

STORAGE STUDIES ON DUCK MEAT STICKS

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In India, ducks are essentially reared for egg and hence duck meat available is usually from spent ducks only. In as much as spent ducks contribute a major share of duck meat it is appropriate that the production of value added products using duck meat will be welcomed. If the low consumption is due to lack of range of convenience food items in the market, development of foods which are ready-to-cook/eat from duck meat could probably lead to an increased per capita consumption. The present investigation was therefore taken up to evaluate duck meat sticks prepared from the deboned minced meat of spent desi ducks using two recipes suitable to

Indian consumers with regard to the nutritional characteristics and shelf-life of the product on storage under deep freezing temperature.

Materials and methods

Deboned minced meat from spent desi ducks aged 2 years was used for the preparation of duck meat sticks, using the recipes listed in Table 1.

All the ingredients excluding the batter mixture were mixed thoroughly with minced meat for 2-3 minutes. The mixture was spread to a uniform thickness on a tray and was

Table 1 Duck meat stick – recipes

Ingredients	Quantity	
	Recipe-I	Recipe-II
Duck meat (Deboned and minced) (g)	1000	1000
*Spice mixture (g)	25	25
Garlic (minced) (g)	25	25
Ginger (minced) (g)	10	10
Skim milk powder (g)	-	25
Salt	to taste	to taste
Onion (chopped and minced) (g)	50	50
Egg (Nos.)	4	4
Maida (g)	50	50
Water (ml)	100-200	100-200
Bread crumbs (g)	150	150

* Spices mixture include – clove 1 g., cinnamon 5 g, anise 6 g, black pepper 6 g, capsicum 5 g and cardamom 2 g.

divided into rectangular pieces such that each piece weighed approximately 100 g. These pieces were kept in a freezer for two hours and thereafter the pieces were removed from the freezer and battered by dipping first in egg-flour mixture and then sprinkling powdered bread crumbs over them. The sticks were packed in butter paper and stored under deep freezing temperature (-15°C).

The duck meat sticks thus prepared by two recipes were withdrawn from freezer at 0, 15, 30, 40, 50 and 60 days of storage. Five duck meat sticks were taken from each recipe and assessed for quality at each withdrawal period.

The samples were analysed for the moisture, protein, fat and total ash as per AOAC (1980). Rancidity was determined by 2-thiobarbituric acid number (TBA number) (Tarladgis *et al.*, 1960), which was expressed as mg malonaldehyde per kg of material.

Total aerobic counts were determined by bacterial count (Harrigan and McCance, 1976) and were expressed as colony forming units/g of sample.

Organoleptic evaluations were conducted with a five member taste panel after deep fat frying of the sticks for 10 to 15 minutes at $150-175^{\circ}\text{C}$ in refined oil. A seven point hedonic scale for flavour, tenderness, juiciness and overall acceptability was used.

The loss in weight during cooking was expressed in terms of percent cooking as follows:

Per cent cooking loss =

$$\frac{\text{Initial weight} - \text{Weight after cooking}}{\text{Initial weight}} \times 100$$

Cost structure of the product was

calculated based on the prevailing cost of the meat and other ingredients used for the preparation.

Statistical analysis (Snedecor and Cochran, 1967) of the data was carried out.

Results and discussion

There was no difference in the contents of moisture, protein, fat and total ash due to difference in recipes under deep freezing temperature (-15°C) (Table 2). The values were almost in agreement with those reported by Cunningham and Bowers (1977) for Chicken patties. Narayanankutty *et al.* (1983) reported that proximate composition remained unaltered upto 90 days at -15°C in chicken sticks. Khanna and Panda (1984) studied the effect of storage on quality of duck sausages and reported that proximate components are not significantly different from zero day to 30 days of storage at -10°C . Rejikumar *et al.* (1991) in their study with chicken meat balls observed that no appreciable change occurred in the proximate composition of the product stored at -15°C for 60 days. Barkataki *et al.* (1994) in their study with quail meat patties stored at -15°C upto 60 days reported that the proximate composition remained unaltered at this temperature.

The TBA numbers of duck meat sticks ranged from 0.16 ± 0.01 to 0.30 ± 0.01 for recipe I and from 0.17 ± 0.01 to 0.31 ± 0.01 for recipe II at -15°C (Table 3). An increase in TBA number was observed with increase in duration of storage for both recipes under frozen storage. The statistical analysis revealed that the TBA number of duck meat stick was influenced by storage period at -15°C and difference in TBA number between zero and any other days of storage was statistically significant ($P < 0.05$). The present finding however, indicated that

Table 2 Proximate composition of duck meat sticks

Type of storage	Storage period (days)	Recipe	Moisture (%)	Protein (%)	Fat (%)	Total ash (%)
Fresh Frozen (-15°C)	0	I	71.94±0.03	18.03±0.02	5.86±0.02	3.88±0.06
		II	71.94±0.05	18.00±0.02	5.86±0.10	3.93±0.02
	15	I	71.93±0.04	18.02±0.04	5.85±0.03	3.91±0.04
		II	71.94±0.05	18.04±0.08	5.84±0.02	3.96±0.04
	30	I	71.94±0.03	18.01±0.02	5.86±0.02	3.90±0.02
		II	71.92±0.04	18.02±0.02	5.86±0.03	3.90±0.02
	40	I	71.90±0.02	18.02±0.02	5.87±0.02	3.91±0.02
		II	71.90±0.02	18.01±0.02	5.89±0.03	3.91±0.03
	50	I	71.94±0.04	18.01±0.02	5.83±0.02	3.97±0.02
		II	71.94±0.05	18.02±0.02	5.86±0.03	3.97±0.02
	60	I	71.91±0.04	18.01±0.04	5.84±0.02	3.94±0.03
		II	71.93±0.04	18.02±0.02	5.85±0.02	3.95±0.04

even at fairly low temperature (-15°C) the fat in the meat product was not totally resistant to exudative rancidity as evidenced by increased TBA number.

Narayanankutty *et al.* (1983) observed that in chicken steak, the TBA numbers increased with an increase in the length of storage. At 5 and -15°C, the chicken steaks remained unaffected with regard to TBA number. Anand *et al.* (1991) observed that in chicken patties the TBA numbers increased with increase in length of storage at -15°C. Rejikumar *et al.* (1991) reported that the TBA values, increased with increased storage period under frozen storage in chicken meat balls. Barkataki *et al.* (1994) reported that the TBA values of quail meat patties increased as the period of storage increase under frozen conditions.

The total bacterial load of the frozen product decreased with the increased duration of storage and the reduction was significant statistically ($P < 0.05$) (Table 3). At -15°C, the total bacterial count ranged from 2.40×10^3 to 1.18×10^5 for recipe I and 2.34×10^3 to 1.25×10^5 for recipe II. During the whole storage period the bacterial load was found to be different statistically ($P < 0.05$) from that obtained for zero day storage.

Maxcy *et al.* (1973) reported that the normal range of total bacterial counts of fresh deboned meat ranged from 10×10^4 to 10×10^5 per gramme of meat. It was reported by Anand *et al.* (1991), Rejikumar *et al.* (1991) and Barkataki *et al.* (1994) that the storage at -15°C or lower temperature helped to reduce the bacterial count in the product and aided to maintain its quality for longer period.

Table 3 Thio-barbituric acid number (TBA number) and bacterial population of duck meat sticks in frozen storage (-15°C).

Type of storage	Storage period (days)	Recipe	TBA number (mg malonaldehyde kg)	Total bacterial count (C.F.U./G)
Fresh	0	I	0.16 ± 0.01 ^a	1.18 × 10 ⁵ ± 7.15 × 10 ^{2a}
		II	0.17 ± 0.01 ^a	1.25 × 10 ⁵ ± 7.15 × 10 ^{2a}
	15	I	0.19 ± 0.01 ^b	1.88 × 10 ⁴ ± 8.94 × 10 ^{1b}
		II	0.19 ± 0.01 ^b	1.02 × 10 ⁴ ± 4.91 × 10 ^{1b}
	30	I	0.28 ± 0.01 ^b	1.30 × 10 ⁵ ± 4.11 × 10 ^{2b}
		II	0.24 ± 0.01 ^b	1.03 × 10 ⁵ ± 1.16 × 10 ^{1b}
	40	I	0.27 ± 0.01 ^b	2.83 × 10 ⁵ ± 3.84 × 10 ^{1b}
		II	0.24 ± 0.01 ^b	1.71 × 10 ⁵ ± 2.50 × 10 ^{1b}
	50	I	0.28 ± 0.01 ^b	2.40 × 10 ⁵ ± 8.04 × 10 ^{1b}
		II	0.27 ± 0.01 ^b	2.34 × 10 ⁵ ± 1.43 × 10 ^{1b}
	60	I	0.30 ± 0.01 ^b	2.42 × 10 ⁵ ± 9.32 × 10 ^{1b}
		II	0.31 ± 0.01 ^b	2.63 × 10 ⁵ ± 8.49 × 10 ^{1b}

Note: Values within the same column between zero day and any other day of storage are not significantly different.

The taste preferences to the duck meat sticks prepared as per two recipes were evaluated in terms of flavour, tenderness, juiciness and overall acceptability (Table 4). The present study revealed that the overall acceptability of the duck meat sticks prepared by both the recipes was not found to be different statistically for varying periods of storage at -15°C. It was opined by the Taste panellists that duck meat sticks prepared with recipes I and II were equally acceptable with regard to flavour, tenderness, juiciness and overall acceptability.

The cooking loss of duck meat sticks prepared as per two recipes and stored at -15°C for varying periods was calculated. The per cent cooking loss averaged 19.45 ± 0.06 and 18.02 ± 0.06 per cent respectively

for zero and 60 days of storage for recipe I. For the sticks prepared using recipe II the value averaged 19.91 ± 0.07 and 18.05 ± 0.07 per cent respectively for zero and 60 days of storage period. The statistical analysis revealed that the cooking loss was influenced by storage periods and the differences in cooking loss between zero and any other periods of storage was statistically significant ($P < 0.05$). The results of the study are in agreement with those reported by Thind *et al.* (1988) who found it to be 18.8 per cent at the end of 60 days of storage. A decrease in cooking loss per cent was observed with increase in the duration of storage for both recipes under frozen condition.

The cost structure analysis revealed that cost of each duck meat stick prepared as per

Table 4 Organoleptic scores of duck meat sticks in different recipes

Type of storage	RecipeNo.	Days of storage					
		0	15	30	40	50	60
Flavour	I	5.40±0.25	5.60±0.40	5.40±0.25	5.40±0.32	5.60±0.25	5.80±0.20
	II	5.60±0.25	5.40±0.25	5.60±0.25	5.40±0.32	6.00±0.20	5.60±0.25
Juiciness	I	5.60±0.25	5.40±0.25	5.40±0.32	5.20±0.32	5.20±0.20	5.40±0.20
	II	5.40±0.25	5.40±0.40	5.20±0.20	5.40±0.25	5.40±0.32	5.20±0.20
Tenderness	I	5.40±0.51	5.20±0.20	5.60±0.25	5.40±0.32	5.20±0.20	5.20±0.32
	II	5.20±0.20	5.40±0.40	5.20±0.20	5.20±0.20	5.40±0.32	5.40±0.32
Overall	I	5.40±0.25	5.40±0.25	5.40±0.25	5.20±0.20	5.40±0.25	5.40±0.32
	II	5.40±0.25	5.60±0.25	5.20±0.20	5.20±0.20	5.20±0.20	5.60±0.25

7 . Excellent; 6. Very good; 5. Good; 4. Fair; 3. Poor; 2. Very poor; 1 . Undesirable

recipes I and II was Rs. 5.63 and Rs. 5.73 respectively.

Summary

Duck meat sticks were prepared from the deboned minced meat of spent desi ducks, using two recipes and were evaluated for consumer acceptability, nutritional characteristics and shelf-life. The duck meat sticks were stored at -15°C upto 60 days. The samples were analysed for proximate components, rancidity, total bacterial count, organoleptic evaluation and cooking loss. The proximate composition remained unaltered at the freezing temperature and periods of storage under reference. The total bacterial count reduced significantly ($P < 0.05$) with the increase in the length of storage. The taste panel opined that duck meat sticks prepared as per recipes I and II were equally acceptable. Cooking losses decreased with increase in storage time. It may be concluded that a highly acceptable and nutritious duck meat product viz., duck meat stick could be prepared from deboned minced meat of spent desi ducks and stored upto 60 days at -15°C without any quality deterioration.

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