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Effect of Conventional and Scientific Slaughtering Methods on Duck Meat Quality

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A B S T R A C T

The present research has been conducted to evaluate both the effect of conventional and scientific methods of slaughtering in order to identify microbial risks related to the various stages of slaughtering the Ducks. Meat samples have been obtained from various locations and are being analyzed by microbial, physicochemical and sensory parameters. It has been found that the duck level, slaughtered by conventional method, is significantly greater than in scientific methods than total plate counts (TPC) and psychotropic counts. The pH, water holding capacity (WHC) of the duck slaughtered with conventional method and extract release volume of duck were significantly lower than the scientific method. The value of the conventional method thiobarbituric acid (TBA) was also higher than that of the scientific method. The meat collected from traditionally raised birds was contaminated at an early stage due to poor hygienic practices.

Introduction

Consumption of duck meat, which is also categorised as poultry meat, has been increasing gradually in recent years and has become the third most widely produced poultry meat in the world after chicken and turkey. In Asia, duck meat occupies the second dominant position in poultry meat after chicken meat. Furthermore, there has been an increase in demand for duck meat because it is no longer considered a seasonal dish and has become acceptable to eat at any time of year. This has been promoted by modern husbandry techniques that are able to supply great quantities of duck meat (Dunn, 2008: Hird *et*

al., 2005). In India duck constitute of 9% of total poultry population and it is about 17.8 million, of which 92% are deshi type (DADF 2012). Duck occupy second place to chicken for the production of eggs in our country. Ducks are mainly rear for laying purpose here. Spent and culled ducks mainly sold in market after 3-4 laying year. Such duck meat intended for human consumption has less in juiciness, more toughness, less palatability which are the hidden reasons for unacceptance of duck meat by consumers, though there is no significant decline in its nutritive value with increase in age (De, 2001). These drawbacks could be overcame by further processing of duck meat to different value added meat products which can increase the acceptability of duck meat can boost the socio-economic status of thousands of rural poor duck raisers scattered in the villages of India.

There are numerous advantages to halal un-stunned meat including complete drainage of blood, better consistency of the meat, and no concern of the poultry dying due to the stunning. To improve the situation a strict hygienic measure by considering the possible hazards in different stages of processing must be conducted. Though consumption of duck meat has increased steadily, the presence of pathogenic and spoilage microorganisms in poultry meat remain a major concern for suppliers, consumers and public health officials worldwide (Das *et al.,* 2004). However, meat on the other hand is a perishable product and is subject to quick deteriorations if it is handling properly. Food safety and the shelf life aspects of duck meat are importance concerns in relation to the microbial growth. The focus is mainly on the absence or control of potentially pathogenic microbes such as salmonella and campylobacter. Commercially spoilage bacteria play an important role in food safety and its shelf life. Microbial aspects of duck meat can be divided into two major categories, in the live phase of duck production and during processing of meat and keeping. Ayres (1960) reported that the common spoilage organisms for fresh meat are aerobic bacteria Pseudomonas and Campylobacter types. Meat is a very good source of animal protein that consists of essential amino acid, minerals, vitamins and essential fatty acids (Lawrie, 1991). Meat provides calories from fat, proteins and limited quantities of carbohydrates (Judge, *et al.,* 1990). Keeping this view, the purpose of the study was to determine the differences of duck meat quality like microbiological, physico-chemical and sensory evaluation under scientific and conventional methods of duck slaughter.

Materials and Methods

The present study was conducted simultaneously where collection of samples are done both from duck slaughtered by conventional method (CM) and scientific method (SM). The procedure of scientific method was followed as per the method adopted by the Christine *et al.,* (1982).and samples of conventional method were collected from the birds slaughtered and dressed in road side slaughtering places as it where the basis.

The meat samples for conventional slaughter were collected from road side slaughter unit of Kolkata and immediately preserved and stored in an ice-pack container maintaining the temperature (4±10˚C) and carried to the Department of Livestock Products Technology for further experiment. Total 20 no of sample were collected randomly.

Similarly, 20 no of duck samples slaughtered under scientific method were collected from departmental small poultry processing unit also transported in similar manner as samples for conventional slaughter. They were kept for evaluation of different parameters. Following

parameters were studied for all 40 samples for comparison of both the methods.

Physico-chemical characteristics**:** Water holding capacity (WHC) was determined by modifying the method of Hughes *et al.,* (1997) as outlined by Cengiz and Gokoglu (2007). Extract release volume (ERV) and thiobarbituric acid (TBA) were estimated as per the procedures described by Strange *et al*., (1977) and Tarladgis *et al.,* (1960) respectively. The pH of meat sample was estimated by the standard method Trout *et al*., (1992).

Microbiological parameters: Total plate count (TPC) and psychotropic count (PC) were carried out as per standard procedures estimated by methods as mentioned by APHA (1992).

Sensory parameters: Cooked samples were organoleptically evaluated for tenderness by 10 member's sensory panel using 8 point descriptive scale (Keeton *et al.,* 1984).

Statistical analysis of the data obtained was carried out using ANOVA technique according to the method described by Snedecor and Cochran (1989).

Results and Discussion

The mean values of the results of pH (Table 1) of meat samples slaughtered under scientific method at departmental poultry processing unit were 6.04±0.003 and the results of pH from the samples slaughtered under conventional method at road side at Kolkata were recorded 6.32±0.129. There was significance difference between these pH values of the meat samples slaughter in scientific and conventional method slaughtering. It was noticed that the pH value of conventional method road side were significantly higher ($p<0.05$) than in Department poultry slaughter unit where scientific slaughter were conducted.

The mean values of the results of WHC (Table 1) of meat samples slaughtered under scientific method at departmental poultry processing unit were 2.10±0.024 cm2 respectively and the results of WHC from the samples slaughtered under conventional method at road side at Kolkata were recorded 1.96±0.047 cm2 respectively. There was significance difference between these WHC values of the meat samples slaughter in scientific and conventional method slaughtering. It was noticed that the pH value of conventional method road side were significantly lower ($p<0.05$) than in Department poultry slaughter unit where scientific slaughter were conducted.

The mean values of the results of ERV (Table 1) of meat samples slaughtered under scientific method at departmental poultry processing unit and under conventional method at road side at Kolkata were 17.00±0.008 ml and 12.90±0.037ml respectively. There was significance difference between these ERV values of the meat samples slaughter in scientific and conventional method slaughtering. It was noticed that the pH value of conventional method road side were significantly lower ($p<0.05$) than in Department poultry slaughter unit where scientific slaughter were conducted.

The mean values of the results of TBA (Table 1) of meat samples slaughtered under scientific method at departmental poultry processing unit and conventional method were 0.474±0.007 mg and 0.589±0.032 mg respectively. There was significance difference between these TBA values of the meat samples slaughtered under scientific and conventional method. It was noticed that the TBA value of conventional method road side

were significantly higher ($p<0.05$) than the Department poultry slaughter unit where scientific slaughter were conducted. It was found that the microbial load in terms of TPC (log CFU/cm2) and PC ((log CFU/ cm2) were highly significant ($p<0.05$) in conventional method than scientific method.

The present study was conducted owing to the fact that there are some major differences of the above two methods of slaughter which are very specific relating to quality and wholesome production and processing of chicken. In scientific method of slaughter, humane slaughter method was practiced with stunning, off fed for 12-24 hrs prior to slaughter, supply of adlibidum potable water, ante- mortem care and inspection, post-mortem inspection, proper cleaning and washing before & after slaughter, whereas, in conventional methods, ritual slaughter methods were practiced without maintained proper hygiene and above such practices. Therefore, in conventional methods of slaughter, there may have the chances of more microbial contamination with less keeping quality of meat. The above results showed that scientific methods having positive impact over conventional method of slaughter and as such meat produced by scientific slaughter are more sound and wholesome. But in case of other places of conventional methods of slaughter in relation to pH such difference were not much pronounced. The difference in pH might be due to the fact that in conventional method, the observation of pH was recorded within 2 hrs of slaughter but in scientific methods, the pH was recorded after 4-6 hrs when the different stages of rigor mortis was completed after ageing. This may be due to depletion of muscle glycogen level resulting in the present observation in terms of pH. This finding is in agreement with the citation of Lawrie (1985) and also in agreement with Das *et al.,* (2004). The above results are also in agreement with the results of Natarajan and Siddique (1981); Biswas *et al.,* (2011) and Kandeepan and Biswas (2007), they also observed an increase level of pH with storage period in different species meats. The differences of WHC in both the methods can be substantiated with the observation of Lawrie (1985). Where he stated that the muscle pH has a large role in affecting the WHC and it is minimum at ultimate pH of muscle. Increased WHC with advancement of storage period was also reported by Pearson (1968). The differences of ERV values of different methods may be looked with pH values of the corresponding hours and methods as ERV value is highly correlated with pH. Reduction in ERV is more pronounced at higher pH (Murthy and Bachhil, 1980) and with an increased in microbial load (Strange *et al.,* 1977). Reduction of ERV with advancement of storage period was in agreement with the finding of Bachhil (1982), who reported that decreased of ERV was mostly due to increase of microbial load (mainly psychrotropic) during refrigerated storage and consequent breakdown of proteins and other biochemical changes (Vijayakuma and Biswas, 2006). The Table 1 showed that the difference of TBA (mg malonaldehyde/kg sample) might be explained as processing probably cause disruption of cell membrane thus exposing phospholipids, which are more prone to oxidation and dilution of natural antioxidants of cell membrane (Mead,1989) and explained that such processing disruptions were very obvious in conventional processing than in scientific processing. Increase microbial load under conventional method may be due to various type of cross contaminations during poultry slaughtering. There are different sources of microbial contamination like water, appliances and air etc and gets contaminations. This results also in agreement with Kandeepan and Biswas (2007) and Das and Biswas (2003). Similar observation was also made by Patra *et al.,* (2016) and Biswas *et al.,* (2017).

Table.1 Effect of scientific and conventional methods on quality attributes of duck (Mean ± SE)

Parameters Location	Location	Physico-chemical parameters				Microbiological evaluation		Sensory evaluation
		pH	WHC (cm^2)	ERV (ml)	TBA (mg Malonaldehyde/ kg)	TPC (log cfu/cm^2)	PC (log cfu/ cm^2)	TC
Scientific Method	Departmental poultry slaughter unit (L.P.T) (20)	6.04 ± 0.003	2.10 ±0.024	17.00 ±0.008	0.474 ±0.007	4.89 ±0.035	2.70±0.024	6.12±0.001
Conventional Method	Road side (20)	6.32 ±0.129	1.96 ±0.047	12.90 ±0.037	0.589 ±0.032	5.51 ±0.048	3.48 ±0.029	5.80±0.018

Means±SE in the same column bearing differ significantly ($p<0.005$)
WHC= Water holding capacity, ERV= Extract release volume, TBA= Thiobarbituric acid, TPC=Total plate count, PC= Phychrotropic count, TC= Tenderness score (8 point scale- 8 denoted extremely desirable and 1 denoted extremely poor)

From the present study, it can be concluded that in conventional method, slaughtered in unhygienic place, repeated washing in same water, evisceration, appliances and retailing were the major point of contaminations during poultry processing but in scientific method of slaughtering different hazards can be reduced by applying scientific techniques like stunning, proper bleeding, evisceration, washing in chilled water and also found that the scientific method of slaughter was superior to conventional methods in terms of parameters like of ERV, TBA, TPC and PC and keeping quality of meat was better in scientific methods.

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