Visible changes of newly developed duck meat loaf incorporated with winter melon (Benincasa hispida) during its life time

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Abstract
A study was undertaken in the to determine the shelf life of Duck meat loaf incorporated with winter melon (Benincasa hispida) by observing its visible changes from the day of its preparation. Almost 10 days passed to get an idea of deterioration that occurred. The first minor physical changes observed in control sample was colour changes of the products which occurred after 4 days of storage at refrigerated temperature. From 5 days onwards of storage there was moderate changes of physical qualities like discoloration, off odour, slime formation etc. On 7 days products became unacceptable. By knowing the above we came to conclude that shelf life of the newly developed product is only 4 days that can be increased by adapting strict hygienic measures.

Keywords: Winter melon, slime, Benincasa hispida, shelf life, hygienic, duck meat loaf

Introduction
Assam situated in the north eastern region (NER) of India has a numerous duck raising capacity which allows a significant number of rural peasants to adopt duck raising as a profitable occupation. Assam has duck population about 4.72 million occupying 2nd position in India whose duck population is 27.43 million [1]. For socio-economic progress amongst the vulnerable sections of masses of villages, duck farming is tremendously helpful as it provides supplementary as well as steady profit apart from providing essential animal protein from duck eggs and meat. There is a huge numbers of water bodies, marshy river sides, wetlands and barren moors in Assam which provides a suitable plate form to adopt duck raising without any reliable problems. Annual duck meat production in Assam is 16.65 tonnes [2]. Since ancient Assam, duck meat is considered as a famous food and is eaten traditionally with enthusiasm. Generally khaki Campbell, Rajahnh, Nageswari and pati are considered as the 5 distinct popular strains of duck amongst whom the later is the most common among the consumers of the village areas. Consumption of duck meat in Assam is irrespective of caste, creed and religion. Chicken is consumed in a huge amount by the people of assam but the popularity of duck meat is also going on day by day as it has a great nutritional value and contains combined characteristics of red meat and white meat which indicates the presence of more rate of phospholipids, precursors of aromas and high level of monounsaturated fatty acids of which oleic acid and linolenic acid occupies a prominent place occupying percentage of about sixty of total fatty acids. The consumption of white meat is gaining importance as red meat is nowadays considered hazardous due to its high cholesterol content thereby giving rise to cardiovascular diseases. Duck meat can be one of the best white meat in the near future. Duck meat loaves were prepared by incorporating Winter melon (Benincasa hispida) and it’s physico-chemical and storage quality characteristics were investigated [3]. Meat processing in the modern world is of utmost importance due to its unique value of producing high quality proteins and essential amino acids in the form of easily available readymade meat products in various cities of the world. The duck meat sector has not attained much importance from the meat processing point of view. Tough duck meat can be processed by meat industries by utilizing valuable ducks in order to achieve smart outcome to the producers.
Value added meat products which are of high economic viability containing nutritional qualities and organoleptic characteristics can be processed by making use of the available ducks in the form of meat. Many tribal communities have been preparing a number of products from duck meat fortifying with different herbs elsewhere in the north eastern region (Assam) in January (festive season also known as magh bihu), there is a practice inherited traditionally of making culinary products like duck meat with winter melon (Benincasa hispida) and that is consumed by people happily as a symbol of satisfaction and enjoyment. Winter melon (Benincasa hispida) is also called kumura, ash gourd. white pumpkin, wax gourd or Chinese water melon is owned by cucurbitaceae family and is acidic in nature. Japan and java is the native land of ash gourd, however it is cultivated more or less throughout the warm countries like India. Asian communities are fond of this vegetable because of its popularity in having beneficial effects both for its nutritional and medicinal purposes as well as its delicacy. It can be prepared by cooking directly, boiling with meat or mixing in a lot of dishes. Keeping in mind, duck meat loaf was prepared using winter melon (Benincasa hispida) and evaluate the visual changes to determine the shelf life from first day onwards to the day of deterioration of the newly developed meat product by observing colour, consistency, odour and slime formation.

**Materials and Method**

Ethical approval: Ethical approval for slaughtering of ducks was obtained from Institutional Animals Ethics Committee (IAEC), Assam Agricultural University, Khanapara, Guwahati, Assam.

**Collection of ducks**

Local Pati ducks of age group 9 – 12 months irrespective of their sex was procured from the Goat research station, Burnihat. These live ducks were transported to the laboratory of the Department of Livestock Products Technology, College of Veterinary science, Khanapara, Guwahati-22 under strict hygienic condition. They were then scientifically slaughtered in the semi- mechanized poultry dressing unit of the Livestock Products Technology Department.

**Collection of winter melon (Benincasa hispida)**

Young and tender winter melon (Benincasa hispida) was purchased from the local market (Ganesghuri), washed with clean water then peeled, cut into small pieces and finely minced with the help of a mixer grinder.

**Slaughtering**

Ducks were slaughtered in the semi-mechanized poultry dressing unit of the Department of Livestock Products Technology.

**Deboning**

The deboning of the dressed carcasses were performed within 3 hrs of slaughter. The liver, heart, gizzard, skin and visceral fat were removed and packed separately in polythene bags before storing at freezing temperature (−18 °C) until used. Similarly, the deboned meat was also packed in polythene bags and stored at freezing temperature (−18 °C) until used.

**Mincing**

The deboned meat was cut into small cubes of 2 cm size and thereafter ground in a mincer through 4mm (pore size) plate.

The fat portion was also minced separately and simultaneously and stored at a refrigeration temperature (4±1 °C) under strict hygienic condition.

**Curing**

Salt (1.5%) and sodium nitrite (0.02%) were added to the minced meat. Ingredients were then thoroughly mixed and stored at 4±1 °C for next 12 hrs to facilitate proper curing.

**Preparation of meat emulsion:**

Meat emulsions were prepared by mixing thoroughly minced duck meat with duck fat and Kumura (Benincasa hispida) at 4 different levels as shown below

| Ingredients          | Control (c) (%) | T1 (%) | T2 (%) | T3 (%) |
|----------------------|----------------|--------|--------|--------|
| Minced duck meat     | 78             | 73     | 70.5   | 68     |
| Duck fat             | 10             | 0      | 10     | 10     |
| Kumura               | 0              | 5      | 7.5    | 10     |
| Spices/Condiments    | 4              | 4      | 4      | 4      |
| Egg white            | 1.18           | 1.18   | 1.18   | 1.18   |
| Ice cubes            | 5              | 5      | 5      | 5      |
| Salt                 | 1.5            | 1.5    | 1.5    | 1.5    |
| Sodium nitrite       | 0.02           | 0.02   | 0.02   | 0.02   |
| Wheat flour          | 0.3            | 0.3    | 0.3    | 0.3    |

During mixing of duck lean, fat and Kumura (Benincasa hispida) necessary seasonings (spices/ condiments) were also added. Then the meat emulsions were stuffed in rectangular stainless-steel boxes(moulds) covered with aluminium foil under strict hygienic condition. The meat emulsions inside the stainless-steel boxes were cooked in hot water at 85 °C (72 °C- core temperature) for 45 mins in a suitable sauce pan. After cooking the stainless steel moulds were taken out and then cooled down with chilled water and kept overnight at refrigeration temperature (4±1 °C) for chilling. Next day chilled cooked blocks along with aluminium foil were taken out from the moulds and meat blocks were sliced manually into suitable shape and size and randomly packaged into high density food grade polythene bags (HDPE). They were then stored under refrigeration temperature (4±1 °C) and subjected to quality evaluation traits on first, fifth and tenth day of storage. Also visual as well as olfactory changes were observed every day from 1th day onwards continuously up to the 10th day and observations were recorded accordingly as follows

**Table 1:** Show the Ingredients and control

| Storage days | Colour | consistency | Odour | Slime formation |
|--------------|--------|-------------|-------|----------------|
| Samples      | c      | T1          | T2    | T3              |
| 1            | +      | +           | +     | +               |
| 2            | ++     | +           | +     | ++              |
| 3            | +++    | +           | +     | +++             |
| 4            | ++++   | +           | +     | ++++            |
| 5            | ++++   | +           | +     | ++++            |
| 6            | ++++   | +           | +     | ++++            |
| 7            | ++++   | +           | +     | ++++            |
| 8            | ++++   | +           | +     | ++++            |
| 9            | ++++   | +           | +     | ++++            |
| 10           | ++++   | +           | +     | ++++            |

C = control
T1= 5% incorporation of kumura
T2=7.5% incorporation of kumura
T3= 10% incorporation of kumura
(−) = No changes
(+) = Minor changes
(++) = Moderate changes
(+++) = Major changes

Results
Physical changes in external qualities
The physical changes in external qualities of both the control and treated duck meat loaves are presented in table above. The visual physical changes observed during the study period are tabulated and presented accordingly. The first minor physical changes observed in control sample was colour changes of the products which occurred after 4 days of storage at refrigerated temperature. From 5 days onwards of storage there was moderate changes of physical qualities like discoloration, off odour, slime formation etc. Gradually from 7 days onwards major changes in all the qualities were observed and products became unacceptable.

Discussion
The study revealed that the Kumura incorporated duck meat loaves have a shelf life below 5 days as there was higher microbial load, TBA values and visible physical changes in external qualities (viz colour, odour, consistency and slime formation) in all the products from the 5th day onwards up to 10th day. The reason might be due to proteolysis, lipid oxidation, formation of alkaline metabolites as well as growth and multiplication of bacteria from 5th day onwards. The relatively lower bacterial count recorded in treatment groups in comparison to the control which may be due to the acidic nature i.e lower pH and presence of certain antimicrobial property in Kumura. The present findings corroborated well with the report of Reddy et al. [10] who also reported a significant (p<0.05) decreased bacterial counts in the TVMBC in tomato paste incorporated chicken meat patties as compared to the control formulation.

The study revealed an increasing trend in TBA values of kumura incorporated duck meat loaves in the treated formulation. The TBA values were lower in all the treated samples than the control product. However TBA values showed an increasing trend along with the increase in the storage periods irrespective of the control and treated formulations. Such decreasing trend in TBA values of the products might be due to the presence of ascorbic acid and other phytochemicals present in Kumura. It was reported that pumpkin incorporated chicken sausages could be successfully stored for a period of 14 days at refrigeration temperature (4±1 °C) without any significant loss in quality [11]. However in the present study shelf lives found to be very less for all the products. It is therefore essential that initial bacterial load can be reduced by adopting better hygienic measures particularly HACCP in the production of similar type of vegetable fortified meat product in the coming generation.

Conclusion
On the basis of the above findings, it can be concluded that winter melon (Benincasa hispida) which is also known as kumura is a valuable, nutrient enriched, medicinal vegetable which can be used to develop a meat product by combining it with duck meat by considering its availability in most parts of Assam. The shelf life of the product can be increased to use it for a long time which is only possible by following better hygienic measures and preventing bacterial, yeast and mould load.

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