The effectiveness of adding apple cider vinegar and garlic to chicken meat kebabs as an antimicrobial and its role in improving its sensory and physiochemical properties

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- Date of research received 05/02/2022 and accepted 22/03/2023

Abstract

Making apple cider vinegar with garlic puree added to it and studying the effect of its antimicrobial, organoleptic and physiochemical properties on chicken thigh meat prepared for making kebabs under refrigeration. The chicken thigh meat was immersed in apple cider vinegar and garlic at concentrations of (50, 70, 100)%, while the control sample was immersed in distilled water. The meat samples were placed in polyethylene bags and kept in refrigeration at 5°C for 11 days. Some organoleptic tests such as color, flavour, taste, general acceptability and microbial tests were performed and included The total number of bacteria, coliform bacteria, proteolytic bacteria, and the physiochemical tests of moisture, pH, and total volatile nitrogen ، during the storage period, the effectiveness of vinegar with garlic puree against some bacterial species was tested by diffusion method, *Pseudomonas florescence* , *Salmonella typhimurium*, *Escherichia coli* , *Staphylococcus aureu*s .The results showed a decrease in microbial numbers after the seventh day of cryopreservation, compared to the number after the first day, for all bacterial species examined and for all concentrations used. It was observed that their numbers increased after the eleventh day of preservation, indicating spoilage and microbial spoilage of the kebabs. An improvement in the sensory characteristics and for all concentrations was observed with the vinegar used compared with the control model. and a decrease in the humidity and pH levels was noted, as well as an increase in the percentage of total volatile nitrogen on the eleventh day, indicating the start of proteolysis and the deterioration of the kebab product during

that period. The results showed a variable effect on the inhibition ability according to the concentration used and the type of bacteria tested, which increased with the increase in the concentration used, and the highest inhibition diameter was 29 mm towards Staph bacteria. aureus at 50% concentration. The lowest inhibition diameter was 10 mm against *E.coli* and *Pseudo. florescence* at concentration 30 %.

Key words: Apple cider vinegar with garlic puree , Chichen kebab , TVN, Antibacterial effectiveness, Sensory qualities .

Citation: Yasmeen I. Al-Hadidy; Saad D. Oleiwi; Anwer A. Khalaf; Hind M. Saleh. "The effectiveness of adding apple cider vinegar and garlic to chicken meat kebabs as an antimicrobial and its role in improving its sensory and physiochemical properties". *Kirkuk University Journal For Agricultural Sciences*, 14, 1, 2023, 117-130. doi: 10.58928/ku23.14110

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Introduction

Meat and its products are one of the main sources of protein, so it must be maintained without pollution or corruption until consumption, and chicken meat is one of the most important sources of used meat, which forms different images in the dishes of peoples around the world, which is characterized by its appropriate price compared to other meat sources, as chicken meat is characterized by its nutritional value for its high protein content and low percentage of fat and cholesterol compared to red meat, as it is characterized by the freshness of its tissues, easy digestion and palatable flavor, as it is rich in vitamins and mineral elements [1] Meat is one of the most perishable foods during processing or storage, as its high content of protein and moisture made it vulnerable to spoilage by several factors, most notably microbial contamination [2],[3], many studies were conducted to find new ways to increase the preservation period of meat and its products and stay away from chemical additives, as attention has turned in recent years towards the use of various natural alternatives to increase the duration of preservation of poultry meat and its products and increase the storage life, especially with a significant increase in the manufacture of meat products as well as their role in giving the desired flavor and taste, they can prolong the shelf life of the food product because of its various therapeutic properties that cause its chemical content of active groups such as phenolic compounds and organic acids [4] Apple cider vinegar and garlic are among the most prominent of these substances because they contain bioactive compounds due to their ant microbiological properties [5].

Apple cider vinegar is a fermented product classified as a functional food because of its compounds and nutrients such as minerals and vitamins in addition to having an inhibitory effectiveness towards many microorganisms through its role in inhibiting the transport of nutrients through its cell membrane as well as its role in improving its manufacturing properties [6], marinating is defined as the processing of raw meat with various ingredients including vinegar or organic acids, oil, salt, sugar, herbs, spices and flavoring ingredients for the purpose of Tenderizing meat, improving its juiciness and flavor, as well as improving microbiological properties and ensuring the safety of meat [7],[8]. There are several studies that have addressed ant microbiological effects during the seasoning process performed by acidic solutions [9],

[10], [11],[12]. Garlic Allium sativum is one of the herbaceous plants and one of the most prominent spices added to meat as flavoring materials and garlic is characterized by containing many active substances Ant microorganism and antioxidant And antioxidants that make it a source of treatment for many diseases, stimulate immunity, lower cholesterol, prevent cardiovascular diseases, and prevent or resist cancerous tumors [13]. The therapeutic properties of garlic are due to a variety of antimicrobial components and the main effect is attributed to the compound Allicin, which is a different derivative of the amino acid Cysteine and liberates volatile substances containing sulfur through multiple reactions that lead to the decomposition of Allinase to produce Allicin, as it protects the plant from soil parasites and fungi, as well as it is responsible for the pungent smell of garlic [14], the current study aimed to find out the effectiveness of adding apple cider vinegar with garlic puree to chicken meat and prepared for the kebab industry and to study its effect as an antimicrobial and prolong the preservation period as well as its effect on the sensory and physicochemical qualities of the food product.

Materiales and methods

1. Apple vinegar and smashied garlic manufacturing

Manufacture of apple cider vinegar and garlic puree Vinegar was prepared according to the method described by [15], [16] by placing the clean apple pieces in a glass container and covered with a porous cloth and kept in a warm place for several weeks to occur the process of spontaneous or self-fermentation by the naturally present yeasts Sacharomyces cerevisiae yeast to produce ethanol alcohol with a concentration of 11-13%, which is known as alcoholic fermentation and followed by acetic fermentation, where the resulting alcohol turns into vinegar, known for its distinctive smell and taste. Stinging by the action of Acetobacter bacteria that grow on the surface of the alcoholic solution and work to oxidize it to acetic acid in the presence of oxygen, then the solution is filtered to obtain vinegar and then kept in bottles sealed until use and peel garlic cloves and mash well and then mix with vinegar in a glass container where there is a vacuum over the mixture by about 5 cm in anticipation of the pressure resulting from the possibility of gas production and then cover the pot with a dark cloth color and leave for about 4 weeks.

1. Chicken meat kebab manufacturing

Prepare chicken kebab by mixing 96% of the meat of the chicken thigh minced well with the addition of (black pepper and salt) and by 4% and garlic puree was added by 5 g / 25 ml vinegar after it was immersed for two hours with different concentrations of apple cider vinegar and garlic puree previously manufactured and the treatments were as follows:

First treatment (T1): The first treatment was prepared by immersing the minced chicken thigh meat in distilled water (control).

First treatment (T2): The second treatment was prepared by immersing the minced chicken thigh meat in vinegar manufactured at a concentration of (50%) and prepared by adding 50 ml of manufactured vinegar with the same amount of sterile distilled water.

First treatment (T3): The third treatment was prepared by immersing the minced chicken thigh meat in vinegar manufactured at a concentration of (70%) and prepared by adding 70 ml of vinegar manufactured in a conical flask volume of 100 ml and completed the volume to the mark with sterile distilled water.

First treatment (T4): The fourth treatment was prepared by immersing the

meat of the minced chicken thigh in the vinegar manufactured directly, i.e. at a concentration of 100%

After that, the kebab was formed and placed in polyethylene bags and kept in the refrigerator at a temperature of (5 º C) until the tests were conducted and during the preservation periods (11, 7, 1) days.

2. Sensory tests

Sensory properties including taste, color, smell and general acceptance were estimated as stated in [17].

3. Microbial tests

The total number of bacteria, coliform bacteria and proteolytic bacteria was estimated using the culture media Nutrient Agar, MacConkey Agar and Skim Milk Agar respectively for kebabs added to it apple cider vinegar and garlic puree by weighing 10 g of the nutritional form and added to it 90 ml of physiological solution to conduct decimal dilution and for the purpose of the fifth dilution and the dishes were planted by transferring 1 ml by pour plate method and the dishes were incubated at a temperature of 37 º C for a period of 24-48 hours and the growing numbers were calculated in CFU colony formation unit / [18],[19], [20].

The inhibitory activity of apple cider vinegar with garlic puree against elective bacteria was estimated using the Well diffusion assay method by activating the bacteria species on the liquid nutrient medium and incubated at 37o C for 18 hours, after which 0.1 µL of bacterial suspension was spread for each species on the Muller-Hinton agar medium. After that, a drill is made using a cork borer with a diameter of 6 mm, after which 0.1 µL of specified concentrations are added (30, 50) % for the manufactured vinegar and leave for an hour in the refrigerator to impregnate then incubate the occlusion at 37 °C and for 24 hours the anti-activity was determined by measuring the Inhibition zone formed around the pits in milliliters [21],[22].

4.Chemical tests

The pH values were determined using a pH-meter device according to the method described by [23] during the different conservation periods used in the experiment.

The humidity was estimated by taking 3 g of the sample in a ceramic lid and drying at a temperature of 105 °C until the weight is stable [23].

Estimation of total nitrogen levels (TVN) for kebab models according to the method mentioned by [24] by taking 10 g of the model and 2 g of magnesium oxide and 300 ml of distilled water placed in a distillation bottle of 500 ml (anti-foam material such as silicon preparations is placed as needed), and 25 ml of boric acid at a concentration of 2% is placed in the receiving vial and a few drops of the red methyl reagent are added to it, then the device is tightly linked and the receiving or receiving tube is placed under The surface of the boric acid solution is then heated The distillation vial is heated so that the liquid boils for 10 minutes after boiling it continues to distill for about 25 minutes, finally the liquid resulting from distillation is decomposed with sulfuric acid (0.1 standard) Multiply the amount of sulfuric acid consumed during the molting × 14 to obtain TVN values in mg nitrogen/100 g of meat as in the following equation:

TVN = Sulfuric acid 1.1 quantity × 14

Results and discusssion

Table (1-1) shows the results of the sensory evaluation of chicken thigh meat kebab added to it apple cider vinegar with garlic puree for the color characteristic used in different concentrations (50, 70, (100% when manufacturing, it has achieved grades 4, 4, 4 respectively, it is noted that there is no

difference in the grades granted to the color characteristic of the product, and the results also show a decrease in the taste values of the product with an increase in the concentration used, which amounted to 4, 3, 3 for the same concentrations respectively compared to the results of the treatment Control, which amounted to 3, 3, 4, 3 for the sensory qualities used respectively, and the concentration of 50% recorded the best sensory evaluation of the taste characteristic, and the flavor got 4, 4, 3 and for the same concentrations respectively, while the results of the general acceptance characteristic of the product amounted to 4, 4, 3 for the same concentrations respectively, and this may be due to the addition of apple cider vinegar with Garlic puree to the product, which in turn improved the organoleptic properties of kebabs, as apple cider vinegar acts as a preservative for nutrients and as an antibacterial [7] as reported by [25] as well as [26] in their study on cooked and uncooked chicken meat that was soaked with apple cider vinegar as they observed no statistical differences between the two In terms of color, it is believed that the acidic or organoacid color of the fruit used may change the properties of The color of the meat treated by it was noted that apple cider vinegar was a good source of increased chicken meat glasses compared to acetic acid, and [27] treated turkey meat with citric acid and grape juice and did not observe any difference in color.

Table (1-1) Organoleptic properties of chicken thigh meat kebab soaked in apple cider vinegar and garlic puree in different concentrations when manufacturing at cooling temperature.

Used Vinegar concentration%	Organoleptic qualities			
	Color	Teste	Flavor	General Admission
Control (distilled water)	3	3	4	3
50	4	4	4	4
70	4	3	4	4
100	4	3	3	3

Table (2-1) shows the total number of bacteria for chicken meat kebabs after the first day of cryopreservation, which was (8.8 ×10 7, 6.56 ×10 7, 7.60 ×10 7, 7.72 ×10 7) unit of colony formation / g for concentrations (0, 50, 70, 100)% respectively, and the total number of bacteria decreased after the seventh day, reaching (0.53×710, 0.30 ×10 7, 0.13×107, 0.14 ×107) colony formation units/g for the same concentrations respectively, which indicates the inhibitory action of vinegar Used to reduce the total number of bacteria, then the total number of bacteria increased after the eleventh day of conservation to reach (1.064 ×10 7, 3×10 7, 2.6 ×10 7, 2.4×10 7) colony formation unit / g meat kebab and for the same concentrations used respectively.

Table (2-1) shows the total number of bacteria for chicken thigh meat kebabs added to apple cider vinegar and garlic puree in different concentrations during the periods of preservation under refrigeration (W.T.M/G)

Used concentration(%)	Storing Duration (Day)		
	(1)	(7)	(11)
Control (distilled water)	$^{7}10\times8.8$	$^{7}10\times$ 0.53	$^{7}10\times1.064$
50	$^{7}10\times6.56$	$^{7}10\times$ 0.30	$^{7}10\times3$

70	^{7}10×7.60	^{7}10× 0.13	^{7}10× 2.6
100	^{7}10× 7.72	^{7}10× 0.14	^{7}10×2.4

Table (3-1) shows the number of coliform bacteria from chicken meat, where after the first day of adding vinegar and preservation (8×10 7, 1.904×10 7, 5.36×10 7, 6.64×10 7) colony formation units / g for concentrations (0, 50, 70, 100)% respectively, the total numbers of colon bacteria decreased after the seventh day to become at (0.45 ×10 7, 0.07 ×10 7, 0.04 ×10 7, 0.02 ×710) colony formation units / g for the same concentrations respectively after which they increased Preparation on the eleventh day of conservation, bringing the total numbers of colon bacteria to (3.2×10 7, 1.7×10 7, 1.4×10 7, 1.3×10 (7 colony formation units / g meat kebab and for the same concentrations used respectively.

Table (3-1) shows the total number of coliform bacteria for chicken thigh meat kebab added to it apple cider vinegar and garlic puree in different concentrations during the periods of preservation under refrigeration (W.T.M/G)

Used concentration(%)	Storing Duration (Day)		
	(1)	(7)	(11)
Control (distilled water)	^{7}10× 8	^{7}10× 0.45	^{7}10×3.2
50	^{7}10× 1.904	^{7}10× 0.07	^{7}10× 1.7
70	^{7}10× 5.36	^{7}10× 0.04	^{7}10×1.4
100	^{7}10× 6.64	^{7}10× 0.02	^{7}10× 1.3

The number of proteolytic bacteria during the preservation periods, shown in Table (4-1) during the first day of preservation under refrigeration was (2.25×10 7, 3.2×10 7, 1.26×10 7, 7 ×10 7) colony formation units / g for concentrations (0, 50, 70, 100)% respectively, and then the numbers decreased after the seventh day and were at (0.58 ×107, 0.17×10 7, 0.31 ×107,0.14 ×710) colony formation units / g for the same concentrations respectively and then increased after the eleventh day At (17×10 7, 12×10 7, 11 ×10 7, 15×10 7) colony formation units / g for the same concentrations respectively and during the conservation periods specified in the experiment.

Table (4-1) shows the total number of proteolytic bacteria for chicken thigh meat kebab added to apple cider vinegar and garlic puree in different concentrations during periods of preservation under cooling (WTM/g).

Used concentration(%)	Storing Duration (Day)		
	(1)	(7)	(11)
Control (distilled water)	^{7}10× 2.25	^{7}10× 0.58	^{7}10×17
50	^{7}10× 3.2	^{7}10× 0.17	^{7}10× 12
70	^{7}10× 1.26	^{7}10× 0.31	^{7}10× 11
100	^{7}10× 7	^{7}10× 0.14	^{7}10×15

Table (5-1) shows the inhibitory activity of apple cider vinegar and garlic puree against some selective bacteria including *staph. aureus, E. coli and Pseudo. florescence and S. typhimurium* showed a varying inhibitory effect depending on the type of bacteria and the concentration used, which increased with increasing concentration, through the diameters of the inhibition zones recorded for concentrations of 30 and 50% respectively, staph bacteria were recorded. aureus had inhibition zone diameters at 24.29 mm, E. coli inhibitory diameters at 10.13 mm and Pseudo. Florescence had inhibitory diameters at 10.12 mm, while *S. typhimurium* had inhibitory diameters at 15 and 17 mm, respectively, and the highest recorded inhibition diameter was for *Staph. Aureus*, which reached 29 mm at 50% concentration.

Table (5-1) Diameters of inhibition zones (mm) of apple cider vinegar and garlic in different concentrations towards some types of selective bacteria.

Used concentration (%)	Bacteria type			
	Staph. Aureus	*E. coli*	*Pseudo. florescence*	*S. typhimurium*
30	24	10	10	15
50	29	13	12	17

The decrease in the number of bacteria after the first week of preservation is evidence of the effectiveness of apple cider vinegar and garlic as a natural preservative because it contains many active compounds such as antimicrobial antagonists, as vinegar contains organic acids such as acetic and malic acid, phenolic compounds such as phenol, cresols and ketone compounds [28],[29], [30]. Apple cider vinegar contains acetic acid, flavonoids, gallic acid, tyrosol catechin and vanillin. Vaninilin, benzoic acid, caftaric acid, coutaric acid, caffeic acid, ferrulic acid, polyphenols, melanoidins, ligustrazine, caffeolic acid, caffeic acid, ferrulic acid, polyphenols, melanoids, ligustrazine, caffeoylsophorose and tryptophol, where these compounds act as antimicrobials and antioxidants that can stimulate the immune system. [31], [32], [7] the mechanism by which organic acids act to inhibit the growth of bacteria through several methods, including the destruction of the outer membrane of bacteria, the consumption of microbe energy and an increase in osmotic pressure, which leads to the destruction of the cell membrane and promotes the generation of antibacterial peptides in host cells, forcing them to release many necessary nutrients such as glutamic and acid ions, to balance the osmotic pressure inside the cells, Which leads to inhibiting the normal growth of bacteria [33], and the results of this study were consistent with the findings of [14], who showed that the use of apple cider vinegar and garlic by 50% has a major role in inhibiting types of positive and negative bacteria for the dye of Cram where all bacterial types were sensitive when using apple cider vinegar and garlic compared to the case of using vinegar alone, Apple cider vinegar has also been found to effectively inhibit the growth of bacterial species. *Staphylococcus epidermidis* and *Pseudomonas aeruginosa* and *Proteus mirabilis* و *Klebsiella pneumonia*.

Garlic's therapeutic properties are mainly due to thiossulfate and allicin, as garlic is used to preserve food and reduce the risk of food contamination with pathogenic microbes [14], [34], [35] noted that garlic contains a variety of antimicrobial components, including allicin, which has inhibitory efficacy against a wide range of Cram-positive and cram negative bacteria, including the toxic E. coli intestinal strain,

viruses and parasites. The biology of allicin, which is a different derivative of the amino acid Cysteine, is a broad-spectrum antibiotic and this compound works by immediate and complete inhibition of RNA synthesis is the primary target of allicin [36]. As allicin interferes with the production of RNA, fat synthesis and protein synthesis, and any defect in the chemical and physical structure of proteins and nucleic acids or preventing their manufacture in the cell or a defect in the permeability of the cytoplasmic membrane, which affects the growth of the organism due to the importance of protein in the composition of all parts in the cell structure and the allicin compound also has an important effect on the phosphorous biolayer and lipids (phospholipids) of the cell membrane of positive and negative bacterial species of Karam pigment, Garlic is also rich in anionic components such as nitrates, chlorides, sulfates and other components, which may be responsible for antibacterial activity as the therapeutic properties of garlic are due to the presence of homocysteine S-allyl Cysteine [37] Garlic has anti-activity against a wide range of positive and negative bacteria genera of Cram dye, including *Escherichia* و *Salmonella* و *Streptococcus* و *Clostridium* و *Proteus* و *Klebsiella* و *Mycobacterium tuberculosis* و *Helicobacter pylori* garlic also works to prevent bacteria Staphylococcus from the production of intestinal toxins Enterotoxins like A, B [38].

Table (6-1) shows the effect of different concentrations of vinegar and garlic puree added, which were at (0, 50, 70, 100) % and during the preservation periods of 1, 7 and 11 days on the moisture percentage of chicken thigh kebab meat stored in refrigeration at 5 ° C, as it was for concentrations (50, 70 and 100) % at (66, 79 and 88) % respectively during the first day of storage compared to the control sample which amounted to 60%. As for the seventh day of storage, the results were at 79, 80, 92% for the same concentrations compared to the control sample, which amounted to 39%. While the humidity recorded a decrease of 63, 66 and 63% at the same concentrations for the eleventh day compared to the control sample which amounted to 38%.

Table (6-1) Moisture Percentage of Thigh Kebab Meat Samples for Chicken Treatment with Apple Cider Vinegar and Garlic Mash During Cryopreservation Periods

Used Vinegar (%)concentration	Storing Duration (Day)		
	(1)	(7)	(11)
Control (distilled water)	60	39	38
50	66	79	63
70	79	80	66
100	88	92	63

Through the results, it was found that there was a decrease in moisture levels with an increase in the duration of cryopreservation, and that this decrease can be due to the decomposition of meat tissues by proteolytic enzymes, which directly affects the change in the pH of the meat, and thus exudes a section of free water to the outside of the tissues and also affects the holding power of water in the tissues, as well as the evaporation of part of the moisture when associated with a decrease in relative humidity in the conditions surrounding the cold storage [39] reported that fresh lamb moisture was 75.16% and 75.07% decreased after a five-day period of cryostorage at 5°C.

Table (7-1) shows the effect of storage periods on the pH of chicken thigh kebab meat stored in refrigeration at 5 °C for 11 days and preserved with apple cider vinegar

in different concentrations (50, 70, 100), noting a relative increase in the seventh day of preservation of the pH were (4.6, 4.6, 4.70) respectively, and there was an increase in the pH on the eleventh day, reaching (4.86, 5.19, 5.16) for the same concentrations respectively.

Table (7-1) pH Values for Chicken Thigh Kebab Meat Samples Treated with Apple Cider Vinegar and Garlic Mash During Cooling Preservation Periods.

Used Vinegar (%)concentration	Storing Duration (Day)		
	(1)	(7)	(11)
Control (distilled water)	6.20	66.	6.16
50	4.31	4.6	4.86
70	4.30	4.6	5.19
100	4.41	4.70	5.16

It was also shown through the results that the pH increased with the progress of the storage period in kebab meat manufactured from chicken thigh and stored by refrigeration, as the increase and variation in pH are associated with the deterioration of proteins and the release of amino acids and the formation of ammonia, nitrogenous bases and amines during tissue decomposition during storage, and the results of the study are consistent with what [40] said, as they explained that many of the qualitative qualities of meat begin to decline when the pH value reaches more than 6.20, and this may be Caused by an increase in nitrogenous bases and amino acids resulting from protein breakdown by proteolytic microorganisms[41]. [6] indicated in their study that the pH values of chicken breast meat soaked in apple cider vinegar and in concentrations of 50 and 100% amounted to 4.32 and 3.53 respectively, that is, they decreased as the concentration increased, [42] soaked chicken breast meat with apple cider vinegar, pomegranate juice and lemon juice and in different concentrations, the pH value of chicken breast meat treated with lemon juice was the lowest value, while pomegranate juice had the highest pH value. The difference between the pH values of chicken meat with apple cider vinegar added may be due to the different pH values of the pickles used.

Table (8-1) Effect of Storage Periods on Total Volatile Nitrogen (TVN) Values of Chicken Thigh Kebab Meat Stored by Cooling at 5 ° C for 11 Days and Added to it Apple Cider Vinegar at different concentrations (50, 70, 100) %, as there was a decrease in the values of total volatile nitrogen during the first day of storage and for all concentrations used were at (25, 28, 19.26) mg / 100 g respectively compared to the control sample which was 39.2 mg / 100 g, and the results showed that Total volatile nitrogen showed an increase during the storage of meat, as it was within the permissible limits during 7 days of storage, while it increased on the eleventh day to very high percentages of (35, 32.2, 26.6) mg / 100 g and for the same concentrations respectively, [43] indicated that the total nitrogen values in chilled chicken meat at 4 °C amounted to (7.8, 18.71, 27.88) mg / 100 g on day 1, 7, 11 From the storage respectively.

Table (8-1) Total Volatile Nitrogen Values (TVN) in mg N / 100 g Meat for meat samples of chicken thigh kebab treated with apple cider vinegar and garlic puree at different periods of cryostorage..

Used Vinegar (%)concentration	Storing Duration (Day)		
	(1)	(7)	(11)
Control (distilled water)	39.2	42	43.4
50	25	29.4	35
70	28	26.6	32.2
100	19.26	16.8	26.6

Liu indicated in their study that the percentage of total volatile nitrogen in cooked chicken meat and apple cider vinegar added to the mechanism on the first day of storage reached 13.48 mg / 100 g and began to increase with the increase of the storage period, as the percentage reached 20.13 mg / 100 g on the fifteenth day of storage[44]. Zhang is report that the percentage of total volatile nitrogen in cooked chicken meat increases with the storage period and this may be due to microbial growth[41]. Kruk and et al have stated that the increase in total volatile nitrogen during storage may be due to the action of enzymes resulting from the growth of microorganisms that break down protein substances and release amino acids and nitrogenous compounds and thus increase their concentration during storage[45]. Al-Dosari indicated in their study, the difference in the values of total volatile nitrogen may be due to storage and handling conditions and that the highest value of the total nitrogen sample was in the lamb product 22.34 mg / 100 g, followed by the beef product 13.93 mg / 100 g, followed by the chicken meat product which amounted to 11.56 mg / 100 g. Sometimes we find a change in values, but they are far from degrees of corruption and are not affected by sensory quality, and this may be due to the anti-action of the concentrations of vinegar and garlic used [46], [47].

Conclusions

We conclude from this study that immersing chicken meat with apple cider vinegar and garlic puree is an important process that must be applied before consuming or processing meat to prevent microbial pathogens transmitted by meat to ensure the safety of meat as well as improving the sensory properties of refrigerated kebabs for a period of more than seven days through a decrease in the total number of bacteria and the total numbers of colon bacteria and proteolytic species after the first week of preservation compared to after the first day as well as retention of moisture and ace value pH and decrease in the value of total nitrogen pilot TVN due to the properties of apple cider vinegar and garlic puree in improving the quality of the product because it contains organic acids and bioactive compounds as antimicrobials, while the total number of bacteria and the total numbers of colon bacteria and proteolytic species increased after the eleventh week of conservation indicating the high microbial load and damage and corruption of the food product as well as loss of moisture and low pH value and high values of total nitrogen pilot TVN, which indicates the start of protein decomposition and product degradation.

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فاعلية اضافة خل التفاح والثوم لكباب لحم الدجاج كمضاد ميكروبي ودوره في تحسين خواصه الحسية والفيزيوكيميائية

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• تاريخ استلام البحث 05/02/2023 وتاريخ قبوله 22/03/2023

المستخلص

صُنع خل التفاح المضاف اليه مهروس الثوم ودرس تأثير خواصه المضادة للاحياء المجهرية والحسية والفيزيوكيميائية في لحم فخذ الدجاج المعد لصناعة الكباب تحت التبريد ، اذ غمر لحم فخذ الدجاج في خل التفاح والثوم بتراكيز (50 ، 70 ، 100) %، بينما غمرت عينة السيطرة بالماء المقطر، وضعت نماذج اللحم في اكياس من البولي اثيلين وحفظت بالتبريد على 5 °م ولمدة 11 يوم ، أُجريت بعض الاختبارات الحسية مثل اللون والنكهة والطعم والقبول العام والاختبارات الميكروبية وشملت العدد الكلي للبكتيريا وبكتيريا القولون والبكتيريا المحللة للبروتين و الاختبارات الفيزيوكيميائية المتمثلة بالرطوبة والرقم الهيدروجيني والنتروجين الكلي الطيار خلال مدة الحفظ و اختبرت فعالية الخل مع مهروس الثوم تجاه بعض الانواع البكتيرية بطريقة الانتشار بالحفر شملت *Pseudomonas florescence* و *Salmonella typhimurium* و *Escherichia coli* و *Staphylococcus aureus* ، اظهرت النتائج انخفاض الاعداد الميكروبية بعد اليوم السابع من الحفظ بالتبريد مقارنة بالعدد بعد اليوم الاول ولجميع الانواع البكتيرية المفحوصة ولجميع التراكيز المستخدمة ، ولوحظ ارتفاع اعدادها بعد اليوم الحادي عشر من الحفظ دلالة على التلف والفساد الميكروبي للكباب . لُوحظ تحسن الصفات الحسية ولجميع التراكيز مع الخل المستعمل مقارنة مع نموذج السيطرة ، ولوحظ انخفاض بنسبة الرطوبة والرقم الهيدروجيني فضلاً عن ارتفاع نسبة النتروجين الكلي الطيار في اليوم الحادي عشر دلالة على بدء التحلل البروتيني وتدهور منتوج الكباب خلال تلك المدة .

بينت النتائج تأثيراً متباين في القابلية التثبيطية تبعاً للتركيز المستعمل ونوع البكتيريا المختبرة والتي ارتفعت مع زيادة التركيز المستخدم وكان اعلى قطر تثبيطي ومقدارهُ 29 ملم تجاه بكتيريا *Staph. aureus* عند التركيز 50%. وأقل قطر تثبيطي ومقدارهُ 10 ملم تجاه بكتريا *E.coli* و *Pseudo. florescence* عند التركيز 30% .

الكلمات المفتاحية: خل التفاح مع مهروس الثوم ، كباب لحم الدجاج، TVN ، الفعالية المضادة للبكتريا . الصفات الحسية .