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Impacts of spice extracts on the safety and shelf life of fresh chicken

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Abstract

Products made from chicken are a great source of nutrients, including exceptional flesh ions, important minerals, vitamins, critical fatty acids, and amino acids like the B-complex. The impact of 2 spice extracts combined on raw chicken flesh during storage for fifteen days at four degree Celsius was investigated for their antibacterial and antioxidant properties. BHT (positive control), rosemary, rosemary (RO), cloves (CL), & combinations were applied to Raw Chicken Flesh (RCF), & the outcomes be contrasted to those of raw Chicken Meat (CM) without any additives. Spice sources' antibacterial and antioxidant properties were identified. RO had lower total phenolic as well as flavonoid contents than cloves. The DPPH radical scavenging capacity of cloves is greater than that of RO. Nevertheless, RO has a substantially greater chelating impact on ferrous ions than cloves. Total Viable Counts (TVC), Enterobacteriaceae counts, Lactic acid bacteria (LAB) counts,pH, instrumental color (CIE L*, a*, b*), Pseudomonas spp. throughout fifteen days, counts & 2-thiobarbituric acid reactive compounds (TBARS) were assessed every three days. During storage, T-RO-CL samples had lesser bacterial counts than control samples. During storage, T-RO-CL samples maintained considerably higher L*, a*, and b* values. The TROCL sample had the lowest TBARS levels of the entire sample. These findings show that spice extracts are very potent natural antioxidants in raw CM and are extremely effective against bacterial activity and lipid oxidation.

Keywords: Raw chicken meat (CM); Antimicrobial; Antioxidant; Spice extracts; TBARS values

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1. Introduction

CM products provide a rich supply of nutrients, including superior meat ions, essential minerals, supplements, essential fatty acids, and amino acids including the B-complex. The customer and shelf life acceptability of chicken flesh and food are significantly influenced by color, microbiological development, and lipid oxidation [1]. Though, the main issue facing the meat business is to create chicken items without added fat that sacrifices texture and flavor. Lean meats are healthy for human cardiovascular problems since they are low in fat and contain less in contrast with non-lean meats. They are also a wonderful source of protein. Those that follow low-calorie, low-fat diets are fond of low-fat meats. A rich source of selenium, vitamin B3, B6, and choline is poultry meat. Selenium has been connected to an increase in immunity and a reduction in cellular free radical activity [2]. From main production locations to production lines and even beyond through successive contaminations, poultry microflora is spread. It is well known that chicken serves as a breeding ground for several pathogens that might harm people. Insufficient sanitization might endanger the customer if the product is not handled safely [3]. From ancient times, several spices and plants have been exploited to season meat and impart a particular flavor to finished goods, but also to prevent the meat from spoiling while being stored. Nowadays, significant antioxidant and antibacterial properties of plants and plant extracts are thought to have a beneficial influence on meat quality. The need for "clean label" meat goods from consumers, particularly in the EU and US nations, has kept the trend of employing a focus on organic products as food products [4]. To maintain food safety and product shelf-life, CM products need to be packaged using the proper materials. Antibacterial or active packaging has attracted a lot of interest recently due to a great deal of promise to satisfy customer and manufacturer needs for products with extended shelf life. Novel antimicrobial packaging materials may now be developed because of recent advances in nanotechnology [5].

The goal of the study [6] was to ascertain the results of a fragrant crude extract an antibacterial qualitative factor and antifungal factors are curious about how long chicken fillets will stay fresh while they were being stored in the refrigerator. The expectancy of raw CM held at four degree Celsius, and the combined effects of modified atmosphere packaging (MAP) and mint lavender oil were studied in [7]. The phytochemical components of frequently used herbs and spices affected the shelf life of ground chicken flesh. Onion leaves, garlic leaves, hattibar leaves,

radish leaves, and chirality were among the five herbs and spices that were gathered, and their methanolic extracts were made [8]. The Paper [9] investigated natural products to enhance it is healthy in regards to the real value and health qualities of ready-to-eat (RTE) meat products. These extracts' sensory impacts on RTE meat products are explored, as well as any potential simultaneous effects of combining different extracts. When RTE carbonado chicken spoils during storage, there are typically health risks and financial losses. Increased shelf life of carbonado chicken, a brand-new edible nano emulsion covered with natural antibacterial and antioxidant properties was used [10]. In addition, to extend the lifespan of particular foods, make them functional foods, or use them in food packaging, various items can be strengthened with phenolic compounds [11]. Article [12] determined how a polylactic acid film combined with nan-chitosan and Polylophium involucrated essential oil affected the chemical, microbiological, and sensory characteristics when eating chicken wings their 10-day storage in the refrigerator. Using ginger essential oil and carboxylated chitosan as source ingredients, simple food nano-coating liquids created by ultrasonic treatment and utilized to increase the shelf life (RTE) of spiced CM [13]. Scientists are therefore becoming more interested in using natural antioxidants to stop the oxidation of lipids in chicken flesh. The usage of more flavonoids found in chicken has been studied Consider the oxidation process in several studies. Article [14] evaluated disseminated information and looked at the impact of in the meat of poultry, natural antioxidants destroy numerous lipids. Paper [15] highlighted the various seed extract in sources of some reactive substances capable of lengthening the usable life and also the functional qualities containing meat or products made from meat. It does the basis of more recent optimization of various extraction techniques to develop ad hoc solutions of green antioxidants.

The research article's organization is as follows; part 2 lists materials and methods. The gathered findings are shown in part 3 along with a discussion of them. The research's conclusion is explored in part 4.

2. Materials and methods

2.1 Reagents and chemicals

"Folin-Ciocalteu's reagent (FCR), 1,1-Diphenyl-2-picrylhydrazyl (DPPH), trolox, 2,2'- azinobis (3-ethyl-benzothiazoline-6-sulonic acid) (ABTS), sodium carbonate (Na2CO3), gallic acid, sodium nitrite (NaNO2), sodium hydroxide (NaOH), quercetin, butylated hydroxytoluene (BHT), thiobarbituric acid (TBA), and trichloroacetic acid (TCA) were purchased from Sigma Chemical Co. (St. Louis, MO, USA)". Sinopharm Chemical Reagent Co., Ltd. provided the methanol and ethanol used in this study.

2.2 Process of making spice extracts

A mixture of 400 ml of 95 percent (v/v) ethanol & aliquots of 50 grams each of powdered and dry spices were shaken constantly for 12 hours (100 rpm). Once again, the remainder was removed with 200 ml of 95 percent ethanol for an extra twelve hours, and after that filtered using what man No. 2 filter paper. In a rotary evaporator at 50 degrees Celsius with a vacuum pump, the mixed filtrates were concentrated. Before usage, dried extracts were stored in airtight vials at 4 degree Celsius. To test both antioxidant and antibacterial characteristics, the resultant compounds were dissolved in 95% ethanol before being diluted in distilled water and used in CM products. Formula (1) is used to calculate the efficiency of the extraction process for the ethanolic extracts of spices.

$$Yields(\%) = \frac{weightofextractedsample}{weightofinitialsample} \times 100 \quad (1)$$

2.3 Spice extraction Analysis

2.3.1 Anti-oxidant function

The following equation (2) was used to get the inhibitory percentage of DPPH:

$$Scaveningactivity(\%) = \left(1 - \frac{Absorbance_{sample}}{Absorbance_{control}}\right) \times 100 \quad (2)$$

The levels of the radical-scavenging activity were 50 percentage points was used to obtain the EC50 value (mg/mL).

2.3.1.1 Assay for chelating metal ions

The assays for "metal chelation (Fe2+)" were using the appropriate process. Briefly, one mL of 20mol/L FeCl2 it merged with 2 mL of 50mol ferrozine and generates a chromophore absorb sharply. The color change be assessed spectrophotometrically at 562 nm following the incorporation of spice extract. Equation (3) was used to determine the capacity of preparations to chelate ferrous ions:

$$Chelating\ activity(\%) = \left(1 - \frac{Absorbance_{sample}}{Absorbance_{control}}\right) \times 100 \quad (3)$$

The levels of the chelating activity were 50 percentage points and were determined to be the EC50 value (mg/mL).

2.3.2 Total flavonoid substance

Using flavonoids as a reference, a modified colorimetric approach accustomed to calculate the overall flavonoid concentration of the spice extracts. 250L of extracts or standard solutions, 1.25 mL of distilled water, 75L of five percentage sodium nitrite (NaNO2) solution, 150L of ten percentage aluminum chloride (AlCl3) solution, and 150L of AlCl3 solution were added five min later. After six minutes, "sodium hydroxide (NaOH)" and .6 mL of distilled water be appended. After combining the solution, the absorbance at 510 nm was determined. To represent the data, we used mg quercetin/g of material. Each determination was made three times.

2.3.3 Extracts' antibacterial properties

2.3.3.1 Microbial strains

"L. monocytogenes" remained put interested in a clean "tryptic soy broth yeast extract (TSBYE)" moderate& left to incubate for 24 hours at 37 degrees Celsius. E. coli and P. fluorescens consisted cultured for 24 hours at 37°C and 30°C, correspondingly, in a sterile broth medium. "L. sake" were injected into a clean "MRS (Man-Rogosa-Sharpe)" mixture & cultured there for 24 hours at 30 °C. From Yongxin Bio-Technology Co., Ltd., all media were

purchased (Yixing, Jiangsu, China). After 24 hours of incubation, the bacterial community in every injected medium exceeded CFU/mL.

2.3.3.2 Assessing the effectiveness of antibiotics in agar media

Using the good diffusion test, the antibacterial activities of spice extracts were investigated in triplicate to look for the inhibition of "L. monocytogenes, E. coli, P. fluorescens, & L. sake. The extracts" of the spices were utilized separately. Spice extraction levels in 95 percent ethanol were used for the tests for individual antimicrobials: 80, 40, 20, 10, and 5 mg/mL. As a control, a 95 percent ethanol solution was employed. L. monocytogenes was cultured on TSA-YE, E. coli. Using a vernier caliper and the inhibitory region approximately the steel cylinder holding the extract, the disc diameter of the inhibition zone was measured to determine the inhibitory effect.

2.4 Sample preparation

A nearby poultry processing facility produced raw chicken breast meat fillets within one hour of the killing; they were transported to the lab in insulated polystyrene crates on cold. Afterward, 25 g sections of breast fillets were aseptically sliced. Five different treatments were applied to the samples: C stands for control samples, PC for positive control using BHT, TBARS, and sensory qualities.

2.5 Meat samples analysis

2.5.1 pH determination

An AOAC guideline was used to calculate pH values. In specifically, distilled water was used to homogenize a 10 g sample of cow muscle before filtering it. A pH meter should be used to determine the pH levels of the deposit.

2.5.2 Analysis of Microbiological

Instantaneously after inoculation, as well as after three, six, nine, and fifteen days of chilled storage, samples were sent for microbiological investigation. The following microflora species were looked at: Enterobacteriaceae, "total viable counts (TVC)", "Lactic acid bacteria (LAB)", and Pseudomonas spp. The "Food and Drug Administration (FDA)", "Bacteriological Analytical Manual (BAM)" was used to conduct all microbiological analyses, with certain changes (BAM, 1998). After being incubated for 48 hours at 37°C, TVC was calculated utilising Plate Count Agar (PCA). After 24 hours of incubation at 37 degree Celsius, the number of Enterobacteriaceae on a plate of "Violet Red Bile Glucose Agar (VRBG)" was counted. After 72 hours at 30 degrees Celsius, lactic acid bacteria were identified on the MRS medium.

Each plate was visually evaluated for the colony type and physical traits specific to each growth medium. To indicate the number of microbial colonies per gram of chicken flesh, log 10CFU (colony forming units) was used.

2.5.3 TBARS value

Using 25 mL of 7.5 percent (w/v) trichloroacetic acid and 15,000 revolutions per minute, about 5.0 gram of flesh be homogenized. At room temperature, the mixture be centrifuged at 3600 gram for 20 minutes. 5 mL of the supernatant and 5 mL of 0.02 mol/L TBA chemicals consisted combined. The combination were brought to a boil for 30 minutes before cooling to room temperature. Using an Ultraviolet spectrophotometer (2550, Shimadzu, Japan) set to detect absorbance at 532 nm, the supernatant solution's absorbance was compared.

2.5.4 Evaluation of sensory

The intensity of the cooked samples' flavors and odors was assessed by the panelists. As a guide, fresh chicken flesh was provided. Using a 9-point hedonic scale, acceptance was calculated as a taste and odor composite. Individual testing booths were used to conduct a sensory examination under controlled circumstances. The palate might be washed with water in between samples. Excellent received a score of 9, very good earned an 8 on the scale, decent earned a 7, and bad earned a 6—the lowest allowed grade. A product was deemed unsuitable whenever the first off-odor or off-taste appeared.

2.6 Analysis of statistical

Various batches of meat were used in the experiments twice, and the particular analyses were performed at least twice. To ascertain the effects of the treatments, information was submitted to analysis of variance to use the common linear model approach. The least significant difference approach was used to determine changes among sample means when treatment was determined to be significant.

3. Results and Discussions

3.1 Spice ethanolic extracts have antibacterial, antioxidant, and extraction yield properties

3.1.1 Extraction yield

For assessing antioxidant activity, there are several antioxidant techniques and their variants. The three that are most often employed to gauge an extract's antioxidant activity are oxidative activity, dpph radical, and DPPH scavenging activity. According to the findings, rosemary and cloves both had somewhat greater extraction efficiency of ethanolic extracts. The spice extracts employed in this study have their chemical make-up previously identified. Eugenol, caryophyllene, and benzene, which have antioxidant and antibacterial properties, were the primary ingredients in the clove extract.

3.1.2 Activity of Antioxidant

A free radical molecule called DPPH is often used to assess a variety of extracts' capacity to scavenge free radicals. Color of the reaction fluid is purple to yellow as DPPH is foraged and converted into DPPH and the magnitude of the change is indicated by the decline in absorption at 517 nm. Table 1 displays the experiment's findings. The DPPH radical scavenging capacity of cloves was greater than that of rosemary. Clove extracts are among the most potent antioxidants, outperforming artificial antioxidants like butylated hydroxytoluene, according to earlier research. The major ingredient in cloves, eugenol, which is recognized for its antioxidant action, maybe the reason for the significant activity of cloves. Table 1 displays the extracts' abilities to chelate ferrous ions. In terms of the

ferrous ion-chelating capacity's EC50 values, rosemary was more effective than cloves in chelating ferrous ions (Table 1). Rosemary had lower total phenolic as well as total flavonoid levels than cloves. Nevertheless, rosemary has a substantially greater ferrous ion-chelating action than clove. The capacity of spice extracts to chelate ions is influenced by a variety of variables. The capacity to deactivate with chelate transition metals is the Primary Mechanism (PM) of ion-chelating activity, so it may facilitate a more efficient Fenton reaction and hydro peroxide breakdown.

3.1.3 Extracts from spices' antiseptic properties

The diffusion of agar wells experiment was used to assess which is antimicrobial property of spice extracts. 4 meat harmful and spoilage species were inhibited to varying degrees by spice extracts (Table 2). The results demonstrate that of the four bacterial strains utilized in the test, gram-positive L. monocytogenes was the most sensitive. The dangerous food-borne bacterium Listeria monocytogenes is extensively dispersed in the environment. L. monocytogenes present a serious risk as a procedure impurity into set toward consuming beef food because of the pathogen's ability to live and proliferate across a broad temperature range, even refrigerator temperatures. It has been shown that extracts from to kill germs, spices and essential oils work best when they target gram-positive bacteria. Our findings somewhat agree with those from other investigations. For instance, gram-positive L. monocytogenes was susceptible to the tested spices, but gram-negative E. coli was only marginally resistant. The gram-positive L. sake was discovered to have been the most resilient of the four bacterial strains tested, which did not precisely match the pattern mentioned above.

3.2Application of extracts to samples of fresh CM

3.2.1 pH

The pH of raw chicken flesh sample after refrigeration at four degrees Celsius for fifteen days is shown in Figure 1. The control sample's original pH and the samples that underwent the various treatments were both found to be 5.65 ± .05. After the storage period, it was discovered that the pH values of the 2 control samples (C and PC) increased from 5.65 .05 to 6.66 0.02 and from 5.65 .05 to 6.37 .04, respectively. Treatments with spice extracts somewhat prevented the pH from rising over the storage period. The pH was reduced to 5.48 0.06 after treatment with RO-CL, which was the most effective, as opposed to the control (C), which had a pH of 6.66 ± .02. The final pH readings for the samples treated using CL and RO were 5.62 ± .03 and 5.58 ± .02, respectively, and were not significantly different from one another. The pH rises when ammonia builds up and amino acid breakdown products are produced. Due to the antibacterial properties of natural spice extracts, which prevent the development and spread of spoilage microbes, the pH of chicken flesh exposed to the RO-CL, CL, & RO treatments was lower than expected.

3.2.2 Colour values

The addition of spice extracts had little impact on the samples of CM's lightness (L*) values (Figure 2). Throughout storage, the L* values steadily rose. Due to the carotenoids in the spice extracts, the CM context of research with them had a vivid red color and greater values of a* (Figure 3). In the same way, ground chicken during storage for 12 days had a* value. While the control sample had the lowest a* values after the storage period, a significant decrease in a* values for all samples was seen in this investigation. Myoglobin's ability to change into ferrylmyoglobin was successfully stopped by phenolic extracts from capers, suggesting a possible connection between certain phenolic chemicals and heme protein redox processes. Throughout storage, sample treated by spice extracts & exhibited considerably higher b* values (Figure 4).

Similarly, adding kiamwood extract made the fish emulsion sausages a little bit darker. Seeing a change in color in fried beef patties after adding natural antioxidants like grape seed extract. The intense yellow hues of the extracts prevent the alterations seen in this work from being firmly attributed to lipids, although the color changes associated with lipid oxidation are extensively described.

3.2.3 Analysis of microbial

The indigenous microflora in chicken flesh included a significant amount of fermentative LAB, which can thrive both with and without oxygen (Figure 5). Several mechanisms of action might be involved in phenolic compounds' antibacterial properties. For instance, phenolic chemicals may damage the cell wall, and interfere with the cell membranes, because cellular components leak out change the composition of fatty acids and phospholipids, affect DNA and RNA production, and prevent protein translocation. As compared to the different extracts' activities, the combined spice extracts' antibacterial activity was shown to be stronger. The potent antibacterial impact of the clove & rosemary extracts in combination that was reported in the current investigation may be due to the synergistic interactions of certain chemicals found in the blended spices. Combining spice extracts has been shown to have synergistic inhibitory effects on germs that are present in food.

3.2.4 TBARS

Malondialdehyde is the primary secondary product of lipid oxidation identified by TBARS analysis, and it may be a factor. Figure 6 displays the effect of flavor ethanolic extract's antioxidant activity on the total oxidant reactive substances (TBARS) levels in CM after 15 days of storage at 4 degrees Celsius. During day 0, it was discovered that all beef samples had identical TBARS readings. All samples' TBARS readings considerably rose when the storage duration was extended. The results of the analysis of variance demonstrated that both preservation and treatment had a substantial impact on the TBARS values. These findings imply that these antioxidants prevented the oxidation of lipids during storage. Natural antioxidants are assumed to cause a stable end product to form because they provide hydrogen from phenolic groups to break up chains of free radicals. This justification is consistent with earlier findings that indicated mustard leaf's high phenolic component concentration conferred antioxidant potential on meals. Similar to cloves, grape seed extracts have powerful antioxidant properties that have been shown to drastically reduce TBA levels in silver carp fillets. A strong correlation

exists between the antioxidant activity of pomegranate peel extract's phenolic concentration.

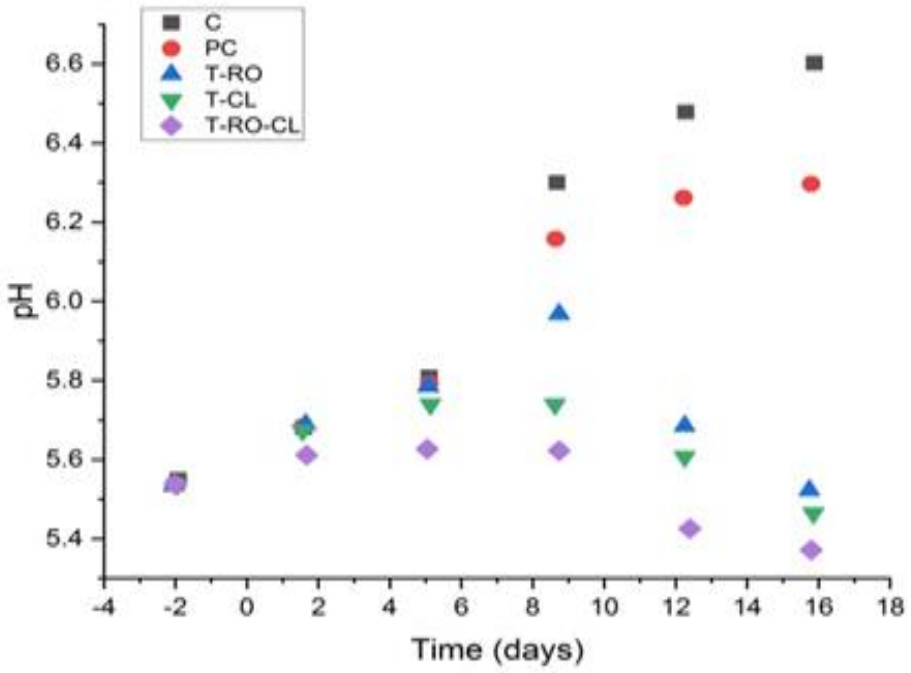

Figure 1: Spice extract impact on the pH of raw chicken flesh stored at four degrees Celsius

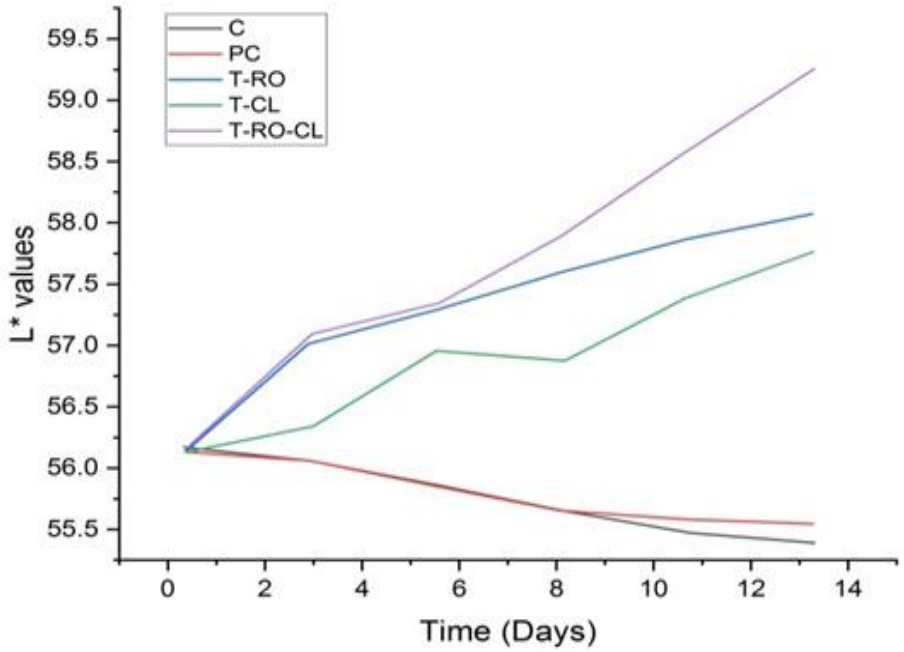

Figure 2: Effect of spice extracts during storage at four degrees Celsius on the color parameter L* in raw chicken flesh

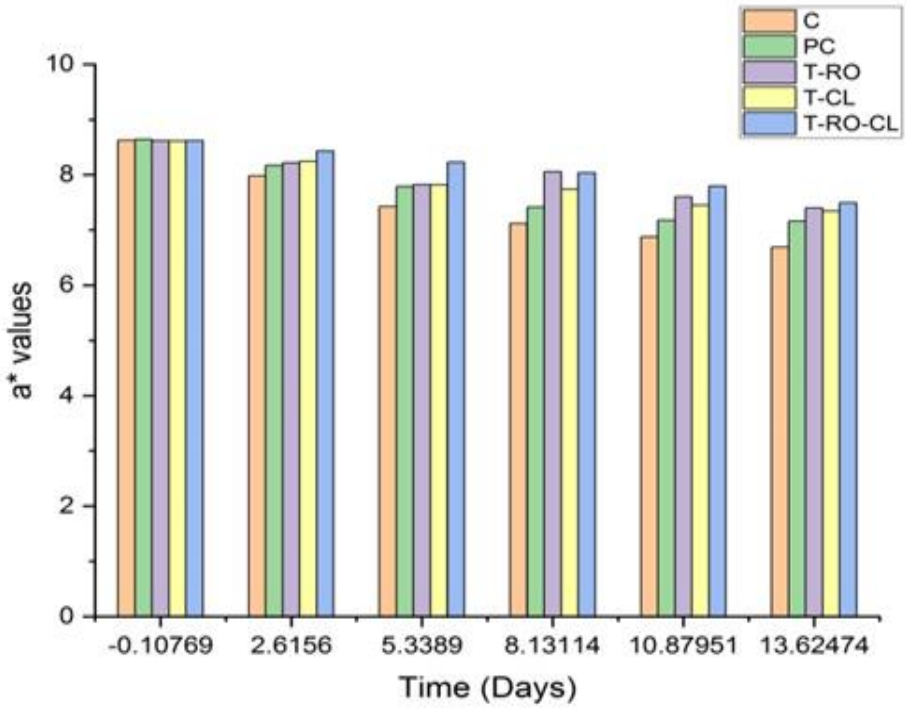

Figure 3: Impact of spice extracts during storage at four degrees Celsius on the color parameter a* in raw chicken flesh

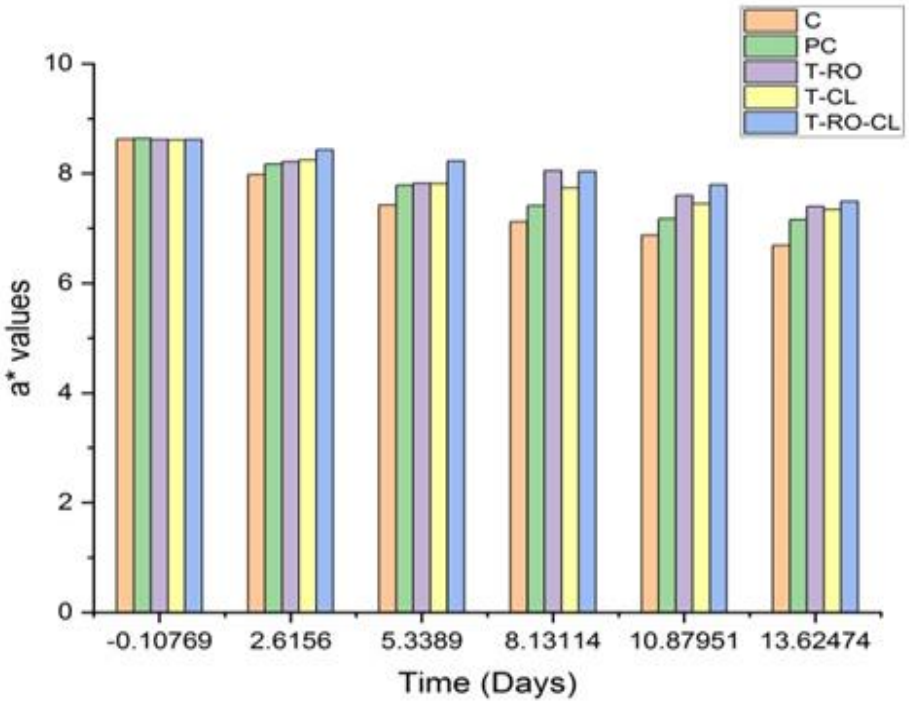

Figure 4: Changes in the color parameter b* of raw chicken during refrigeration at four degree Celsius caused by extracts of various spices

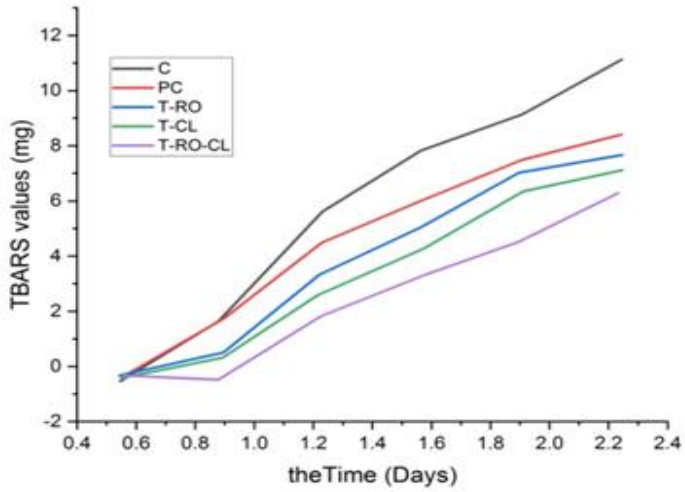

Figure 5: Storage of raw chicken at 4 degrees Celsius: The Influence of Spice Extracts on TBARS

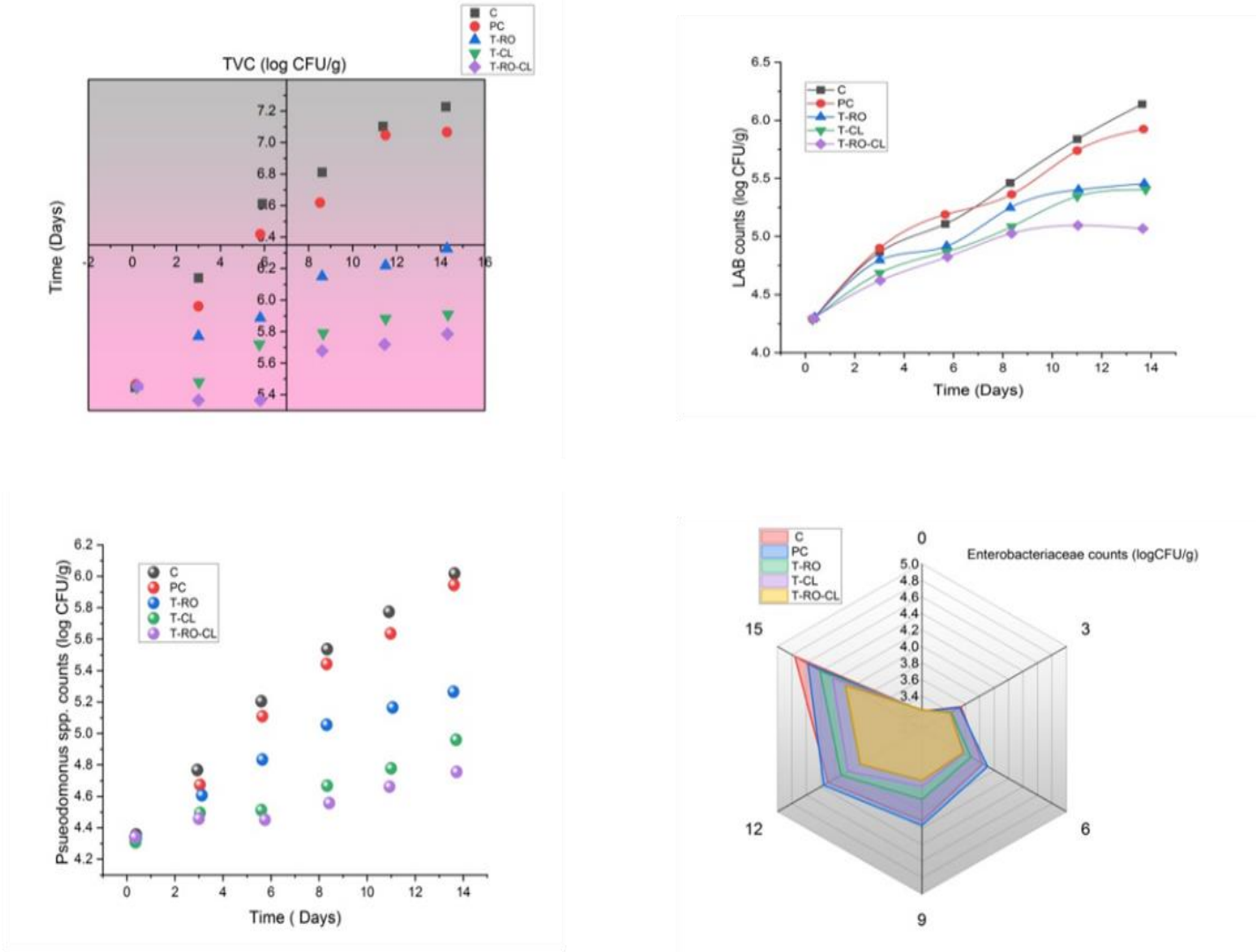

Figure 6. Storage of raw chicken at 4 degrees Celsius and the antibacterial activity of spice extract against Enterobacteriaceae, LAB, TVC, and pseudomonas species

Table 1: Clove and rosemary ethanol extracts were tested, DPPH radical scavenging capacity, ferrous capability, total phenolic content, & total flavonoid content

Spice		(mg/mL) DPPH	Extractionyield(%)	Chelation potential (mL/mg)	Total phenoliccontent(g/mgGAE)	Total flavonoid content(g/mgquercetin)
Rosemary		0.50 ± 0.02	23.56 ± 0.45	0.43 ± 0.01	34.20 ± 1.24	9.89 ± 0.85
Cloves		0.23± 0.05	28.39± 0.58	0.62± 0.02	48.51± 1.20	12.09±0.97

Table 2: Spice ethanol extracts have antibacterial properties against certain bacterial strains

Spice	Concentration (mg)	width of reserve sector (mm)			
		L monocytogenes	E.coli	P.fluorescens	L sake
Rosemary	80	21.46 ± 0.55^{a}	20.82 ± 0.47^{a}	19.22 ± 0.09^{a}	16.90 ± 0.23^{a}
	5	12.89 ± 0.30^{e}	12.15 ± 0.79^{d}	9.42 ± 0.05^{e}	9.31 ± 0.30^{e}
	20	16.27 ± 0.44^{c}	16.81 ± 0.51^{b}	13.07 ± 0.08^{c}	11.89 ± 0.50^{c}
	30	17.87 ± 0.55^{b}	17.44 ± 0.77^{b}	17.75 ± 0.05^{b}	11.39 ± 0.21^{b}
	10	13.95 ± 0.30^{d}	13.85 ± 0.10^{c}	11.49 ± 0.12^{d}	9.90 ± 0.34^{d}
Control	0	7.6 ±0.00	7.6±0.0	7.6 ±0.00	7.6±0.0
Clove	80	25.68 ± 0.32^{a}	20.59 ± 0.29^{a}	21.04 ± 0.05^{a}	14.91 ± 0.36^{a}
	10	13.14 ± 0.22^{d}	11.19 ± 0.13^{d}	13.37 ± 0.10^{d}	7.8 ± 0.10^{d}
	5	12.20±0.31^{e}	7.8 ± 0.01^{e}	11.17 ± 0.15^{e}	7.7 ± 0.01^{d}
	40	20.06 ± 0.42^{b}	16.70 ± 0.24^{b}	21.32 ± 0.38^{b}	12.82 ± 0.23^{b}
	20	19.32 ± 0.31^{c}	16.67 ± 0.32^{c}	16.13 ± 0.32^{c}	9.36 ± 0.23^{c}

Table 3: Special effects of spice extracts on the aroma & flavor of raw CM kept at four degrees Celsius

Sample	Storage time					
	0	3	6	9	12	12
Taste						
T-CL	8.8 ± .2^{aA}	8.7 ± .2^{aA}	7.6 ± .2^{bB}	7.4 ± .2^{bC}	6.4 ± .2^{aD}	4.4 ± .2bE
PC	8.8 ± .2^{aA}	7.7 ± .2^{bB}	5.2 ± .2^{cC}	3.6 ± .3^{dD}	NT	NT
T-RO-CL	8.8 ± .2^{aA}	8.7 ± .2^{aA}	7.3 ± .2^{aB}	8.1 ± .2^{aB}	6.4 ± .3^{aC}	5.3 ± .2aD
T-RO	7.8 ± .2^{aA}	9.0 ± .2^{aA}	7.4 ± .2^{bB}	6.8 ± .2^{bC}	6.2 ± .3^{aD}	4.2± .2^{bE}
C	8.8 ± .2^{aA}	7.4 ± .2^{bB}	5.4 ± .2^{cC}	3.4 ± .3^{dD}	NT	NT
Odour						
T-RO	8.7 ± .4^{aA}	8.7 ± .40^{abA}	7.6 ± .3^{aB}	6.6 ± .4^{aC}	6.2 ± .4^{aC}	4.2 ± .3^{bD}
T-RO-CL	8.7 ± .2^{aA}	8.9 ± .25^{aA}	8.3 ± .4^{aAB}	7.7 ± .4^{aBC}	6.9 ± .4^{aC}	5.8 ± .4^{bD}
T-CL	8.7 ± .2^{aA}	8.4 ± .40^{aAB}	7.6 ± .4^{aB}	6.6 ± .5^{aC}	6.4 ± .4^{aC}	4.7 ± .4^{aD}
PC	8.7 ± .2^{aA}	7.8 ± .30^{bcB}	6.3 ± .4^{bC}	5.3 ± .4^{bD}	4.3 ± .4^{bE}	2.9 ± .3^{cF}
C	8.7 ± .2^{aA}	7.7 ± .30^{cB}	6.7 ± .3^{bC}	4.6 ± .4^{bD}	3.3 ± .3^{cE}	1.9 ± .4^{dF}

Grape seed extract's anti-oxidant properties in chicken patties. While phenolic molecules in fruits are said to be connected with antioxidant activity, these data might be explained by a hypothetical synergism between phenolic chemicals and other substances.

3.2.5Evaluation of sensory

The findings are shown in Table 3, which details how samples of cooked chicken that were subjected to various treatments while being stored in the refrigerator changed in terms of aroma and taste approval. During the time spent in the refrigerator, cooked chicken's sensory ratings for flavor and aroma declined (Table 3). None of the treatments, chicken's odor, and taste ratings showed the same trend of declining acceptability (Table 3). For flavor, a similar trend of declining acceptance was seen (Table 3). In contrast to the odor and taste ratings, the visual scores for all chicken samples declined more slowly. Samples lacking spice extracts may deteriorate sooner because of higher microbiological populations. Moreover, the off-odor produced by lipid oxidation products as well as the ammonia produced by microorganisms' degradation of proteins may have contributed to the low rating of samples that were not treated on the fifteenth day of storage.

4. Conclusions

The findings show how clove and rosemary extracts may prevent microbiological development, lower lipid oxidation, preserve or enhance sensory qualities, & extend the shelf life of raw CM when stored at four degrees Celsius for fifteen days. A clove exhibited strong activity through increased flavonoid levels & was extensively distinct commencing the rosemary extract, according to research on the antioxidant characteristics of ethanolic spice extraction. Analytical of the preservative impact of combining the 2, the greatest preservation effect was obtained “by combining the spice extracts T-RO-CL”. The utilization of these potent spice extracts in the creation of unique, nutritious meat products might be very useful and appealing due to their supposedly health-promoting properties.

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