

Role of Nisin in Improving the Characteristics and Prolonging the Shelf Life of Frozen Minced Chicken Meat

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ABSTRACT

This study was aimed to investigate the role of adding nisin in improving the quality characteristics and prolonging the storage life of frozen broiler meat, while 0.01% of industrial antioxidant (BHA) was added to the fifth treatment, then samples were stored minced meat for a period of 0, 15 and 30 days by freezing at a temperature of meat, as it was added at amount of 0, 155, 150 and 160 mg / kg of meat to the four temperature -18 °C, the physical changes, indicators of fat oxidation and microbial characteristics were studied. The results showed: The addition of nisin contributed to a significant ($P < 0.01$) increase in pH and water retention capacity (WHC) while it decreased significantly in cooking loss percent, thaw loss percent, values of thiobarbituric acid (TBA) peroxide number (PV) and the percentage of free fatty acids (FFA). Also significantly reduced the total bacterial count, psychrophilic count and coliform bacteria in minced chicken meat during storage periods in frozen.

Key words: meat quality, microbial and physical traits, nisin.



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INTRODUCTION

The poultry industry is one of the main pillars of many countries' economies due to the importance of its products in nutrition. However, the chemical and biological nature of poultry meat makes it susceptible to oxidative spoilage during storage, resulting in undesirable odors and flavors. This is because the fat content of poultry meat contains relatively high levels of polyunsaturated fatty acids and low levels of natural antioxidants, which reduce its shelf life (Yolmeh et al., 2014). Additionally, poultry meat serves as a suitable nutritional medium for the growth and proliferation of microorganisms, which produce compounds that cause spoilage and food poisoning, leading to economic losses (Andres et al., 2014). The need for researchers to find new methods to improve the quality characteristics and inhibit microbial spoilage of meat products (Amaral et al., 2018) has led to the use of antioxidants (Ali et al., 2024) to counteract the negative effects of fat oxidation

in meat. Antioxidants work by donating hydrogen atoms (H^+) to scavenge free radicals, thereby preventing and delaying oxidation and rancidity of fats without causing any significant changes in the nutritional value of meat, thus extending its shelf life (Kumar et al., 2015). They also inhibit the activity of enzymes involved in the vital processes of bacterial cells (Zeliha et al., 2016). One of these additives is nisin, which is a type of bacteriocin used as an antimicrobial agent. It is produced by specific strains of *Lactococcus* bacteria and is a cyclic peptide composed of 34 amino acids. Nisin is widely used worldwide to preserve meats and canned foods and is recognized by the U.S. Food and Drug Administration (FDA) (Millette et al., 2007) veterinary, pharmaceutical, and health care products (Luciana et al., 2009). Nisin can be obtained by culturing *Lactococcus lactis* bacteria on natural substances such as milk or dextrose and is not chemically synthesized (Ramith et al., 2015). Jia et al., (2021) have

indicated the possibility of using nisin as an inhibitor of fat oxidation when used at a concentration of 0.500 g/kg or 0.075 g/kg of potassium sorbate for minced meat stored under refrigeration for 12 hours to extend the shelf life of the meat and reduce the loss of nutritional value and improved meat quality characteristics (Al-Rubeii et al.,2022). Considering consumers' desire to obtain poultry meat that maintains its quality characteristics, this study was conducted to determine the effect of adding different concentrations of nisin on extending the shelf life of frozen chicken meat.

MATERIALS AND METHODS

Preparing treatments sample

This study was conducted in the Meat Science and Technology laboratory for postgraduate students at University of Baghdad , college of agricultural engineering sciences in the year 2021 , as Ross308 broiler carcasses were obtained from the poultry field of the Department of Animal Production, where physical separation was performed the skin and bones were removed for the main pieces, then the meat was cut into cubes Small and chopped mechanically using a meat grinder with a hole diameter of 8 mm . Vegetal Nisin powder was obtained from one of the scientific offices in Abu Nuwas, produced by the Handary Company used in food laboratories 47% purity in a box containing 500 grams of nisin, and it was added directly to the meat of the four treatments in amounts of 0, 150, 155, and 160 mg. /kg of meat weight, amounting to 3 kg for one treatment, while 0.01% of the synthetic antioxidant BHA (Butylated Hydroxy Anisole) was added for the fifth treatment , then the mixture was mixed manually using sterile medical gloves for the purpose of homogeneity well with the meat for each treatment separately, and then the process was completed Preservation in polyethylene bags inside the freezer at a temperature of -18°C for 0, 15 and 30 days.

Quality and microbial characteristics

The pH and water holding capacity was estimated according based on the method of (Verma et al.,2008) and the percentage of cooking , thaw loss , using the method (Alvarado and Sams ,2002) and the number of

thiobarbituric acid (TBA) based on what was mentioned by Balentine et al. (Balentine et al.,2006) and the value of the PV (Peroxide Value) and the percentage of volatile fatty acids FFA (Free Fatty Acid) based on the method of (A.O.A.C. ,2016) and the total bacteria and Psychrophiles count on Nutrient Agar culture media and Coliform bacteria on MacCoky Agar culture media were estimated using the Pour-Plate Method and incubation at 37 °C for a period of 2 days for total bacteria and coliform bacteria at 7 C for a period of 7 days for Psychrophiles bacteria according to the method mentioned in (Roberts and Greenwood ,2003) .The statistical analysis was conducted using the statistical program (SAS,2018) and applied a complete random design (CRD) to analyze the effect of different treatments and storage periods on the studied traits and the significant differences between the mean treatments were estimated using Duncan (1955) multi-level test at the level of 0.01 and 0.05.

RESULTS AND DISCUSSION

Table (1) refer the effect of adding nisin and the synthetic antioxidant BHA on some physical properties of minced and frozen chicken meat. It can be observed that treatment T4 achieved a highly significant superiority ($P<0.01$) at day 0 compared to the control treatment, while treatments T2 and T5 followed with a significant effect compared to treatment T3, which showed significant superiority over treatments T1, T2, and T5. Treatment T4 (160 mg/kg meat) continued to exhibit significant superiority ($P<0.05$) compared to the control treatment (T1), with values of 5.67 and 5.50, respectively. Treatment T3 (155 mg/kg meat) showed similar effects to treatments T2 and T5 and did not differ significantly from the control treatment during the 15-day storage period. However, no significant differences were observed between the addition treatments and the control treatment in the pH values of the meat after 30 days of storage. The increase in pH values in favor of the addition treatments of nisin and synthetic antioxidant throughout the storage periods can be attributed to the chemical nature of nisin. It is a peptide composed of 34 amino acids that acts as salts,

contributing to the increase of new negative charges that interact with water and enhance the moisture content of the meat. Consequently, the solubility and dispersion of proteins improve (Sebranek ,2009). From the data in the table, it can be observed that there was a significant increase ($P<0.05$) in water-holding capacity (WHC) for treatments T3 (150 mg/kg) and T4 (155 mg/kg) compared to the control treatment (no addition), with values of 38.38% and 38.90%, respectively, compared to 32.25%. Similarly, treatment T2 (150 mg/kg) and T5 (0.01% BHA) showed similar effects and did not differ significantly

from each other or the control treatment at day 0. However, there were no significant differences among all the addition treatments (T2, T3, T4, and T5) and the control treatment (T1) at day 15. Treatment T4 showed a highly significant superiority ($P<0.01$) in WHC compared to the control treatment, with values of 34.28% and 29.12%, respectively. Treatment T3 (31.90%) did not differ significantly from treatment T2 and did not differ significantly from the control treatment (T1), while treatment T5 did not show a significant superiority over the control treatment at day 30 of storage.

Table 1. Effect of nisin and synthetic antioxidant (BHA) addition on the physical properties of minced and frozen chicken meat

Traits	Treatments	Storage period (days)		
		0	15	30
PH	T1	±0.01 c5.62	±0.04 b5.50	±0.335.07
	T2	±0.02 c5.67	±0.01 b5.56	±0.025.54
	T3	±0.01 b5.72	5.59±0.01 ab	±0.015.57
	T4	±0.01 a5.77	±0.04a5.67	±0.15.57
	T5	±0.01 c5.65	±0.04 b5.52	±0.015.43
Level of significant		**	*	Ns
WHC (%)	T1	±1.14 b32.25	±0.3931.18	±0.31cd29.12
	T2	±0.16 ab34.02	±0.4531.84	±0.65 bc31.45
	T3	±0.25 a38.38	±1.3133.01	±1.11 a31.90
	T4	±0.33 a38.90	±2.3035.63	±0.95 a34.28
	T5	±2.29 ab34.20	±1.2431.33	±0.51 d27.30
Level of significant		*	NS	**
Cooking Loss (%)	T1	±0.78 a32.51	±0.33 a32.39	±0.25 a30.94
	T2	±1.09 a31.79	±0.33 a31.05	±1.47 b25.77
	T3	27.49±1.30 b	±0.51 b24.47	±1.19 c22.32
	T4	±1.19 b26.80	±1.82 b23.83	±0.54 c19.42
	T5	±0.04 a31.41	32.29±0.21	±1.30 c18.84
Level of significant		**	**	**
Thaw Loss (%)	T1	±0.02 a2.49	±0.40 a3.97	±0.28 a4.55
	T2	±0.07 c1.19	±0.04 c1.48	±0.12 b2.84
	T3	±0.02 d0.92	±0.03 c1.45	±0.02 b2.56
	T4	±0.02 d0.85	±0.03 c1.24	±0.01 c1.94
	T5	±0.09 b1.49	±0.05 b2.16	±0.02 b2.74
Level of significant		**	**	**

Treatment : T1 without any addition (control), T2 addition of nisin by 150 mg/kg of meat, T3 addition of nisin by 155 mg/kg of meat, T4 by addition of nisin by 160 mg/kg of meat, T5 by addition of BHA by 0.01% . The different letters within the same column indicate significant differences between the means of the treatments within the same storage period . * indicates a significant difference at the ($P<0.05$) level ** indicates a significant difference at the ($P<0.01$) level, and NS: indicates no significant difference.

The improvement in water-holding capacity (WHC) for the treatments with added nisin may be attributed to the increased pH value, which enhances protein solubility and improves water binding. The nisin used is a food-grade product with a purity of 47%, and

the remaining 50% is salt added to meat and its products, which helps retain water associated with meat proteins, leading to increased water-holding capacity (Jia et al.,2021). The decrease in water-holding capacity during storage may be due to tissue

shrinkage caused by moisture loss during thawing (Al-Rubeii, 2006). Regarding cooking loss, it can be observed from the data in Table 1 that there was a significant decrease ($P<0.01$) in cooking loss for the chicken meat at day 0 and 15 for treatments T3 and T4 compared to the control treatment (T1), with values of 27.49% and 26.80%, respectively, compared to 32.51% at day 0, and 24.47% and 23.83%, respectively, compared to 32.39% at day 15. Treatment T2 and T5 did not differ significantly from each other or the control treatment at both time points. At day 30 of storage, a significant decrease in cooking loss was observed for treatments T3, T4, and T5 compared to the control treatment (T1) and T2, with values of 22.32%, 19.42%, and 18.84%, respectively, compared to 30.94% and 25.77%. The decrease in cooking loss for the addition treatments may be attributed to the increased pH value, which increases water binding and retention, resulting in reduced weight loss during cooking (Al-Safi and Zangana, 2022). The decrease in cooking loss with extended storage time may be due to evaporation of moisture from the meat surface during thawing, as well as the contribution of protein-degrading enzymes to breaking the bonds between protein and water, leading to loss (Muhammed, 2018). Regarding the percentage of loss during thawing, the data in Table (1) shows a significant decrease in this trait for the treatment of adding nisin (T4) compared to the control treatment and treatment T5, with values of 1.94% compared to 4.55% and 4.74%, respectively. This was followed by treatments T2 and T3, with values of 2.84% and 2.56%, respectively, on day 0. A significant decrease was also observed in favor of the nisin addition treatments (T2, T3, and T4) compared to the control treatment (T1) (3.97%) and BHA addition treatment (T5) (2.16%) on day 15 of storage. Similarly, a significant decrease was observed for treatments T3 and T4 compared to the control treatment, with values of 0.92% and 0.85% compared to 2.49%, respectively, followed by treatment T2 (1.19%) and treatment T5 (1.49%) on day 30 of storage. The decrease in the percentage of loss during thawing may be attributed to the increased moisture content,

which improves the meat's water-holding capacity and reduces the loss during freezing storage for different periods (Muhammed , 2018). Table (2) refer the effect of adding nisin and the synthetic antioxidant (BHA) on Thiobarbituric Acid (TBA) value, Peroxide value (PV), and Free Fatty Acid (FFA) percentage in minced frozen chicken meat. A highly significant decrease ($P<0.01$) was observed in the value of TBA for the T4 treatment compared to the control treatment, with values of 0.85 compared to 1.49 mg malondialdehyde/kg meat. This was followed by the T3 treatment, which did not differ significantly from the T2 treatment, followed by the T5 treatment on day 0. The T4 treatment continued to show a significant decrease ($P<0.05$) in the 15-day storage period compared to the T5 and T1 treatments, while the T2 and T3 treatments did not differ significantly from each other or the other treatments. In the 30-day storage period, a highly significant decrease ($P<0.01$) was observed for treatments T3 and T4 compared to the control treatment, as well as treatments T2 and T5, which did not differ significantly from each other. The decrease in TBA value may be attributed to the role of nisin and the synthetic antioxidant as preservatives, which contribute to extending the shelf life of meat and reducing nutritional loss. This is similar to the case of adding oils and powders of some medicinal herbs to meat, which are natural antioxidants with high efficacy in preventing fat oxidation and achieving lower values of TBA and PV (Chrpova' et al.,2010). The increase in TBA value with longer storage periods may be due to the occurrence of lipid oxidation processes, which is a suitable and clear indicator of oxidative rancidity due to the action of enzymes that hydrolyze fats, resulting in the production of ketones and aldehydes (Al-Rubeii et al.,2022). It appears that all the addition treatments did not exceed the maximum allowable limit for malonaldehyde values (2 mg malonaldehyde/kg meat) according to FSIS (Chrpova' et al., 2010). Regarding the peroxide value (Pv), Table (2) shows a significant decrease ($P<0.01$) in the value of this parameter in favor of treatment T4 compared to the control

treatment, with values of 0.58 compared to 0.95 milliequivalents/kg meat, followed by treatment T3, which did not differ significantly from treatment T2, and then treatment T5 at day 0. Treatment T4 continued to exhibit a significant decrease during the 15day storage period compared to the control treatment, with values of 9.61 compared to 1.26 milliequivalents/kg meat, respectively. Treatment T3 did not differ significantly from treatment T2 during this period, and there was no significant difference between treatments T2 and T3. Treatment T4 also continued to show a significant decrease during the 30 day storage period compared to the control treatment, with values of 0.62 compared to 1.97 milliequivalents/kg meat, followed by treatment T3, which did not differ significantly from treatment T2, and treatment T5 (0.01% BHA) did not differ significantly from treatment T2 either. The increase in peroxide value with prolonged storage period is an indicator of lipid oxidation, and the addition of different levels of nisin has maintained the quality of frozen chicken meat, thereby increasing its shelf life. All addition treatments did not exceed the maximum allowable limit (10 milliequivalents/kg meat) according to FSIS (2000). Regarding the levels of free fatty acids (FFA), Table 2 also shows no significant differences between all the nisin and BHA addition treatments and the control treatment, despite their decrease in the 0 day period. Additionally, a significant decrease ($P<0.01$) in the value of this parameter was observed in favor of treatment T4 compared to the control treatment and treatment T5, with values of 0.23% compared to 0.57% and 0.51%, respectively. Treatment T3 did not differ significantly from treatment T2, and there was

no significant difference between treatments T2 and T3 during the 15day storage period. Treatment T4 continued to show a significant decrease during the 30 day storage period compared to the control treatment and treatment T5, with values of 0.25% compared to 0.61% and 0.57%, respectively. Treatment T4 also did not differ significantly from treatment T2, and treatment T3 did not differ significantly from treatment T2 either, and there was no significant difference between treatment T3 and treatment T5. The decrease in the percentage of free fatty acids may be due to the effect of nisin and the synthetic antioxidant in breaking the oxidative reactions chain . On the other hand, the increase in the percentage of free fatty acids with prolonged storage period may be attributed to the increased activity of fat-degrading enzymes such as lipolytic enzymes, lipase, and phospholipase produced by bacteria that degrade fats. This enzymatic activity leads to the hydrolysis of triglycerides and the release of free fatty acids, contributing to the formation of undesirable odors and the deterioration of meat flavor as the storage period increases, as indicated by some studies (Al-Rubeii ,2009). None of the addition treatments exceeded the allowed limit of free fatty acid percentage (1.5%) according to the Iraqi Central Organization for Standardization and Quality Control (2006). Previous studies by Mula and Al-Rubeii (2023) indicated that the addition of different treatments of nisin, potassium sorbate, and sodium lactate to refrigerated minced beef contributed to a significant increase in pH value and a decrease in peroxide value and free fatty acid percentages compared to the control treatment .

Table 2. shows the effect of adding nisin and the synthetic antioxidant (BHA) on the thiobarbituric acid (TBA) value, peroxide value (PV), and free fatty acid (FFA) percentage of frozen minced chicken meat

Traits	Treatments ⁽¹⁾	Storage period (days)		
		0	15	30
TBA (Mg of malonaldehyde /kg meat)	T1	a0.02 1.49±	0.04 a±1.57	0.02 a1.66±
	T2	0.04c±1.02	0.11 ab1.35±	0.05 a1.51±
	T3	0.01 cd0.94±	0.02 ab1.23±	0.07 b1.23±
	T4	0.03 d0.85±	0.24 a0.95±	0.06 b1.17±
	T5	0.07 b1.35±	0.04g1.48±	0.04 a1.56±
Level of significant		**	*	**
POV (mequivalent/kg meat)	T1	0.01 a0.95±	0.02 a1.26±	0.03 a±1.97
	T2	0.01c0.68±	0.10 c0.78±	0.01 bc0.91±
	T3	0.03 cd0.61±	0.01 cd0.65±	0.10 cd0.77±
	T4	0.04 d0.58±	0.02 d0.61±	0.01 d0.62±
	T5	0.02 b 0.85±	0.02 b0.94±	0.03 b0.95±
Level of significant		**	**	**
FFA(%)	T1	0.060.32±	0.01 a0.57±	0.01 a0.61±
	T2	0.31±0.08	0.06 b0.35±	0.02 bc0.46±
	T3	0.22±0.02	0.03 bc0.24±	0.04 cd0.38±
	T4	0.21±0.02	0.02 c0.23±	0.01 d0.25±
	T5	0.31±0.07	0.01 a0.51±	0.09 ab0.57±
Level of significant		NS	**	**

Treatment :T1 without any addition (control), T2 addition of nisin by 150 mg/kg of meat, T3 addition of nisin by 155 mg/kg of meat, T4 by addition of nisin by 160 mg/kg of meat, T5 by addition of BHA by 0.01% , The different letters within the same column indicate significant differences between the means of the treatments within the same storage period . * indicates a significant difference at the (P<0.05) level ** indicates a significant difference at the (P<0.01) level , NS indicates no significant difference.

Figure (1) shows the effect of adding nisin and the synthetic antioxidant (BHA) on the total bacterial count of frozen minced chicken meat. A significant decrease (P<0.05) was observed for treatments T3 and T4 compared to the control treatment, with values of 4.06 and 3.64 log CFU/g of meat, respectively, compared to 6.48 log CFU/g for the control treatment, followed by treatments T2 and T5 at day 0. Treatments T3 and T4 continued to show a significant decrease (P<0.01) compared to the control treatment, with values of 2.35 and 2.16 log CFU/g of meat, respectively, compared to 3.63 log CFU/g for the control treatment,

followed by treatment T2, which did not differ significantly from treatment T5 and showed no significant difference between treatments T2 and T3 during the 15 day storage period. Furthermore, there was no significant difference between treatment T3 and treatment T5. Treatments T3 and T4 continued to show a significant decrease (P<0.01) in total bacterial count compared to the control treatment and the synthetic antioxidant treatment, with values of 1.18 and 1.17 log CFU/g of meat, respectively, compared to 2.11 and 1.39 log CFU/g, respectively, during the 30 day storage period.

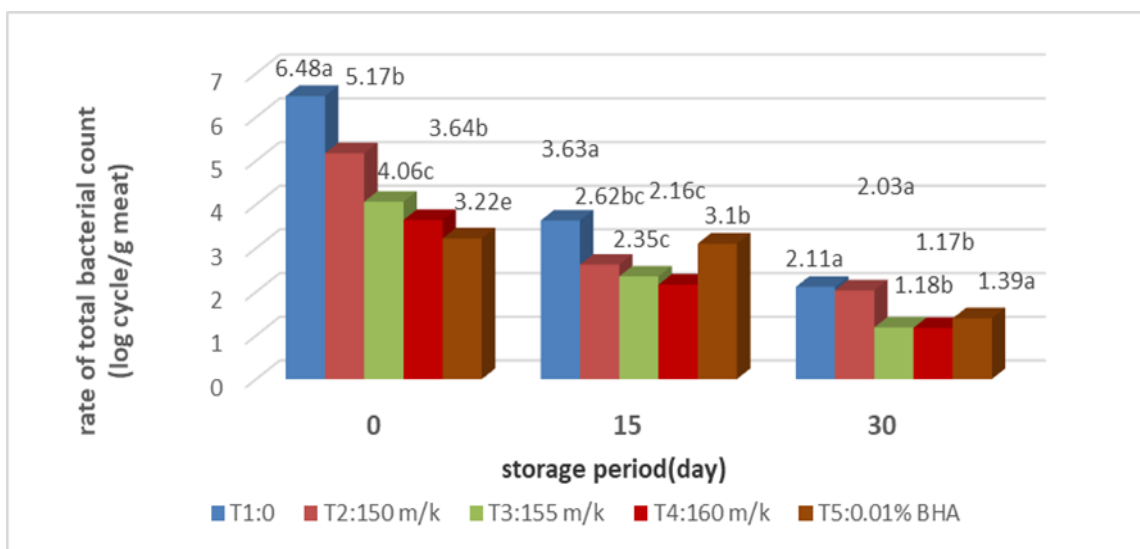


Figure 1. shows the effect of adding nisin and the synthetic antioxidant (BHA) on the total bacterial count of frozen minced chicken meat

Figure (2) refer the effect of the addition of nisin and the industrial antioxidant (BHA) on the rate of Psychrophiles bacterial numbers of minced and frozen chicken meat, as decreased significantly for treatment T5 compared to the control treatment, with values of 3.02 log CFU/g of meat compared to 5.84 log CFU/g, followed by the effect of nisin addition in treatment T4, which did not differ significantly from treatment T3, and the latter did not differ from treatment T2 at day 0. Additionally, a significant decrease ($P < 0.05$) was observed for treatment T4 compared to the control

treatment, with values of 0.92 log CFU/g compared to 1.89 log CFU/g, and similar values were observed for treatments T2, T3, and T5, which did not differ significantly from each other or from the control treatment during the 15 day storage period. Furthermore, the nisin addition treatments continued to show a significant decrease ($P < 0.01$) compared to the control treatment and the BHA addition treatment (T5), with values of 0.08, 0.08, and 0.07 log CFU/g, respectively, compared to 1.08 and 0.78 log CFU/g, respectively, after 30 days of storage for the meat.

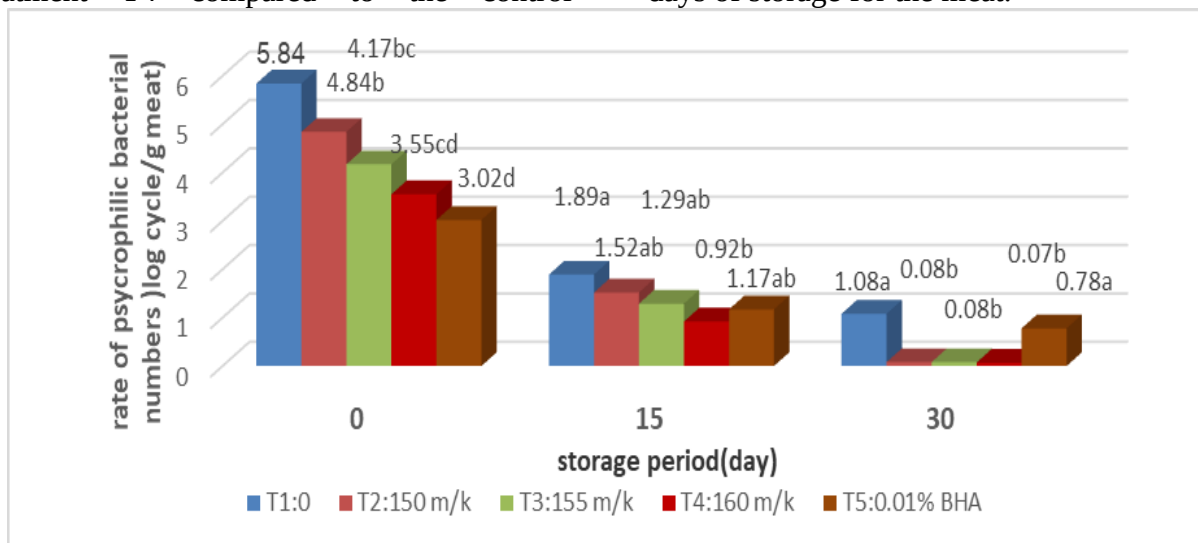


Figure 2. shows the effect of adding nisin and the synthetic antioxidant (BHA) on the total Psychrophiles count of frozen minced chicken meat

Figure (3) shows the effect of adding nisin and the synthetic antioxidant (BHA) on the total coliform count of frozen minced chicken meat.

A significant decrease ($P < 0.01$) was observed for treatment T4 compared to the control treatment, which recorded the highest value

(4.78 log CFU/g of meat). Treatment T4 showed similar effects to treatments T3 and T5, which did not differ significantly from each other or from treatment T5 at day 0. However, there were no significant differences among all the nisin and BHA addition treatments and the control treatment, despite their decrease in values in favor of the addition

treatments during the 15 day storage period. Furthermore, a significant decrease was observed for all nisin addition treatments compared to the control treatment and treatment T5, with values of 0.06, 0.03, and 0.01 log CFU/g, respectively, compared to 1.02 and 0.71 log CFU/g, respectively, after 30 days of storage

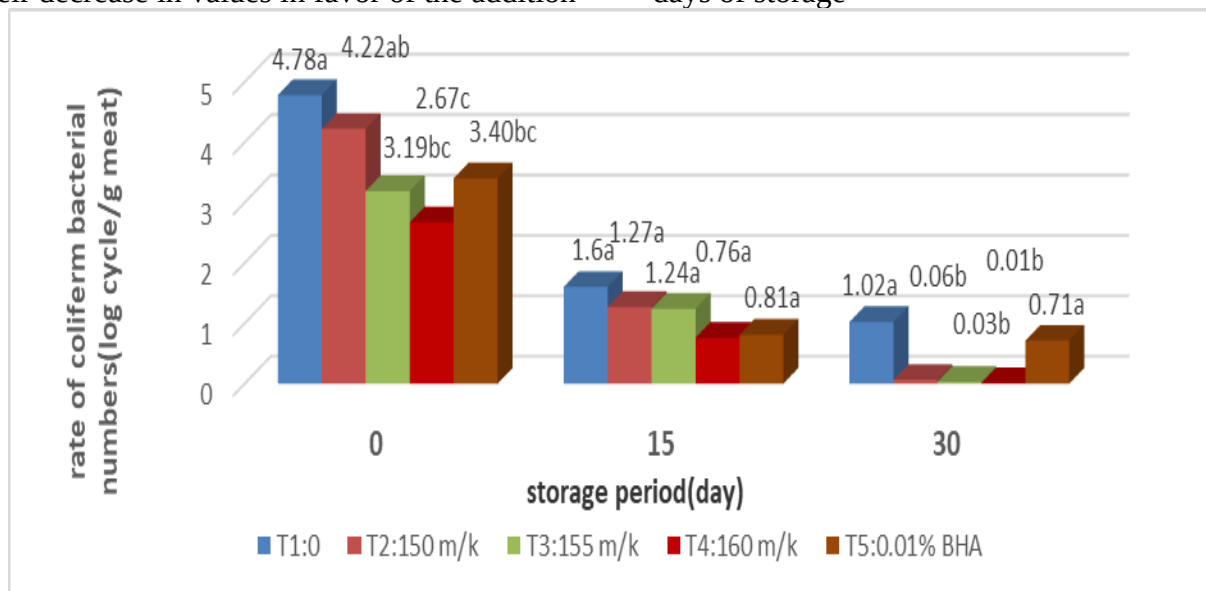


Figure 3. shows the effect of adding nisin and the synthetic antioxidant (BHA) on the total coliform count of frozen minced chicken meat

The decrease in bacterial count can be attributed to the inhibitory effect of nisin powder, as it is a natural antimicrobial with inhibitory and bactericidal effects on susceptible bacteria and other types (Mula , 2023). This is achieved by increasing the sensitivity of the bacterial cell wall. Additionally, nisin affects the penetration of cell membranes by influencing electron transfer, nutrient absorption, protein and DNA synthesis, and enzymatic activity of the cells. It is also used as a method of biological preservation (Zeliha et al.,2016). It was observed that the total bacterial count was within the limits allowed by the Central Agency for Standardization and Quality Control (7 log CFU/g of meat) in 2006. Piskernik et al.,(2011) demonstrated that the use of natural antimicrobials such as nisin and rosemary extract was effective in reducing *Campylobacter* bacterial counts by 2 log CFU/g of chicken meat stored at a refrigeration temperature of 8°C. Based on the results of this study, it can be concluded that nisin powder can be successfully used to

inhibit bacterial growth, preserve the quality of frozen chicken meat, and extend its shelf life by adding it as a natural preservative instead of synthetic compounds, while improving its quality characteristics .

CONCLUSION

This study leads us to conclude that adding niacin to minced chicken meat contributes to extending it's shelf life without unacceptable changes in its quality characteristics .

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I extend my sincere thanks to thoes who assisted me in conducting laboratory tests and statistical analysis

CONFLICT OF INTEREST

There is no conflict of interest in the scope of this research .

AUTHOR/S DECLARATION

The quality of frozen chicken meat is an important and necessary factor in its acceptance by the consumer

AUTHOR'S CONTRIBUTION STATEMENT

The author's contribution to preserving the quality and shelf life of minced frozen chicken meat

REFERENCES

- Al-Rubeii, A. M. S. (2006). Effect of sodium lactate, potassium sorbate and cetylpyridinium chloride on physicochemical properties and microbial count of cold ground beef meat. *Alex. J. Ft. Sci. & Technol.* 3(2):1-11.
<https://doi.org/10.21608/ajfs.2006.19623>
- Al-Rubeii, A. M. S., Al-Kaisey, M. T. & Khadom, M. J. (2009). Effect of some natural and synthetic antioxidants on ground beef meat during cold storage. *Alex. J. Ft. Sci. and Technol.* 6(1):1.
<https://doi.org/10.21608/ajfs.2009.28816>
- Al-Rubeii, A.M.S., Al-Mamoori, A.K.J. & Abtan, A.A.M., (2022). Effect of sodium triphosphate, sodium lactate and nisin in some chemical and physical characteristics of cold beef meat. *Proceedings of Research World International Conference*, Budapest, Hungary.
- Al-Safi, N.H.J. & Zangana, B.S.R. (2022). Effect of using raw and treated quinoa seeds (*Chenopodium quinoa*) in the diets on some microbial, physical and chemical properties of broiler carcass. *J. of Kerbala for Agricultural Sciences Issue* 9(2):46-58.
<https://doi.org/10.59658/jkas.v9i2.961>
- Alvarado, C. Z. & Sams, A. R. (2002). The role of carcass chilling rate in the development of pale, exudative turkey pectoralis. *Poultry Sci.* 81:1365-1370
<https://doi.org/10.1093/ps/81.9.1365>
- Amaral, A. B., Silva, M. V. da. & Lannes, S. C. da S. (2018). Lipid oxidation in meat: mechanisms and protective factors, A review, *Food Science and Technology* 38(1):1-15.
<https://doi.org/10.1590/fst.32518>
- Andres, S., Huerga, L. J., Mateo, M.L., Tejido, R., Bodas, R. & Moran, L. (2014). The effect of quercetin dietary supplementation on meat oxidation processes and texture of fattening lambs. *eat Science*, 96:806-811.
DOI: [10.1016/j.meatsci.2013.09.020](https://doi.org/10.1016/j.meatsci.2013.09.020)
- A. O. A. C. (2016). Association of Official Analysis Chemists. *Official Methods of Analysis*. 18th edn. Association of Official Analytical Chemists. Gaithersburg, M.D. USA.
- Balentine, C. W., Crandall, P. G., O'Bryan, C. A., Duong, D. Q. & Pohiman, F. W. (2006). The pre and post-grinding application of rosemary and its effect on lipid oxidation and color during storage of ground beef. *Meat Sci.* 73:413-421.
<https://doi.org/10.1016/j.meatsci.2005.12.003>
- Chrpová, D., Kouřimská, L., Gordon, M.H., Heřmanová, V., Roubíčková, I. & Pánek, J. (2010). Antioxidant activity of selected phenols and herbs used in diets for medical conditions. *Czech J. Food Sci.*, 28: 317-325.
<https://doi.org/10.17221/129/2010-CJFS>
- Central Organization Standardization and Quality Control. (2006). Microbial limits of Meat and Meat Products. Iraqi Standard Specifications No.4/2270. Baghdad, Iraq.
- Central Organization Standardization and Quality Control. (2006). Microbial limits of Meat and Meat Products. Iraqi Standard Specifications No.4/2270. Baghdad, Iraq.
- Duncan, D. B. (1955). Multiple range and multiple F test. *Biometrics*, 11:1-24.
<https://doi.org/10.2307/3001478>
- FSIS (Food Safety and Inspection Service). (2000). Substances approved for use in the preparation of meat and poultry products. (60 F R 67459). 9 C F R Parts 310, 318, 319, 381 and 424. U. S Dep. Agric. Washington.
- Jia, W., Wu, X. R., Li, L., Liu, S. & Shi, L. (2021). Effect of nisin and potassium sorbate additions on lipids and nutritional quality of Tan sheep meat. *Food Chemistry*, 365: 130535.
<https://doi.org/10.1016/j.foodchem.2021.130535>
- Kumar, Y., Yadav, D. N., Ahmad, T., & Narsaiah, K. (2015). Recent trends in the use of natural antioxidants for meat and meat products. *Comprehensive Reviews in Food Science and Food Safety*, 14(6): 796-812.
<https://doi.org/10.1111/1541-4337.12156>
- Luciana, J. D. A., Angela, F.J., Priscila, G.M., & Thereza, C.V.P. (2009). Nisin biotechnological production and application: a review trends in Food Science & Technology, 20146-15.
<https://doi.org/10.1116/j.tifs.2009.01.056>
- Millette, M., Tien, C.L., Smoragiewicz, W., & Monique, L. (2007). Inhibition of *Staphylococcus aureus* on beef by nisin-containing modified alginate film and beads. *Food Control* 18:878-884.
<https://doi.org/10.1016/j.foodcont.2006.05.003>

- Muhammed, A. R. A. Study of the Replacement of Nitrite by Annatto Seeds Powder in Quality Microbial Characteristics for Cold Beef Meat Sausage . (2018). M.SC. Thesis. College of Agricultural Engineering Sciences . University of Baghdad .pp:125. <https://iqdr.iq/search?view=9999b6ceb4be7fd2be4cfe280a0d8baf>
- Mula, N.S.A.H. (2023). Effect of Addition of Nisin , Potassium Sorbate and Sodium Lactate on Some Qualitative and Microbial Characteristics of Chilled Ground Beef Meat . M.SC. Thesis . College of Agriculture . University of Baghdad .pp:162.
- Mula, N.S.A.H. & Al-Rubeii, A.M.S. (2023). Evaluation of the effect of nisin , potassium sorbate and sodium lactate on fat oxidation and some qualitative and microbial properties of chilled ground beef meat . Iraqi Journal of Market research and Consumer Protection 15(1):222-231. [https://doi.org/10.28936/jmracpc15.1.2023.\(20\)](https://doi.org/10.28936/jmracpc15.1.2023.(20))
- Piskernik, S., Klan-cnik, A., Riede, T.C., Brondsted, L., & Mozina, S. S. (2011). Reduction of Campylobacter jejuni by natural antimicrobials in chicken meat-related conditions. Food Control. 22 :718-724. <https://doi.org/10.1016/j.foodcont.2010.11.002>
- Ramith, R., Prithvi, S., Aishwarya, T.D., Ashwini, P., Kumuda, J., Lochana, M., Zameer, F. , Dhananjaya ,B . , and Nagendra, P. M. (2015). Bacteriocins and their applications in food preservation . Food Sci. and Nut.Doi:10.1080
DOI: [10.1080/10408398.2015.1020918](https://doi.org/10.1080/10408398.2015.1020918)
- Roberts, D., & Greenwood, M. (2003). Practical Food Microbiology .3Ed.Blackwell Publishing Ltd Blackwell Publishing . Inc.,350 Main Street Malden Massachusetts 0214-5018,USA .
<https://www.scribd.com/doc/37088998/24943166-Practical-Food-Microbiology-3rd-Ed>
- SAS , Intsttue. (2018). SAS User's Guide : Statistics Version 9.6 end., SAS Institute Inc., Cary , NC. USA .
- Sebranek, J. G. (2009). Basic Curing Ingredients. In Ingredients in Meat Products . Springer, New York , NY. pp:1-32. https://doi.org/10.1007/978-0-387-71327-4_1
- Verma, A.K , Lakshmanan ,V., Das, A.K., Mendiratta, S.K., & R. Anjaneyulu, A.S. (2008). Physico- chemical and functional quality of buffalo head meat and hert meat . Merican Journal of Food Techology .3(2):134-140
<https://doi.org/10.3923/ajft.2008.134.140>
- Yolmeh, M., Najafi, M . B . H., & Farhoosh, R. (2014). Optimisation of ultrasound-assisted extraction of natural pigment from annatto seeds by response surface methodology (RSM). Food Chemistry, 155: 319-324 .
<https://doi.org/10.1016/j.foodchem.2014.01.059>
- Zeliha, Y. , Sabire ,Y., Nilgun, O., & Tuba, S. (2016). Inhibitory effect Lactococin Bz Against Listeria innocua Indigenous microbiota of fresh beef . Food Techol.Biot. 54(3): 317-323 .
<https://doi.org/10.17113/ftb.54.03.16.4373>

دور النيسين في تحسين الصفات النوعية وإطالة العمر التخزيني للحم الدجاج المفروم والمجمد
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المستخلص

هدفت الدراسة الى معرفة دور اضافة النيسين في تحسين الصفات النوعية وإطالة العمر التخزيني للحم الفروج المفروم والمجمد، أذ اضيف بمقدار 0، 155، 150 و 160 ملغم/كغم لحم للمعاملات الاربعة في حين اضيف 0.01% من مضاد الاكسدة الصناعي (BHA) للمعاملة الخامسة ثم خزنت عينات اللحم المفروم لمدة 0 و 15 و 30 يوماً بالتجميد بدرجة حرارة -18م⁰، درست التغيرات الفيزيائية ومؤشرات اكسدة الدهون والصفات المايكروبية بينت النتائج مايلى:- اسهمت اضافة مسحوق النيسين بحدوث زيادة معنوية بدرجة الاس الهيدروجيني وقابلية الاحتفاظ بالماء (WHC) ، في حين انخفضت معنوياً ($P<0.01$) نسبة فقدان اثناء الطبخ والفقدان اثناء الاذابة وقيم حامض الثايوباربيتوريك (TBA) ورقم البيروكسيد (PV) ونسبة الاحماض الدهنية الحرة (FFA) فضلاً عن خفض العدد الكلي للبكتريا والبكتريا المحبة للبرودة وبكتريا القولون معنوياً في لحم الفروج المفروم خلال مدد التخزين بالتجميد .

الكلمات المفتاحية: نوعية اللحم ، صفات مايكروبية وفيزيائية ، نيسين