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Research Article

PRESERVING QUALITY: INVESTIGATING THE OXIDATIVE STABILITY OF CANNED SAUSAGE FROM SAMAWAH CITY- IRAQ

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Abstract

The rise of industrialization has led to increased in consumption of the meat-based diets, including processed meat products. Lipids in food provide important characteristic such as aroma, taste and texture, but they were also highly vulnerable to oxidation, which can cause changes in nutritional value, unpleasant taste and aroma, and reduce shelf-life. meat products, lipid oxidation is significant issue that persists during post-mortem periods, processing and storage, Various natural compound, like phenolic compound, ascorbic acid, tocopherol, and carotenoid, had antioxidant properties that can help mitigate the effects of lipid oxidation. Malondialdehyde (MDA) is a chemical compound formed through the oxidation of lipids that can pose health hazards to humans. pH changes in meat products can impact and alter various aspects of meat quality, including changes in protein solubility, conformation, and stability. During frozen of the food, changes in salts concentrations and compositions can cause pH changing that can ultimately impact the functional and structural properties of proteins in frozen foods. Understanding the effects of pH changes during freezing is important for developing effective freezing processes and maintaining the quality of the frozen foods. the study aimed to investigated that the TBARS value and pH level of canned sausages from Samawah city. The results revealed that the TBARS value of beef sausage was 0.3682±0.18, while that of chicken sausage was 1.6322±0.78. These findings indicate that chicken sausage is more susceptible to lipid oxidation than beef sausages. Additionally, pH value of beef sausage was 5.78±0.19, while that of chicken sausage was 6.302±0.05. The observed difference in pH levels suggests that chicken sausage may be more alkaline than beef sausage.

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1. Introduction

The rise of industrialization on a global scale had led to increase in the consumptions of meat-based diets, which also includes processed meat products. This trend has been observed across various regions, driven by several factors such as increased urbanization, changes in lifestyle, and improvements in the distribution and availability of food products (You *et al.*, 2020).

Meat is valuable sources of dietary proteins that contain high level of essential amino acid, including histidine, lysine, and methionine (Argel *et al.*, 2020). Foods that contain a lot of lipids are highly vulnerable to oxidation, particularly if they are kept in presence of lights, oxygen, moistures, and high temperature (McClements and Decker 2000). Lipids not only add nutritional value to food, but also provide important characteristic such as a texture, softness,

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aroma, and taste which are valued by consumers and are essential fora healthy diets (Mariutti and Bragagnolo, 2017) The oxidation of lipids can affect the chemical composition and concentrations of certain compound in food, leading to changes in nutritional values and causing that loss of fat-soluble vitamin and sensory properties. This can result in the formation of unpleasant aroma and tastes, and can reduced the shelf-life of the food. In meat product, lipid oxidations is significant issue as it begins after slaughter and continues as long as there are fatty acid present, persisting through post-mortem periods, processing and storage (Mariutti and Bragagnolo, 2017).

Various cultures include sausages in their diets, and the sausages are made by dispersing meat and fat in a mixture of ice and water, which creates a stable matrix when heated moderately. Hot dog sausages, for instance, can be pasteurized and vacuum-sealed for 30 - 90 days under refrigeration until they are cooked and consumed. The longevity of these products is generally determined by factors such as microbial growth, surface dryness, alterations in texture, and color and the developments of unwanted rancid flavor brought on by lipid oxidations, lipolysis, and other chemical reaction (Valencia *et al.,* 2007). Numerous natural compounds have been found to have antioxidant properties. Tocopherol Ascorbic acid, certain phenolic compounds, and carotenoids have been extensively studies in a various food matrices, including meats product (Georgantelis *et al.,* 2007). Chemical compound that are formed through oxidations of lipid like Malondialdehydes (MDA) pose health hazards to humans, as they have been associated with carcinogenes, atherosclerosis, mutagenesis, neurodegenerative diseases (like Alzheimer's diseases and Parkinson's diseases), and chronic inflammatory disease (Teasdale *et al.,* 2002). pH. changes in meats product have been extensively studies, as pH was considered an intrinsic factor that can impacts and alter various aspect of meat quality (Pellissery *et al.,* 2020). During the freezing of food, pH of frozen food can changes due to the concentrations of solutes increasing, which results in the formation of ice and precipitation of a salts at a supersaturated level. This change in a salt concentrations and compositions can cause a pH change in frozen foods, which can affect the reactivity of protein. Changes in pH can lead to changes in protein solubility, conformation, and stability, which can ultimately impact the functional and structural properties of proteins in frozen foods. Therefore, understanding the effects of pH changes during freezing is important for developing effective freezing processes and maintaining the quality of frozen foods (Şayin Sert *et al.*, 2022).

2. Material and Method

Sample collections

Total of fifty samples of canned sausages (beef and chicken) were collected from different supermarkets in the city of Samawah. The samples were randomly selected and purchased within a week to ensure that they were fresh and representative of the market.

Determination of Lipids Oxidation

Extent of lipids oxidations in canned sausages were determined by measured the levels of TBARS. Thiobarbituric acid reactive substance TBARS values were measure used the methods (Witte *et al.*, 1970). To homogenizes the samples, 20 grams were mixed with a cold solutions of 20 % Trichloroacetic acids (TCA) in 2 M aphosphoric acids, in (50 ml) volume, for 2 minutes. Afterwards, (50 ml) of distilled water which added and mixtures was homogenize for another minute. slurry was filtered using Whatman no1 filter paper into 100 ml flask, and the volume were made up to (100 ml) using a 1:1 mixtures of TCA and distill water. From this mixtures, 5 ml of the filtrates was transfers into test tube, and 5 ml of chilled TBA (0.02 M in distilled water) were added. The tubes were incubated at 80 °C for 30 minutes and then cooled to room temperatures. The absorbance of solution was measure at 532 nm using a Spectrophotometers, and compared against a blank solution prepared with 1:1 TCA-distilled water. TBARS value (mg malonaldehyde

/kg sample) were expressed by multiplying the absorbance by 5.2. According to the Follows formula:

$$TBARS\ (mgMDA/\ kg) = A532/\ Ws * 9.48$$

*A*532 = absorbances of the solutions, *Ws*= sausage weight (g), and 9.48 =constant (Sun et al., 2019).

pH measurement

Using an electronic pH meter (pen type-china) is a common laboratory technique employed for the determination of pH values in various samples. Prior to measuring the pH, it is essential to prepare the samples appropriately to ensure accurate results. The preparation of the samples may involve dilution, filtration, or any other necessary treatment. Once the samples have been properly prepared, the pH meter is calibrated using standard buffer solutions to ensure accuracy and precision. The pH meter probe is then inserted into the sample, and the pH value is measured.

3. Result and discussion

TBARS value of sausage (beef and chicken)

The results depicted in (Table – 1; Figure - 1) demonstrate clear and statistically significant differences in the lipids oxidative of beef and chicken sausage. The mean lipids oxidative of beef sausage (0.3682) was notably lower than that of chicken sausage (1.6322), indicating a higher resistance to lipid oxidation in beef sausage. This finding is particularly noteworthy given the importance of oxidative stability in meat products, as oxidation can lead to flavor degradation and potentially harmful changes in the nutritional profile of the product. This finding is particularly noteworthy in the context of meat product quality, as oxidative stability is a critical factor that can impact sensory attributes, nutritional composition, and shelf life. The differential oxidative stability observed between beef and chicken sausage may have implications for product development and marketing strategies in the meat industry.

Table – 1: TBARS value of sausage beef and chicken

Type	No.	TBARs (MDA/kg)
Beef sausage	25	0.3682±0.18
Chicken sausage	25	1.6322±0.78

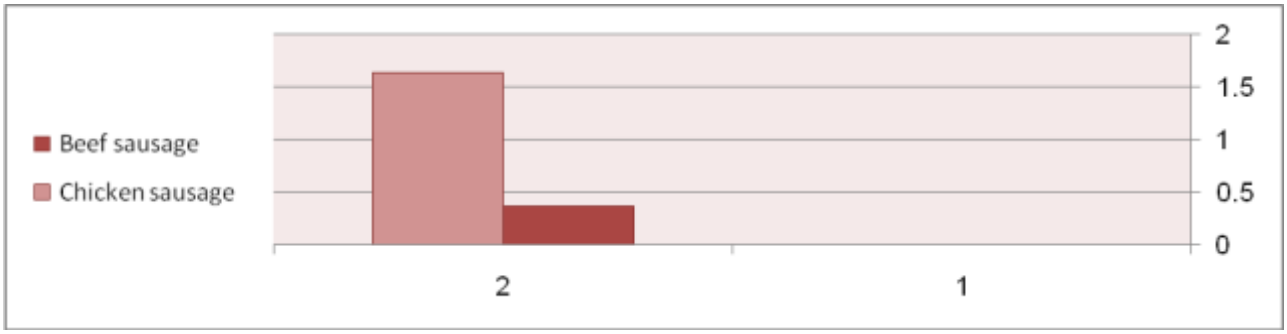

Figure – 1: Different between beef and chicken in TBARS value

Chemical compounds that are produced by oxidations of lipid can pose risk to humans health, as these compound have been associated with a carcinogenesis, mutagenesis, atherosclerosis, neurodegenerative disorder (like Alzheimer's and Parkinson's diseases), and chronic inflammatory diseases (Andrade *et al.,* 2019). The process of oxidation is a significant contributor to degradation of quality in meat product over time. this can result in several undesirable outcomes, such as changes in flavor, loss of essential nutrients, discoloration, and in some cases, the formation of toxic compounds (Kong *et al.,* 2010). As the storage time of meat increases, the TBARS

value tends to increase as well. This is often attributed to lipid oxidation, which is a chemical process that occurs in meat when it is exposed to oxygen. The oxidation of lipids may lead to the productions of Reactive oxygen species (ROS), which can cause oxidative damage to meat and results in an increase in TBARS value (Hong *et al.,* 2013). The results of the study disagree with Sabrine *et al.* (2020) and Sun *et al.* (2019). They noted that there were increased in TBARS value during storage. The chicken breast sausage had an initial (TBARS) value of 0.064 mg MDA/kg (Jouki *et al.,* 2020). Foods that contains high levels of lipids are highly prone to oxidations, particularly when they were storage in presence of light, moisture, oxygen and elevated temperature (McClements *et al.*, 2000).

pH value of sausage (beef and chicken)

Physical quality of the meats is a parameter that includes several characteristics, one of which is pH values. pH values is an important physical characteristics that was used to the assess quality of the meats and meat products. pH values of sausages produce from different types of meats were found to be significantly different. The Table - 2 and Figure - 2 presents the results of a comparative analysis between beef sausage and chicken sausage in terms of pH value. The analysis revealed statistically significant difference between two types of sausages, with chicken sausage exhibiting a significantly higher pH value compared to the beef sausage.

Table – 2: pH value of Sausage (Beef and Chicken)

Type	No.	pH value
Beef sausage	25	5.78±0.19
Chicken sausage	25	6.302±0.05

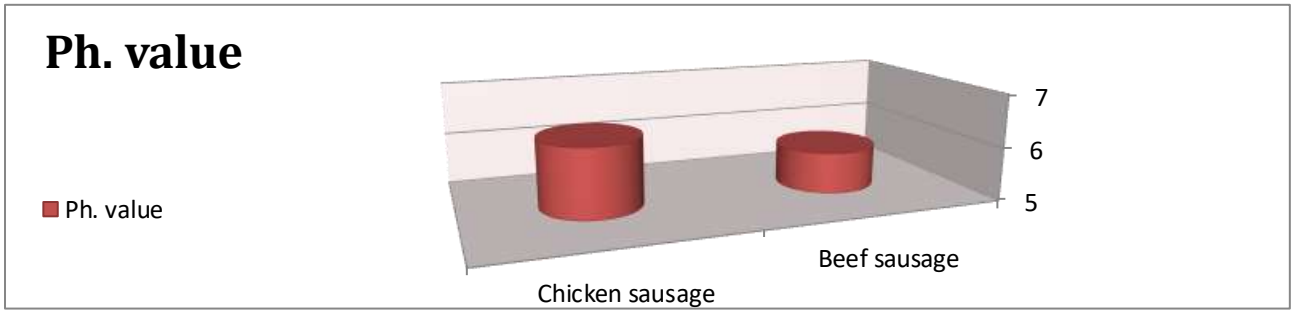

Figure – 2: Different between beef and chicken in ph. value

The pH value of sausage is a fundamental physicochemical parameter that plays a crucial role in determining its overall quality and shelf life. As a professional in the food industry, understanding and monitoring pH values of sausage was essential to ensuring the safety, freshness, and palatability of this popular delicacy (Ullah *et al.,* 2012). Physical qualities of the sausage were one of the variables used to evaluate the quality of sausages product that was tested objectively (Prayitno *et al.*, 2022).

Result of the study agreed with Saleh *et al.* (2021) who observed pH values of the same group was not affected by freezing during the storage week. The obtains results disagree with the El-Nashi *et al.,* (2015). It was discovered there were no significant in the pH values of various prepared beef sausages sample. The result of study disagree with (Prayitno *et al.,* 2022) they shown that pH value of beef sausage produce range from 6.38 - 8.93. The results agree with Xiong *et al.* (2022) and they noted that controls samples, particularly maintained a much more stable pH over the 20 days storages periods.

The acidity level in stored meat products is strongly influenced by the growth of microorganisms, particularly acid-producing bacteria like lactic acid bacteria, which can lead to

a decreased in initial pH (Jin *et al.,* 2021). The quality of meat product can be significantly impacted by ph. level of meat batter. The addition of alkaline phosphate can raise the pH level of the meat batter, which was a crucial factor to consider in maintaining the desired quality of final products (O'Flynn *et al.,* 2018). When the pH level of meat batter rises, it causes the myofibrillar protein to become more negatively charged, which leads to an increase in the repulsive forces between the proteins (Jo and Jung 2018).

4. Conclusion

In summary, the result of study suggested that there are a significant difference in both oxidative stability and pH values of beef and chicken sausage. The beef sausage exhibited a higher resistance to lipid oxidation compared to the chicken sausage, which is important for maintaining sensory attributes, nutritional composition, and the shelf-life of products. Additionally, the pH values of the sausages were significantly different, with the chicken sausage exhibiting a significantly higher pH value compared to the beef sausage. These findings may have implications for product development and marketing strategies in the meat industry, as understanding the factors that influence meat product quality can help inform the development of strategies to enhance product shelf life and consumer satisfaction. Overall, these findings provide valuable information for the meat industry to consider when developing and marketing their products.

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