIC

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ABSTRACT

A study was carried out to assess the shelf life of chicken pickle incorporated with *amla*, ginger and garlic. Chicken pickle was prepared by using *amla*, and ginger-garlic at 20 per cent replacement level of chicken meat. Control pickle and pickles incorporated with *amla,* and ginger-garlic were evaluated at ambient temperature on every 15th day interval for 60 days. The pH, TBA values, and total viable count increased significantly ($p<0.01$) during storage but were within the acceptable limit. Water activity did not show noticeable change and remained constant throughout the storage period. During storage periods, the chicken pickle incorporated with *amla* and ginger-garlic maintained significantly higher sensory scores compared to the control. During the storage of chicken pickle, the sensory scores for all the attributes declined significantly ($p<0.01$) with the progress of the storage period. In addition, vitamin C content of control, *amla* and ginger- garlic incorporated chicken pickles were 22 mg/100gm, 105 mg/100gm and 38mg/100gm, respectively. Based on the findings, it is concluded that the *amla* and ginger-garlic incorporated chicken pickles could be stored for up to 60 days with no deteriorative changes.

Keywords: Shelf life, chicken meat pickle, storage studies, value added products

INTRODUCTION

The name meat pickle is given to the meat-based condiment made up of meat, spices, salt, vegetable oil and with or without acetic acid (Sidhu *et al.,* 1995). Meat pickles are ready to eat, convenient meat products with good shelf stability at ambient temperature (Das *et al.* 2007). Gadekar *et al.* (2010) stated that the pickling of meat offers highly delicious and nutritious ready to eat products with a relatively better shelf life. In the orient, especially in countries like India, Nepal and some countries in the Far East pickle

type of food is well known for its appetite enhancing property and the property to aid in the digestion of food by stimulating the flow of gastric juice. Preparation of different meat pickles has been reported (Pal, 1990; Pal and Agnihotri, 1994; Sachdev *et al.,* 1994; Puttarajappa *et al.,*1996; Shukla and Srivastava, 1999; Sen and Karim, 2003; Das *et al.,* 2007; Gadekar *et al.,* 2010; Kanagaraju and Subramanian, 2012; Das *et al.,* 2013, Hafiz *et al.,* 2013, Bhusal *et al.,* 2017). Due to the lower initial cost of investment and lack of need for refrigeration facility, the meat pickle has good potential to be developed by the rural entrepreneurs.

Ginger is a rhizome widely used as a spice in a variety of food products in general, and particularly in meat-based foods. Ginger enhances the flavour of the product, it also has antimicrobial (Sazler, 1982) property that helps to extend the shelf life of a product (Ziauddin *et al.,*1996 and Kim *et al.,* 2007) and also has antioxidant (Lee *et al.,* 1986; Mendiratta *et al.,* 2000) property. Garlic products are used as sources of medicine in many ways in human beings in their day-to-day life. Garlic extract has antimicrobial activity against many genera of bacteria, fungi and viruses (Gebreyohannes and Tedla, 2013). Biological effects of garlic are attributed to its characteristic organosulfur compounds. The chemical constituents of garlic have also been investigated for the treatment of cardiovascular disease, cancer, diabetes, blood pressure, atherosclerosis and hyperlipidaemia. Fresh and powdered garlic are popular for food flavour and are used in many dishes. .

All parts of *amla* or Indian gooseberry are useful in the treatment of various diseases. Among all, the most important part is fruit. *Amla* fruit is widely used in the Indian system of medicine as diuretic, laxative, liver tonic, refrigerant, stomachic, restorative, antipyretic, hair tonic, ulcer preventive and for common cold, fever; alone or in combination with other plants. Phytochemical studies on *amla* disclosed major chemical constituents, including tannins, alkaloids, polyphenols, vitamins and minerals. Gallic acid, ellagic acid, emblicanin A & B, phyllembein, quercetin and ascorbic acid are found to be biologically effective. *Amla* is also reported to possess potent free radical scavenging, antioxidant, anti-inflammatory, anti-mutagenic, and immunomodulatory activities, which are efficacious in the prevention and treatment of various diseases like cancer, atherosclerosis, diabetes, liver and heart diseases (Dasaoju and Gottumukkala 2014**).** There is scarcity of information on the development and storage stability of vegetable incorporated chicken meat pickles. Moreover, meat pickles have

the potential of becoming a ready-to-eat, highly acceptable, convenient meat product of indigenous origin. Therefore, a study was carried out to assess the shelf life and quality of *amla* and ginger-garlic, incorporated chicken pickle during ambient temperature storage.

MATERIALS AND METHODS

Freshly slaughtered and dressed broiler chicken breast was bought from the local market of Namakkal, Tamil Nadu, India. After overnight chilling at 4± 1°C in a refrigerator, meat was separated from the bone and trimmed to remove adhering fatty tissues. The meat was weighed, cut into thumb size (15 gram) pieces and marinated with vinegar for 2 hrs and cooked in boiling water (1:1) to reach internal core temperature of 75°C. The cooked meat was fried in vegetable oil in a frying pan at 175±5°C to golden brown colour. The excess oil was drained off. For incorporation of *amla* and ginger-garlic the subsequent procedure was followed. Washed *amla* was steamed, peeled, and pan-fried with vegetable oil and was kept aside. Ginger and garlic, after skin removal, in a ratio of 50: 50 was cut into small pieces. The pieces were slightly pan fried with vegetable oil at low flame. Dry spice mix and green condiments were fried in the remaining vegetable oil and fried meat was added to it and heated with constant stirring till complete mixing of meat and spice mix. During mixing prepared *amla* or ginger-garlic were added along with fried meat. The pickles were allowed to cool on their own. Thereafter, the required quantity of vinegar was added and mixed thoroughly. After cooling, pickles were packed in the polyethylene terephthalate (PET) bottles and stored at 32±0.5°C. Control and two treatment (*amla* incorporated and ginger-garlic incorporated) chicken pickles were prepared for further studies .

Analysis of Samples

After seven days of maturation period, changes in physico-chemical, microbiological and organoleptic properties were monitored at an interval of 15 days up to 60 days. The proximate composition of chicken meat pickle was determined as per AOAC (1997). The vitamin C content of chicken meat pickle was determined as per the methods recommended by AOAC (2012). Each sample was analysed for pH (Trout *et al.,* 1992) using digital pH meter (Model 361, Systronics, India), water activity (Irshad, 2021) using Aqua Lab water activity meter and thiobarbituric acid reactive substance (TBARS) number (Witte *et al.,*1970). Total viable count, *Salmonella spp, E.coli* and *Staphylococcus aureus* counts were determined by the method described by APHA (1984).

Table 1: Ingredients for control, *amla* and ginger-garlic incorporated chicken pickle preparation

Ingredients	Control	*Amla* incorporated	Ginger-garlic incorporated
Boneless chicken breast (gm)	1000	800	800
Vegetable / Plant source	-	200	200
Vinegar (ml)	100	100	100
Oil (ml)	400	400	400
Ginger and garlic paste (g)	100	100	100
Cumin powder (g)	10	10	10
Asafoetida powder (g)	5	5	5
Fenugreek (g)	5	5	5
Mustard (g)	10	10	10
Chilli powder (g)	30	30	30
Salt (g)	30	30	30
Chicken masala (g)	10	10	10

Sensory evaluation of developed chicken pickle was conducted by semi trained panelists at the Department of Livestock Products Technology (Meat Science), Veterinary College and Research Institute, Namakkal, Tamil Nadu-637 002 by using the eight-point hedonic scale (Meilgaard *et al.,* 1991). Sensory attributes *viz.*, appearance, flavour, juiciness, texture, sourness and overall acceptability of the pickles were evaluated using 8 point descriptive hedonic scale, where 8 denoted extremely desirable and 1 denoted extremely poor. Panelists were instructed to cleanse their palates with water between analysis of samples.

Six similar trials were conducted and results were analysed using analysis of variance followed by Duncan's Multiple Range Test (Snedecor and Cochran, 1994).

Table 2: Proximate composition of control, *amla* and ginger-garlic incorporated chicken pickles

Proximate composition	T1 (Control)	T2 (*Amla* incorporated)	T3 (Ginger-garlic incorporated)
Moisture (%)	8.52	8.85	9.10
Protein (%)	27.82	25.44	25.97
Total fat (%)	33.90	34.78	32.75
Total ash (%)	1.4	1.38	1.46
Vitamin C (mg/100g)	22	105	38

RESULTS AND DISCUSSION

The proximate composition and vitamin C content of control, *amla* and ginger-garlic incorporated chicken pickles are presented in table 2.

Results showed that after seven days of maturation period, the pH values of *amla* and ginger- garlic incorporated chicken pickle were significantly ($p<0.05$) different from the control pickle. There was a slight increase in pH of 4.43 to 4.80, 3.77 to 4.31 and 4.11 to 4.81 in control, *amla* and ginger-garlic incorporated chicken meat pickles, respectively on storage. Similar patterns of change in the pH of various meat pickles have been reported earlier (Das *et al.,* 2007; Maiti *et al.;* 2009 and Bhusal *et al.,* 2017). The pH values of pickles were significantly ($p<0.05$) different during the storage period (Table 2) and were well below the pH value of 5.0, which is considered to be critical for the storage stability of pickled meat products (Dziezak, 1986).

Water activity

Water activity did not show noticeable change and remained constant throughout the storage period. The water activity of control, *amla* and ginger-garlic incorporated chicken pickles were 0.950 ±0.01, 0.948±0.02 and 0.949±0.01, respectively during the initial day of storage periods.

TBARS number

Lipid oxidation is the main non-microbial cause of the quality deterioration of meat and meat products. Changes in TBARS value (mg malondialdehyde/Kg) during storage periods of *amla* and ginger-garlic incorporated chicken pickles are given in Fig 1.

The initial TBARS value (mg malondialdehyde/Kg) of the control, *amla* and ginger-garlic incorporated pickles were 0.45, 0.38 and 0.42 respectively. However, from the graph

Table 3: Mean (±) SE of pH of amla and ginger garlic incorporated chicken pickle[#]

Chicken pickle	0 day	15th day	30th day	45th day	60th day	Overall treatment mean
T1 **(Control),**	4.43±0.03	4.5±0.06	4.60±0.05	4.71±0.01	4.80±0.01	4.61±0.04^{C}
T2 **(*Amla* incorporated)**	3.77±0.01	3.98±0.00	4.18±0.00	4.24±0.00	4.31±0.01	4.09±0.05^{A}
T3 **(Ginger -garlic incorporated)**	4.11±0.00	4.31±0.01	4.47±0.01	4.74±0.00	4.81±0.01	4.49±0.07^{B}
Overall storage period mean	4.10±0.1^{a}	4.26±0.08^{b}	4.42±0.06^{c}	4.56±0.08^{d}	4.64±0.08^{e}	

[#]Means bearing uncommon superscripts within rows and coloum differ significantly

it is seen that TBARS values of control, *amla* and ginger-garlic incorporated chicken meat pickles increased gradually up to 60th day. On the 60th day, the mean TBARS value of the control, *amla* and ginger-garlic incorporated pickle were 0.78, 0.68 and 0.65, respectively. The significantly lower TBARS value noticed in *amla* and ginger-garlic incorporated chicken meat pickles may be due to the antioxidant properties of *amla* and ginger-garlic. Abinayaselvi (2017) reported that addition of various gooseberry (*amla*) preparations could be used as natural antioxidant to control the lipid oxidation in n-3 fatty acids incorporated chicken meatballs and the products could be stored up to 60 days under frozen (-18±1°C) storage.

Microbial quality

The total plate counts of control, *amla* and ginger-garlic incorporated chicken pickles are presented in table 4. Lower overall mean total plate count in *amla* and ginger-garlic incorporated chicken pickle may be because of additional antimicrobial effect of *amla* (Kumar and Langoo, 2015) ginger (Muthulakshmi *et al.,* 2018) and garlic (Aydin *et al.,* 2007).

The total plate count increased significantly during storage periods, but

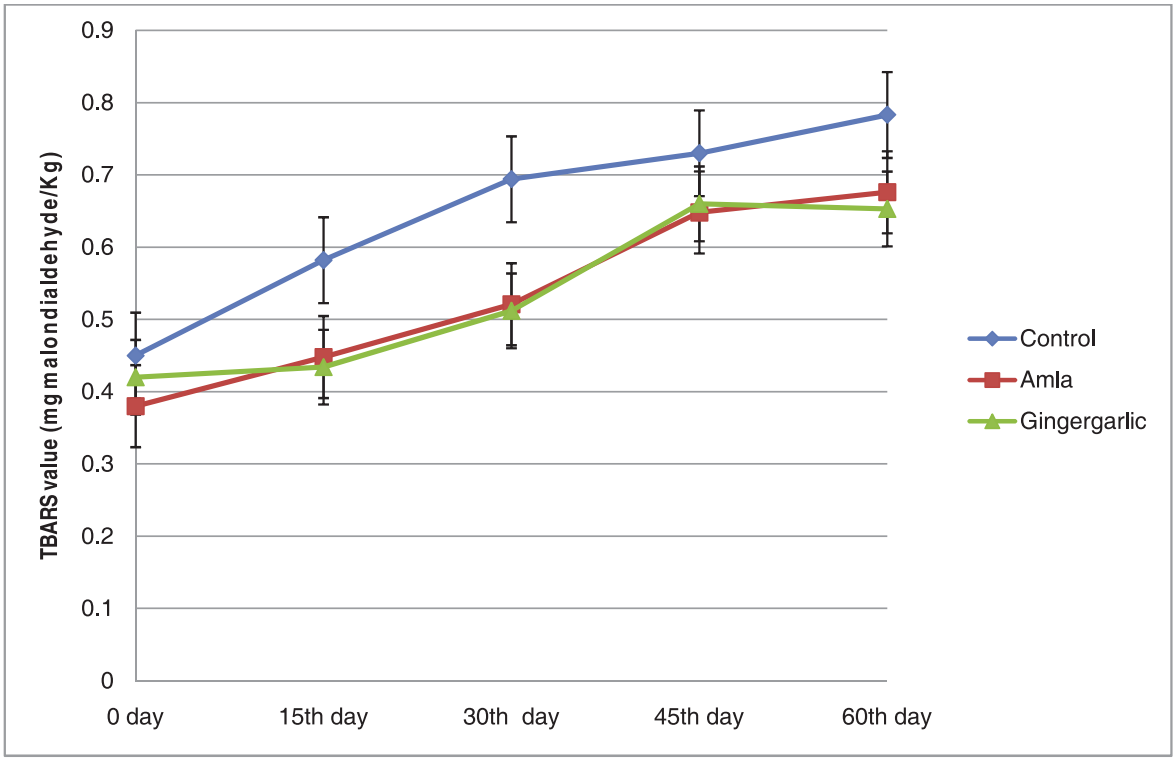

Fig 1. Changes in TBARS value (mg malondialdehyde/Kg) during storage

Table 4: Total plate counts (log_{10} cfu/g) of *amla* and ginger- garlic incorporated chicken meat pickle[#]

Chicken pickle	Storage period (day)					Overall treatment mean
	0	15	30	45	60	
T1 (Control),	1.46±0.02	1.88±0.01	2.38±0.02	2.53±0.01	2.88±0.01	2.22±0.13
T2 (*Amla* incorporated)	1.40±0.00	1.81±0.01	2.29±0.00	2.46±0.01	2.74±0.00	2.14±0.11
T3 (Ginger-garlic incorporated)	1.42±0.01	1.77±0.01	2.39±0.24	2.43±0.01	2.71±0.01	2.14±0.08
Overall storage period mean	1.43±0.01^{a}	1.82±0.02^{b}	2.35±0.07^{c}	2.47±0.01^{d}	2.78±0.03^{e}	

[#]Means bearing uncommon superscripts within rows and coloum differ significantly ($p<0.05$)

within the prescribed limit of FSSAI standards (2011) and *Staphylococcus aureus, Salmonella, Escherichia coli* were not detected. The commercial product vinegar is made from acetic acid. Acetic acid and heat are considered as major factors for increasing microbial safety of pickled products (Lee, 2004). Yeast and mould were detected on 60th day of storage period but within the prescribed limit.

Sensory qualities

The sensory qualities of control, *amla* incorporated as well as ginger-garlic incorporated chicken pickles are presented in table 5. There was a significant difference noticed between treatments, *amla* incorporated pickle had higher score compared to control and ginger-garlic incorporated chicken pickle. During the storage period sensory qualities show meagre reduction except for appearance score which remained satisfactory throughout the storage period. Similar findings were also reported by Pal and Agnihotri (1994), Sen and Karim (2003) and Das *et al.* (2007).

CONCLUSION

From this study, it was found that the *amla* or ginger-garlic incorporated into the chicken pickle is well-accepted sensorially. In addition, vitamin C content of *amla* incorporated chicken pickle (105 mg/100gm) was significantly higher compared to control (22 mg/100gm) and ginger-garlic incorporated chicken pickle (38 mg/100gm). Furthermore, the cost of *amla* and ginger garlic are lower compared to chicken meat, and their incorporation into chicken pickle will help to reduce the cost of production with additional benefits of antimicrobial as well as oxidative stability without overtly affecting the nutritional content. Based on the above study it is concluded that the developed pickle could be stored for 60 days with no deteriorative changes.

Table 5: Sensory qualities of *amla* and ginger garlic incorporated chicken meat pickles

Chicken pickle	Storage period (day)					Overall treatment mean
	0	15	30	45	60	
	Appearance					
T1 (Control),	7.17±0.17	7.08±0.08	7.00±0.00	7.04±0.04	6.96±0.04	7.05±0.04^{A}
T2 (*Amla* incorporated)	7.41±0.04	7.36±0.01	7.37±0.00	7.32±0.05	7.41±0.04	7.37±0.02^{C}
T3 (Ginger -garlic incorporated)	7.2±0.05	7.25±0	7.25±0	7.2±0.05	7.12±0.07	7.21±0.02^{B}
Overall storage period mean	7.26±0.06	7.23±0.05	7.21±0.05	7.19±0.05	7.16±0.07	
	Flavour					
T1 (Control),	7.00±0.00	7.00±0.00	6.88±0.00	6.66±0.00	6.44±0.06	7.00±0.00^{A}
T2 (*Amla* incorporated)	7.5±0.00	7.33±0.00	7.11±0.00	7.11±0.00	7.00±0.00	7.21±0.05^{C}
T3 (Ginger -garlic incorporated)	7.25±0.00	7.25±0.00	7.25±0.00	7.12±0.07	6.96±0.04	7.17±0.03^{B}
Overall storage period mean	7.25±0.07a	7.19±0.05b	7.08±0.05c	6.96±0.08d	6.8±0.09e	
	Juiciness					
T1 (Control),	7.17±0.17	7.04±0.04	6.88±0.00	6.66±0.00	6.50±0.00	6.85±0.08^{A}
T2 (*Amla* incorporated)	7.67±0.08	7.39±0.06	7.11±0.00	7.11±0.00	7±0.00	7.25±0.07^{C}
T3 (Ginger -garlic incorporated)	7.25±0	7.25±0.00	7.25±0.00	7.12±0.07	6.96±0.04	7.17±0.03^{B}
Overall storage period mean	7.36±0.09^{a}	7.22±0.05^{b}	7.08±0.05^{c}	6.96±0.08^{d}	6.82±0.09^{e}	
	Texture					
T1 (Control)	7.00±0.00	7.00±0.00	7.00±0.00	6.88±0.00	6.66±0.00	6.91±0.04^{A}
T2 (*Amla* incorporated)	7.08±0.08	7.00±0.00	7.00±0.00	6.88±0.00	6.73±0.07	6.94±0.04^{A}
T3 (Ginger -garlic incorporated)	7.12±0.07	7.07±0.04	7.00±0.00	7.04±0.04	6.85±0.03	7.02±0.03^{B}
Overall storage period mean	7.07±0.04^{a}	7.02±0.02^{ab}	7.00±0.00^{b}	6.93±0.03^{c}	6.75±0.04^{d}	
	Overall acceptability					
T1 (Control),	7.00±0.00	7.00±0.00	6.88±0.00	6.66±0.00	6.44±0.06	7.00±0.00^{A}
T2 (*Amla* incorporated)	7.5±0.00	7.33±0.00	7.11±0.00	7.11±0.00	7.00±0.00	7.21±0.05^{C}
T3 (Ginger -garlic incorporated)	7.25±0.00	7.25±0.00	7.25±0.00	7.12±0.07	6.96±0.04	7.17±0.03^{B}
Overall storage period mean	7.25±0.07^{a}	7.19±0.05^{b}	7.08±0.05^{c}	6.96±0.08^{d}	6.8±0.09^{e}	

$^{\#}$Means bearing uncommon superscripts within rows and coloum differ significantly ($p<0.05$)

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