

EFFECT OF STORAGE DURATION IN ICE ON SOME CHEMICAL AND SENSORY PROPERTIES OF BROILER BREAST MEAT

U. M. Kolo¹, M. B. *Bislava¹, A. I. Bukar², J. Yerima¹, A. Y. Girgiri¹, T. A. Jibrin¹, and G. G. Badejo¹

ABSTRACT

The objective of this study was to determine the effect of storage duration in ice on some chemical and sensory properties of broiler breast meat. Twenty four (24) broiler chickens of table size were used. The chicken breast meat was harvested and cut into pieces of uniform thickness, individually packed in air-tight packages and randomly assigned to four treatments with twelve breast meat pieces per treatment in completely randomized design (CRD). The treatments consist of stored for 0 day, stored for 1 day, stored for 2 days and stored for 3 days for treatments 1, 2, 3 and 4 respectively. At the end of storage period, breast meat samples were obtained from each treatment for chemical properties and sensory evaluation. Data collected were analyzed using one way analysis of variance (ANOVA). There were no significant ($p > 0.05$) differences in all the chemical properties measured. There was significant difference ($p < 0.05$) in aroma and tenderness scores among the treatments means. The meat aroma score for treatment 1 was significantly ($p < 0.05$) higher with least score in treatment 4. The meat tenderness score of treatment 3 is significantly higher ($p < 0.05$) than treatment 4 but is similar to treatments 1 and 2. The research concluded that ice storage for up to three days had no effect on chemical properties but had significantly ($p < 0.05$) affected aroma and tenderness of broiler breast meat.

Keywords: Breast Meat, Ice Temperature, Chemical and Sensory Properties

INTRODUCTION

Poultry products (eggs and meat) are widely consumed because they are not restricted by cultural or religious beliefs (Liu *et al.*, 2012). The meat is perceived as healthy and nutritious due to its low fat content and higher unsaturated fatty acid content than other red meats (Sharma *et al.*, 2015). The nutritional composition of chicken meat can be explained using the moisture, crude protein, crude fat, and ash content information provided (Kreuzer *et al.*, 2020). According to Lugano *et al.* (2009), fatty acids in meat contribute to the sensory attributes of the meat by improving its palatability through enhancing tenderness, colour stability, juiciness, aroma and flavour. According to Sharma *et al.* (2015), the demand and consumption of chicken meat has increased significantly, over the last few decades in many parts of the world. This could not be unconnected with the geometric increase in the world population. As a result, the broiler industry is expanding to meet the ever-increasing demand for chicken meat from the world's growing population. Poultry meat is widely consumed as a source of protein in many developing countries, particularly Nigeria, and it is either eaten cooked or processed into other forms to avoid spoilage. Broiler meat is a nutritious protein-rich food that is highly perishable and has a short shelf life unless preserved. As a result, there is an urgent need to investigate some less expensive methods of preserving chicken meat.

Freezing is a rapid heat transfer that is used for preservation of perishable products as it leads to minimal loss of quality during long term storage. Also freezing is one of the easiest, quickest, most versatile and convenient methods of food preserving. Properly frozen food maintains more of their original colour, flavour, texture and nutrients than foods preserved by other methods (Julie, 2013). Furthermore, freezing

is used to slow down undesirable biochemical reactions in meat, but there is some cell disruption and muscle fibre destruction due to the formation of ice crystals (Sebranek, 1982). Against this background, the present study intends to investigate the effect of ice on chemical and sensory properties of broiler breast meat stored different periods.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the Poultry Unit, Department of Animal Science, University of Maiduguri, Borno State. Maiduguri is located within the Sahelian (semi-arid) region of West Africa on an elevation of 354 m above sea level in the North-eastern part of Nigeria on Latitude 11.51° North and Longitude 30.05° East (NOAA, 2016). Characterized by three distinct seasons namely Wet (June-September), dry cold (October-January) and dry hot (February-May). The hottest season is between April and May, which is characterized with bright sunny day and the atmospheric temperature fluctuates between 35-45°C. During the rainy season, the temperature may drop to about 30°C or less. The peak of rainfall is August where precipitation may exceed 198.6 mm while the relative humidity may reach up to about 45 % in the wet season drops to about 5 – 10 % during the dry cold season (NOAA, 2016).

Animals and Experimental Design

The broiler birds that were used for this experiment were purchased within Maiduguri Metropolitan Council (MMC). Twenty four (24) birds at table size and fed uniform diet was procured. The birds were numbered with tag using masking tape and subsequently samples of breast meat were allocated to four (4) treatments in a Completely Randomized Design.

Sampling Procedure

After fasting for 12 hours, the birds were humanely slaughtered, dressed, eviscerated, and the breast meat was obtained for storage at 0, 1, 2, and 3 days for T₁, T₂, T₃, and T₄, respectively. The meat samples from each treatment were weighed and stored in an airtight container with an ice block of equal weight. Breast meat samples for each treatment were obtained at the end of the storage interval for proximate and sensory analyses.

Chemical Analysis of Broiler Breast Meat

Proximate analysis was conducted in the Animal Science Laboratory in the Department of Animal Science, University of Maiduguri. Three breast meat samples from each treatment were acquired for proximate analysis. Dry matter (DM), crude proteins (CP) and Ash contents of samples were determined according to the procedures described by the Association of Official Analytical Chemist (AOAC) (AOAC, 2007).

Sensory Analysis of Breast Meat

The sensory properties of breast meat samples was carried out in the Poultry Unit, Department of Animal Science, University of Maiduguri. Six breast meat samples were randomly selected from each treatment for sensory evaluation. Sensory evaluation was carried out using hedonic scale twelve sensory panels, which will constitute of both staff and students of various Departments in the University. The panelists were semi-trained on the criteria for the sensory evaluation of meat. Meat samples for each treatment were packed in polyethylene bags and placed in boiling water (100°C) for 30 minutes. The cooked meat samples were served to the panelists for review on unique disposable plates with codes. In order to lessen the impact between samples, the panelists were encouraged to use water to rinse their palates. Each participant was asked to assess the meat samples for aroma, tenderness, colour, and overall acceptability. A nine-point hedonic scale was used to score each of these attributes; 1= extremely dislike, to 9, like extremely as described by Kroll (1990).

Statistical Analysis.

All data generated were analysed using one way analysis of variance (ANOVA), mean difference were separated by Least Significant Difference (LSD) test using SPSS version 21.0 (SPSS, 2012).

RESULTS AND DISCUSSION

Chemical Analysis of Broiler Breast Meat Stored on Ice for Different Periods

The results of chemical analysis of broiler breast meat stored on ice for different periods are presented in Table 1. There were no significant differences ($p > 0.05$) in all the parameters measured. The

dry matter (DM) content ranges from 23.43 to 27.95 %. The crude protein (CP) values ranges from 20.91 to 25.70 %. The ash content also ranges from 0.50 to 0.83 %.

Table 1: Chemical Analysis of Broiler Breast Meat Stored on Ice for Different Periods

Treatment	DM	CP	ASH
1	27.95	21.64	0.67
2	23.43	25.70	0.83
3	24.44	20.91	0.50
4	24.50	20.94	0.67
SEM	1.71	2.13	0.14

DM - Dry matter

CP - Crude protein

SEM - Standard error of mean

Sensory Properties of Broiler Breast Meat Stored on Ice for Different Periods

The results of sensory evaluation are presented in Table 2. There was significant difference ($p < 0.05$) in aroma and tenderness scores among the treatments means, while colour flavour and overall means scores did not differ ($p > 0.05$) significantly across the treatment means. The meat aroma mean score for treatment 1 was significantly higher ($p < 0.05$) than the mean score of treatment 4 but is similar to mean score of treatments 2 and 3. The meat tenderness mean score of treatment 3 is significantly higher ($p < 0.05$) than mean score of treatment 4 but is similar to means scores of treatments 1 and 2. The means scores of meat colour ranges from 6.09 to 7.09. The means scores of meat flavour ranges from 6.27 to 7.64. The means scores of overall ranges from 6.36 to 7.82.

Table 2: Sensory Properties of Broiler Breast Meat Stored on Ice for Different Periods

Treatment	Aroma	Colour	Flavour	Tenderness	Overall
1	8.00 ^a	7.09	7.00	6.45 ^{ab}	7.82
2	7.45 ^{ab}	6.09	7.64	6.73 ^{ab}	7.18
3	7.09 ^{ab}	6.36	6.27	7.64 ^a	7.36
4	6.64 ^b	6.27	6.90	5.91 ^b	6.36
SEM	0.46	0.47	0.51	0.49	0.58

SEM - Standard error of mean

DISCUSSION

The lower score in aroma of meat obtained in treatment 4 might be due to as a result of prolong storage on ice which causes the decline of aroma of meat which affected quality of the meat. This result is line with work by Oliveira *et al.* (2015) who found that the formation of ice crystals during freezing in meat damages the altar structure and concentrates the solutes in the meat which in turn leads to alteration in the biochemical reaction that occur at the cellular level and influence the physical quality parameters of meat (aroma and tenderness).

The difference between tenderness of meat samples might not be as a result of prolong storage on ice because consumer test (affective test) which was assessed by the responded to product may not be the most important attribute for tenderness. This is because sensory evaluation is a subjective analysis and broiler breast meat is generally considered as tender meat depending on the age. The result of this study is similar with the work of Hughes *et al.* (2014) who reported that thawed meat result in less water being available to hydrate the muscle fibre which can increase number of fibre per surface area and the toughness as perceived by sensory panelist. However, when meat is frozen the constituent water expands and crystallises which may increase meat tenderness. The result of this study differs with the work of Lyon and Lyon (1996) who concluded that the formation of large extracellular ice crystals disrupts the physical structure by breaking muscle fibre resulting in tenderization of meat.

CONCLUSION AND RECOMMENDATION

The study concludes that ice-temperature storage for up to three days had no effect on proximate composition but has a significant impact on the aroma and tenderness of broiler breast meat. According to the findings of this study, poultry meat retailers can store broiler breast meat on ice for three days with no effect on the proximate composition, colour, and flavour of broiler breast meat.

REFERENCES

- AOAC, (2007). Association of Official Analytical *Chemists*. Official methods of analysis of the Association of Official Analytical Chemists, 18th Edition, Washinton, D.C; USA.
- Hughes, J. M., Oiseth, K., Purslow, P. and Warner, R. D. (2014). A Structural approach to understanding the interaction between colour water holding capacity and tenderness, *Meat Science*. 98:520 -532.
- Julie, (2013). Prevalence of campylobacteria in the finisher broiler chicken chain from producer to the consumer. *Acta Veterinarian Journal*, 33(6): 651-668.
- Kreuzer, M., Müller, S., Mazzolini, L., Messikommer, R. E. and Gangnat, I. D. (2020). Are dual-purpose and male chickens more resilient against a low-protein-low soybean diet than slow-growing broilers? *British Poultry Science*, 61 (1), 33–42.
- Kroll, B. J. (1990). Evaluating rating scales for sensory testing with children. *Food Technology*, 44(11), 78-86.
- Liu, X. D., Jayasena, D. D., Jung, Y., Jung, S., Kang, B. S. and Heo, K. N. (2012). Differential proteome analysis of breast and thigh muscles between Korean native chickens and commercial broilers. *Asian Australasian Journal of Animal Science*, 25: 895–902.
- Lugano, A., Ceci, E., Lastella, N.M.B., Introna, M. and Tufarelli, V. (2009). Dietary manipulation of muscle long-chain omega-3 and omega-6 fatty acids and sensory properties of lamb meat. *Meat Science*, 60(2): 125-132.
- Lyon, B. G. and Lyon, C. E. (1996). Texture evaluation of cooked diced broiler breast samples by sensory and mechanical method, *Poultry Science*, 75:83-19.
- NOAA (2016). National Oceanic and Atmospheric Administration. “Maiduguri, Nigeria Climate, Global Warning and Daylight Charts and Data”. Climate Charts. Archived from the original on 19 September 2017.
- Oliveira, M. R., Gubert, G., Roman, S. S., Kempka, A. P. and Prestes, R. C. (2015). Meat quality of chicken breast subjected to different thawing methods. *Brazilian Journal of Poultry Science*, 17:165–171.
- Sebranek, J. G. (1982). Use of cryogenics for muscle foods. *Food Technology*, 36(4): 121–127.
- Sharma, H., Mendiratta, S.K., Agrawal, R.K. and Kandeepan, G. (2015). Effect of clove and holy basil essential oil on sensory and microbiological quality of fresh chicken sausages. *Journal of Meat Science and Technology*, 3(4): 37-41.
- SPSS (2012). Statistical Package for Social Scientists. S.P.S.S Base 21.0 User’s Guide, Copyright ©2012. S.P.S.S. Inc., 233 South Wacker Drive, 11th Floor, Chicago, IL USA.