Effect The Addition Different Concentrations of Sodium Triphosphate and Sodium Lactate on The Microbial Count of Cold Ground Beef Meat

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Abstract

This study was conducted in the laboratories of Al-Musaib Technical College, Al-Furat Al-Awsat Technical University with the aim of studying the effect of adding sodium triphosphate salts at concentrations of 0, 0.5, 1, 1.5 and 2% and sodium lactate at concentrations of 0, 0.5, 1, 1.5 and 2% on the microbial count of ground beef and cooled for 24 hours at a temperature at 4 °C. The results of the study indicated an increase in the rate of the total count of bacteria, psychrophilic bacteria, coliforms, yeasts and molds in all ground meat samples, not treated with salt, than the permissible limits. As samples of ground meat not treated with trisodium and sodium lactate salts recorded the highest rate in the total count of bacteria after 24 hours of cold storage at 4 °C, when they reached 6.544 CFU. The count of these bacteria decreased by increasing the concentration of salts, so the minimal count of bacteria was at a concentration of 2% when adding both salts of sodium triphosphate and sodium lactate together as 3.426 CFU. Also found a clear reduction in the count of Psychrophilic bacteria at a concentration of 2% for both salts as recorded the last treatment rate 2.127 CFU. It is the minimal count compared to the other treatments, while the control treatments recorded the highest count 6.400 CFU. At the same time, the addition of different concentrations of sodium triphosphate and sodium lactate led to a gradual decrease in the counts of coliform bacteria, with an increase in the salt concentration, as it reached 1.204 CFU. Also found a significant difference was found (P <0.05). In the count of yeasts and molds, which were significantly decreased by increasing the concentration of both salts, as they were 1.079 CFU. In the last treatment, while the highest count recorded since reached 4.361 CFU. When salts are not added. This is a clear indication of the existence of a synergistic action of these salts to reduce the increasing counts of bacteria, yeasts and molds by inhibiting these microbial species with increased concentration.

Keywords: Sodium Triphosphate, Sodium Lactate, Microbial Count, Beef, Cold Ground

1. Introduction

Meat is one of the most important foods with a high nutritional value, as it is an important source of animal protein as well as it contains essential amino acids, saturated fatty acids and mineral elements, and it is a good source of vitamins important in human nutrition, and meat is very sensitive to microbial contamination due to its high water activity and its pH Close to neutral and a high percentage of nutrients [1], therefore it is rapidly spoilage due to its biochemical and biological composition. The shelf life of meats is identified being the period when the meats quality remains satisfying within sever conditions of storage, distribution, and display. Spoilage is the method in which meats has degenerate and turns into unacceptable for humans being or its quality diminished turning meats improper for selling or consumption [2], and with the increase in need of meat and its products of high quality, acceptable appearance, safe, with a long shelf life and free from preservatives or lightly treatment, the use of additives was natural rather than synthetic additives are widely accepted [3], [4]. The changes occurring meat when applying the techniques of various preservatives are the changes in the physical which changes in the composition of the tissues that affect the sensory qualities of the product such as size, appearance, color, odor, taste, flavor, tenderness, juiciness and overall platability [5]. As for the chemical changes of meat, it is due to the molecular reactions that occur when thermal treatment and when using food additives or when storage for a long time, as the chemical composition of the materials is responsible for the organoleptic properties and the nutritional value of meat and its products [6]. So it is necessary to save it well and prevent spoilage due to many factors are interrelated that effect of the shelf life and appearance of meat such as light, moisture, oxygen, temperature and internal enzymes and the most important of...
microbiology [7] and there are several used ways to save meat which is that appearing differed, all aiming to limit the growth of microorganisms by controlling them with temperature, including freezing and cooling, and controlling micro-organisms directly, such as the use of antibiotics, radiation, chemical preservatives, and controlling moisture, including drying and salting [8], as improve sensory evaluation such as flavor, tenderness, juiciness, color, and increase water holding capacity [9]. It also has preservative role whatever it assist to delay the occurrence of changes of chemical, biological, physical and inhibits the growth of most pathological and non-pathological microbiology [10], as well as sodium triphosphate salts effective in improving the quality and sensory characteristics of meat, as it works to neutrality the pH and it increases the water holding capacity and extract muscle proteins, as well as protect meat against fat oxidation and microbial growth and prevent off-flavors, and found [11] The gram positive bacteria more sensitive to the sodium triphosphate salts as compared with the gram negative bacteria, lactate also working to reduce the change of chemical and increase shelf life and improve sensory characteristics such as taste and color as it gives the color pink reddish constant through the reduction of deoxymyoglobin and production deoxyglobuline and working as antioxidants. Lactate is also considered as antimicrobial compounds that limit microbial growth, the [12] considered that the quality of Ground meat, whether local or imported, is acceptable as it contains 10⁶/g total count bacteria. While [13] The total count bacteria allowed 10⁵/g, staphylococcus 10⁷/g in ground meat to be acceptable healthy [11]. So it became the use of common food additives more in recent years due to an increase prepared products that use those additives and phosphate is one of them which are necessary for several reasons, including increasing the pH and increase the water holding capacity and other sensory characteristics and the shelf life of meat. The phosphates used in meat preservation are the salts of phosphoric acid, sodium or potassium, and these salts have a great effect on the ionic strength, so they are considered a bacterial inhibitor that inhibits a large group of bacteria positive for the Gram stain [14]. In view of the above, the present study aims to study the effect of using different concentrations of sodium triphosphate and sodium lactate on the microbial count of Cold ground beef.

2. Materials and Methods

2.1. Preparing the meat for the experiment samples

These experiments conducted in the laboratories of Al-Musaib Technical College / Al-Furat Al-Awsat Technical University, where beef meat was taken from the local markets in Babil Governorate immediately after the slaughtering process and placed in tightly sealed polyethylene bags and transferred to the laboratory in a cork box containing ice powder and preserved in the refrigerator at 4°C for 24 hours.

2.2. Preparation of samples

The meat was cut into medium-sized pieces with a clean and sterile knife, after which the meat was homogenized to ensure that the meat ingredients were evenly distributed, and then the meat was Ground using a special electric grinding machine for this, then the ingredients of the Ground meat were mixed by hand together to ensure homogenety [15]. Also used sodium triphosphate salt with prescribed concentrations 0, 1, 1.5, and 2%, and sodium lactate at concentrations 0, 0.5 , 1, 1.5, and 2%. Sodium Triphosphate and Sodium Lactate were added directly to each treatment according to the prescribed proportions mentioned above at room temperature and the mixture was mixed manually for each treatment separately to obtain a homogeneous mixture and the meat samples were kept in the refrigerator at temperature of 4°C for 24 hours [9].

2.3. Microbial tests

Microbial tests worked in sterile conditions, as has been prepared culture media for the growth of microorganisms and sterilized using autoclave at a temperature 121°C for 15 minutes and under the pressure of 15 bar / Inch, and sterilized all glassware used to operate laboratory oven electric at 180°C for two hours. then prepare dilutions needed for samples by transferring 1 g of each sample to test tube containing 9 ml sterile peptone water with a concentration of 0.1% to obtain the concentration of 10⁻¹ [16], such as the preparation of other dilutions chain by transfer 1 ml each time to 9 ml of prepared previously and sterilized water peptone and conducted dilutions to 10⁻² for each sample and used this dilutions to conduct appropriate microbial tests of samples based on mentioned [17]. After that, each of the experimental samples was cultured by transferring 1 ml of the appropriate dilution to sterile plastic Petri dishes with a sterile automatic micropipette, and then the culture medium was poured. Potato Dextrose Agar (PDA)Special for the growth of yeasts, fungi and the culture medium(MacConky agar)Suitable for coliform growth and culture medium (Nutrient agar) The appropriate for growth the total count bacteria and psychrophilic bacteria in sterile petri dishes [18]. The samples were mixed with the culture medium inside the dishes by moving them quietly in the four sides, then the dishes were left to solid the culture medium, and the Petri dishes were kept upside down in the incubator at a temperature of 37°C for 48 hours for the bacterial growth dishes and at a
temperature of 27 C° for 5 days for the yeasts and molds growth dishes, Then the bacterial colonies and the yeast and mold colonies were counted by the plates [19].

3. Results

Table (1) indicates the significant effect for different concentrations of sodium triphosphate salts and sodium lactate on the logarithm of the total count bacteria there is a significant difference, as recorded control treatment without adding Salts highest value in the rate of the logarithm of the total count bacteria, reached to 6.544 Unit Forming Colony / gm of meat, while the last treatment recorded the minimal value in the mean of the logarithm of the total count bacteria, which was 3.426 colony forming unit / gm of meat, so there was a significant difference (P <0.05) In the interference rate between the concentrations was 5.042, it was found that the best concentration to reduce the total count of bacteria is 2%. He also found a significant difference (P <0.05) Among the treatments, the value of 4.693 was found, where it was found that using both salt together gave the minimal value for the total count of bacteria, while Table. (2) indicates the effect of the studied treatments on psychrophilic bacteria, which is one of the main causes of damage and spoilage of meat that increases during cold storage compared to other types of bacteria. Because this group of microorganisms prefer to grow at lower temperatures compared to mesophilic bacteria, there is a significant difference (P <0.05).

The control treatment recorded the highest value in the logarithm of the count of psychrophic bacteria, as it reached 6,400 unit forming colony / gm of meat, and a gradual decrease in the count of these bacteria was observed by increasing the concentration of salts until it reached the minimal value in the last treatment, as the logarithm of the count of psychrophilic bacteria 2.127 unit forming colony / gm of meat, and there was a clear significant difference in the interferens rate between the concentrations was 5.598, and this gave an indication that the concentration of 2% was the best concentration and gave the minimal logarithm rate for the count of psychrophilic bacteria. Also, a significant difference was found between the parameters, whose value was 5.249. However, using sodium triphosphate salt with sodium lactate salt gave the best results, which is the minimal logarithm rate for the count of psychrophilic bacteria. Also, Table No. (3) shows the effect of the studied parameters on the logarithm of the count of coliform bacteria, indicating a significant difference. (P <0.05) The control treatment recorded the highest rate in the mean of the coliform logarithm, as it reached 6.431 Unit Forming Colony / gm of meat, while the last treatment recorded the minimal value in the mean coliform logarithm, as it reached 1.204 Colony Forming Unit / g of meat, and it was found that there is a significant difference in the interferers rate between the concentrations of 5.892 as it was found that the best concentration to limit the growth and increase the count of coliform is 2%. Also, there was found a significant difference between the treatments with a value of 5.542 as the use of both salts together had The effective effect of reducing the logarithm of the count of coliform bacteria, as it gave the minimal value.

The Table (4) the effect of the studied treatments on the logarithm of the total count of yeasts and molds have pointed a significant difference, as was the rate of the logarithm of the total count of yeasts and molds reached 4.361 Colony Forming Unit / g meat, the highest value, which gradually declined to increase the concentration of sodium triphosphate and sodium lactate as recorded the last treatment lower value as of rate logarithm of the total count of yeasts and molds reached 1.079 Colony Forming Unit / g of meat, and there was a significant difference (P <0.05) In the interference rate between the concentrations it was 5.892, as it was found that the concentration of 2% gave the minimal value in the rate of the logarithm of the count of yeasts and molds, and also a significant difference of 5.542 was found between the treatments, as the treatment in which both salts were used recorded the minimal logarithm rate for yeasts and molds among other treatments. The results of this study agreed with [20].

The reason for the increase in the total count of bacteria, psychrophilic bacteria, coliform bacteria, and the total count of yeasts and molds in the control treatment compared to the other treatments is due to the occurrence of accidental contamination during slaughter. [21] In addition to the fact that ground meat is easier to spoil than non-ground meat due to the increase in surface area, the mincing process is a process of mixing bacteria with meat as it is in direct contact with the contents of the meat suitable for the growth and reproduction of bacteria [9]. Sodium lactate, which is a salt, acts as a bound acid that passes through the microbial cell membrane and makes the inner part of the cell acidic, and this change leads to a rapid pH reduction and thus cell death [22]. The reason for the decrease in the microbial count by increasing the concentration of salts is due to the fact that the treatment with salts (sodium triphosphate and sodium lactate) leads to loss of microorganism vitality, as the increase in the salt concentration leads to inhibition of enzymatic activity inside the cell of the microorganism and thus loss of its vitality [23]. Also, the inhibitory effect of salts is due to the fact that they reduce the solubility of oxygen in the water, so that the microorganisms benefit less from it, and they also create a high osmotic pressure that causes the shrinkage of the cells of the microorganisms and thus their death, so these salts play a multifunctional role in preserving and processing meat and increasing its shelf life. By reducing the water activity of meat and thus reducing its microbial count [24] These results were in agreement with what was stated [25] That sodium lactate works to reduce microbial growth and also confirms what previous studies indicated that sodium triphosphate salts and sodium lactate are
effective against The total count of bacteria, coliform bacteria, and psychrophilic bacteria, and the total count of yeasts and molds [10].

**Table 1.** The effect of addition different concentrations of sodium triphosphate and sodium lactate on the logarithm the total count bacteria of cold ground beef.

| Con. | SPP  | SL   | SPP*S | Concentration rate |
|------|------|------|-------|-------------------|
| 0    | 6.954| 5.85 | 5.875 | 6.544             |
| 0.5  | 5.4  | 5.544| 5.176 | 5.425             |
| 1    | 4.397| 4.444| 4.176 | 4.397             |
| 1.5  | 3.812| 3.812| 3.602 | 3.753             |
| 2    | 3.477| 3.544| 3.176 | 3.426             |
| L.S.D (0.05) | 5.042 | interference | 4.803 |

**L.S.D Treatment (0.05) | 4.693**

**Table 2.** The effect of addition different concentrations of sodium triphosphate and sodium lactate on the logarithm psychrophilic bacteria of cold ground beef.

| Con. | SPP  | SL   | SPP*S | Concentration rate |
|------|------|------|-------|-------------------|
| 0    | 6.812| 5.740| 5.698 | 6.400             |
| 0.5  | 5.397| 5.397| 5.176 | 5.335             |
| 1    | 4.397| 4.301| 4     | 4.263             |
| 1.5  | 3.301| 3.301| 3     | 3.221             |
| 2    | 2.176| 2.176| 2     | 2.127             |
| L.S.D interference (0.05) | 5.598 |

**L.S.D Treatment (5.249) (0.05)**

**Table 3.** The effect of addition different concentrations of sodium triphosphate and sodium lactate on the logarithm coliform of cold ground beef.

| Con. | SPP  | SL   | SPP*S | Concentration rate |
|------|------|------|-------|-------------------|
| 0    | 6.845| 5.740| 5.740 | 6.431             |
| 0.5  | 4.397| 4.477| 4.176 | 4.367             |
| 1    | 3.398| 3.397| 3.176 | 3.335             |
| 1.5  | 2.397| 2.399| 2.176 | 2.336             |
| 2    | 1.204| 1.301| 1.041 | 1.204             |
| L.S.D interference (5.653) | 5.892 | 5.598 |

**L.S.D Treatment (5.542) (0.05)**

**Table 4.** The effect of addition different concentrations of sodium triphosphate and sodium lactate on the logarithm yeasts and molds of cold ground beef.

| Con. | SPP  | SL   | SPP*S | Concentration rate |
|------|------|------|-------|-------------------|
| 0    | 4.778| 3.653| 3.653 | 4.361             |
| 0.5  | 3.176| 3.397| 3     | 3.221             |
| 1    | 2.178| 2.176| 2     | 2.127             |
| 1.5  | 2.176| 2.176| 2     | 2.127             |
| 2    | 1.041| 1.176| 1.041 | 1.079             |
| L.S.D interference (5.653) | 3.893 |

**L.S.D Treatment (5.542) (0.05)**
Conclusions

Previously Concluded that the treatment of cold meat with different concentrations of sodium tripolyphosphate and sodium lactate led to reduced total count bacteria, psychrotrophic bacteria, coliform, yeasts and molds significantly, which is reflected in the quality and safety of meat from microbiological contamination.

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