AHC -14

Assessment of Degree of Spoilage of Meat in a Daily Simulated Market Style of Southwest Nigeria

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Abstract
Degree of spoilage and wholesomeness of beef sold at different hours of the day at Oja-Oba market in Akure was investigated. Spoilage was assessed based on the chemical analysis in which Trimethylamine (TMA) level in each of meat samples was measured using standard pictrate technique as described by Muray and Gibson, (1972a and b). The effect of time (hours) on TMA concentration revealed no significantly different at ($p \geq 0.05$) in the spoilage rate of meat, though, the mean value of TMA concentration of liver, meaty, and fatty portion increases as the time (hours) increases. The degree of spoilage is higher in the late evening (9 hours). Therefore, buying and selling of meat in the late evening should be discouraged to reduce the risk of unwholesome meat consumption by the public due to putrefaction which increased TMA recorded in this study indicates.

Keywords: Meat spoilage, Trimethylamine, Market, Nigeria.

Introduction

Meats are important components of the human diet; their nutritive value and palatability are widely appreciated. Despite the relevance of meat in the human diet as well as in the economy of Nigeria, a larger quantity of meats are prone to spoilage which could be as a result of the activity of pathogenic bacteria and fungi and this makes meat unfit for human consumption.

Spoilage of meat is a problem for livestock producers, retailers and consumers. It could lead to food wastage consequently economic losses leading to food insecurity as well as a reduction in the profit of farmers. Trimethylamine (TMA), $(CH_3)_3N$ is a tertiary amine which is gaseous at normal temperature and has a characteristic smell of rotting fish. The TMA content determines the flavor of the meat and it is also an important factor which determines the natural quality of meat (Mohammod *et al.,* 2013). Trimethylamine (TMA) levels are used universally to determine microbial deterioration leading to spoilage of both fish and meat. The amount of TMA produced is a measure of the activity of spoilage bacteria in the flesh, thus it is an indicator of spoilage (Dalgaard *et al.,* 2006). Unfortunately, there is a notable dearth of literature on the degree of spoilage of beef sold at different hours of the day in response to time and ambient temperature at various markets in Akure Ondo State Nigeria.

This present study therefore, seeks to bridge this gap in knowledge.

Materials and methods

This experiment was carried out in the nutrition unit of the Department of Animal Production and Health, Federal University of Technology, Akure, Ondo state, Nigeria. Three samples each of different part of bull (liver, meaty and fatty portion) were purchased twice a week for five weeks from an abattoir in Akure for study in the laboratory. The baseline temperature of the samples were recorded immediately after purchased with a resistance thermometer probe and referred to as the control. The samples were then subjected to ambient temperature and their degree of spoilage was evaluated after 3 hours, 6 hours and 9 hours of purchase. Spoilage was assessed based on the chemical analysis in which Trimethylamine (TMA) level in each of the purchased samples was measured using the standard pictrate technique as described by Muray and Gibson, (1972a and b).

Data collected were subjected to a factorial analysis of the Statistical Analysis System (SAS, 2003) programme. The treatment means where significant ($p<0.05$) were separated using the Duncan's Multiple Range Test of the same software.

Results

Table 1 shows the mean values of TMA concentration ($\mu g\ TMA\ /100g$) of liver, meaty and fatty

tissues of bull at different hours of the day. There was significant difference ($p \leq 0.05$) in the TMA concentration of the liver, meaty and fatty tissues of the bull as the time (hours) increases from 0 – 9 hours with fatty tissues giving the higher mean values of TMA concentration ($\mu g\ TMA\ /100g$) at 3 hour (3.389 ± 0.014^{a}), 6 hour (4.447 ± 0.052^{a}) and 9 hour (8.237 ± 0.046^{a}) of the experiment.

Table 1: Effect of time (hours) on TMA concentration ($\mu g\ TMA\ /100g$) of different parts of bull (Mean ± SD)

Time (hours)	Liver	Meaty portion	Fatty tissue
0 hour	1.948 ± 0.004^{d}	1.894 ± 0.007^{d}	1.795 ± 0.013^{d}
3hours	3.243 ± 0.008^{b}	3.161 ± 0.012^{c}	3.389 ± 0.014^{a}
6hours	4.335 ± 0.007^{b}	4.290 ± 0.008^{c}	4.447 ± 0.052^{a}
9hours	7.767 ± 0.048^{a}	7.173 ± 0.118^{b}	8.237 ± 0.046^{a}

(a-d) = mean values on the same row with different superscript are significantly different ($p<0.05$). SD = Standard Deviation

Table 2 shows the mean values of ambient temperature (^{0}C) of liver, meaty and fatty portion of a bull at different hours of the day. The analysis of variance shows that there was significant difference ($p \leq 0.05$) in ambient temperature (^{0}C) of the liver, meaty and fatty tissues of the bull as the time (hours) increases from 0 – 9 hours with fatty tissues giving the higher mean values of ambient temperature (^{0}C) at 3 hour (34.320 ± 1.361^{a}), 6 hour (36.280 ± 1.222^{a}) and 9 hour (32.691 ± 0.489^{a}) of the experiment.

Table 2: Effect of time (hours) on ambient temperature (^{0}C) of different parts of bull (Mean ± SD)

Time (hours)	Liver	Meaty portion	Fatty tissue
0hour	27.510 ± 0.250^{b}	28.830 ± 0.239^{b}	28.360 ± 0.290^{b}
3hours	32.230 ± 1.072^{b}	31.250 ± 0.883^{c}	34.320 ± 1.361^{a}
6hours	33.790 ± 1.111^{b}	32.400 ± 0.808^{c}	36.280 ± 1.222^{a}
9hours	29.440 ± 0.338^{bc}	29.590 ± 0.368^{bc}	32.691 ± 0.489^{a}

(a-c) = mean values on the same row with different superscript are significantly different ($p<0.05$). SD = Standard Deviation

Discussion

Spoilage of meats as well as their products is a great problem for livestock producers as well as consumers as it makes them unfit for human consumption. Unwholesome consumption of these products poses a great threat to public health. In the present study, the TMA concentration of different parts of bull at different hours of the day were not significantly different ($p \geq 0.05$) from each other, though, the mean value of TMA concentration of different parts of bull (liver, meaty and fatty portion) increases as the time (hours) increases. The mean values of TMA concentration of fatty tissues of bull were slightly lower at the start of the experiment compared to liver and meaty portion from the same animal but at 3 hours, 6 hours, and 9 hours of the experiment the mean values of TMA concentration of fatty tissues were slightly higher than other parts of the bull (liver and meaty portion). This could be due to increase in ambient temperature at this hour of the day which enhances the proliferation of microorganism and hence, the degree of spoilage. This findings indicate that rate of spoilage is faster is higher in fatty tissues than other parts of bull. The increase in TMA level in meat with respect to storage time was also observed by Mohammod *et al.,* (2013).

The activities of microorganisms are largely responsible for spoilage of meat leading to increase in the TMA level in the affected meat. Elevation of ambient temperature enhances the multiplication of putrefactive organisms leading to spoilage. Spoilage bacteria respond to temperature and the extent at which bacteria proliferate depends largely on environmental temperatures which result into spoilage of meat. The assessment of the rate of spoilage of different part of bull by exposure to different ambient temperatures at 3 hours, 6hours, and 9 hours showed that mean values of ambient temperatures of fatty tissues were significantly different at ($p \leq 0.05$) than other parts such as and meaty portion. This indicates that degree of spoilage is higher in fatty tissues than other parts of bull, as a result, fatty tissues spoil faster when compared with others due to increase in ambient temperature which corroborates the growth of putrefactive organisms. This finding is in compliance

with the study of zeev *et al.,* (2002) who reported that muscle food with high level of fatty tissues had elevated TMA level, even when they were fresh.

This experiment is relevant to this study environment because the marketing of beef is done under unmanipulated tropical temperature which enhances the growth of natural mesophilic microorganisms on meat. This assessment of beef in response to daily ambient temperature enables the understanding of the gradual spoilage of the fresh meat which in turn provide useful information for marketing and distribution of meat in the tropical environment.

Conclusion and Recommendation

Based on the results of this experiment, it can be concluded that the degree of spoilage is higher in the late evening (9 hours after slaughtering). It is therefore recommended that buying and selling of meat in the late evening should be discouraged to reduce the risk of unwholesome meat consumption by the public due to decay/putrefaction which increased TMA recorded in this study indicates. Putrefaction is an indicator of microbial presence. Consumers should endeavor to purchase meat within a short time after slaughtering process to prevent the consumption of unhygienic meat, especially where storage facility is in doubt. Butchers should be enlightened via extension services on hygienic handling of meat to avert multiplication of bacteria.

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