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Effect of Natural Plant Extract (Ginger) to Increase the Shelf Life of Raw Poultry Meat at Refrigeration Temperature

Sana Zulfiqar[1*], Sabahat Firdous[1], Muhammad Aqib Sharif[1], Ahmad Uzair[2] and Maria Zulfiqar[3]

[1]Department of Chemistry, University of Engineering and Technology, Lahore, Pakistan
[2]National Institute of Food Science and Technology, University of Agriculture, Faisalabad
[3]Department of Agriculture Sciences, University of Agriculture, Faisalabad, Pakistan

[*]**Corresponding author:** Sana Zulfiqar

sanarandhawafst@gmail.com

Department of Chemistry, University of Engineering and Technology, Lahore, Pakistan

Tel: +00923041989957

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Abstract

Background: Meat is an integral part of human diet. It is at high risk of bacterial spoilage because of its high perishability which affects the quality attributes of meat products. Lipid oxidation and bacterial contamination are main factors that decide the food quality and the shelf-life reduction. Therefore the delay of lipid oxidation and the inhibition of bacterial contamination are of great importance for the quality of meat. Antioxidants are those compounds that withstand lipid oxidation. Fruits and vegetables are natural healthy sources of antioxidants.

Methods and Findings: The research work was conducted to investigate the antioxidant and antimicrobial properties of ginger, lipid oxidation and microbial growth in pieces of chicken stored at refrigeration temperature. Different concentrations of ginger (2%, 3%) are applied to pieces of chicken that not only reduced lipid oxidation but also inhibited microbial activity.

Conclusion: The overall evaluation shows there is a good antioxidant role in ginger. The medicine, which contains both 3% ginger and 2%, has obtained the best results among these. Both showed strong inhibiting properties of the free radicals. It is discovered from the analysis that treatment with 3% ginger produced the best antioxidant and antimicrobial impact. Their presence also affects the Colour, taste and texture of the chicken bits. As the storage time increased lipid peroxidation and increased microbial charge values, it is evident from the data.

Keywords: Meat; Bacterial contamination; Antioxidant; Antimicrobial; Ginger

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Introduction

Meat is a significant part of human diet. Meat use is growing every day in many nations. The good source of protein is meat wise in terms of both quantity and consistency. Meat is known to be a full protein food. Meat production in the world over the past few years is reported as; production of 304 million tons and 311.8 million tons, respectively, is reported in 2012 and 2014. An individual consumes 42.9 kg of meat per annum according to the global average. Normal use of meat in developing countries was 33.5 kg and its annual use in industrial countries is 76.2 kg. During the year 2012-2013 the contribution of livestock sector is almost 55.4% to agriculture and 11.9% to GDP.

The major source of complete protein convenient for humans is meat and it's by products. Protein is very necessary for our body and mind to function properly. So essential amino acids present in meat provide the all which our body needs. The other forms of proteins are incomplete and they don't meet all the requirements to human body. As for as the interest of consumer towards the nutrition and quality of food is increasing, the study on meat its nutritional values and chemical composition is very little.

Nutritional value of meat includes a large profile comprising of fat, protein, vitamins, minerals, iron, zinc and B12. The fat content in meat is different for different animals, like it differs from breed to breed, age and type of meat. For example, the fat content of lamb varies from 7.5%-13.3%, beef 3.5%-9.3%, white meat of chicken and turkey differs from 1.1%-9.7% and 2.0%-6.6% respectively. The processed meat contains the maximum content of fat that is up to 25% [1].

The broiler chicken is mostly used in human diet now days, which is the animal only grown for meat. Protein rich source and have

low cholesterol level and very rich in nutrients. Lipid profile of broiler meat is parallel to other poultry meat [2].

Off flavor and off Colour of meat develops due to oxidation process of lipids when it is exposed to oxygen and light. Due to spoilage of meat by these factors scientists are using natural antioxidants to overcome this issue. The biochemical processes that occur during oxidation process are minimized by using antioxidants in low concentrations. In this way these antioxidants increase the shelf life of meat. Its effect is seen in both cooked and raw meat. Natural antioxidants are preferred as compared to synthetic ones as they show some toxicological effects [3].

A good quality protein is meat; it contains the traces of vitamins and minerals also. Meat of poultry is used in world, the addition of meat in diet is also very important as it provides nutrients and the best quality of protein [4].

Methods

Attainment of raw material

Testing, poultry meat and ginger both were purchased from Lahore's local market.

Cleaning of chicken pieces at first

Initially, chicken pieces were washed in. These parts were then cut into uniform pieces and stored at freezing temperature to avoid microbial spoilage and contamination of some other kind.

Preparation of sample

Soxhlet extraction method for sample preparation was used to extract first fresh ginger [5]. 200 gingers were taken in a glass bottle. The glass bottle was filled with ethanol (solvent) until layer was formed on the sample. The sample was then shaken continuously for 48 hours, with an interval of 3 hours. The sample was subsequently filtered using filter paper and extract was transferred to rotary evaporation for solvent removing. When the volume of extract remained 1 ml, distillation process halted as shown in **Table 1.**

Table 1: Treatment plan.

Treatment	Ginger
1	Control
2	2%
3	3%

Determination of antioxidant activity

Following methods were used to find out the antioxidant activity of ginger.

Total Phenolic Content (TPC) determination: FCM approach was used to assess TPC of samples [6]. Sample of 125 micro liter collected and chosen from a sample solution having known concentration. 500 µL of and 6 minutes of sample was left standing. The sample contained 1.25 ml sodium carbonate of 7%. The sample added distillate water to final amount. 125 micro litter Folinciocalteu added to sample having size 3 ml. 1 ml distil water was used. Sample placed for one and half hour and sample analyzed on spectrophotometer at 760 nm triplicate absorbance. Solution of 25 g was poured in distilled water 25 ml and dissolved. 0 ml-500 ml concentration of gallic acid was taken and standard curve utilized to measure TPC. Calculated TPC as,

$TPC=C \times V/m$

To assess antimicrobial activity

The Funk, et al. method was used to investigate antimicrobial activity in ginger [6]. To make final concentration of 400 mg/ml, ethanolic solution stock solution was made after dilution of extract with a solution of 10% Dimethyl Sulphoxide (DMSO).

Bacterial growth medium: On the nutrient agar medium pure culture has been preserved in the slants and Petri dishes. 13 g/L of nutrient broth (oxide) distributed homogenously well-filtered distill water for inoculum preparation. The mean time was autoclaved at 121°C for 15 min. The loop was mixed in the medium filled with pure bacterial strain culture and placed in a shaker for 24 hours at 37°C. They kept 4°C of inocula. The inocula with 1 × 108 spores/ml were utilized for more study.

Disc diffusion method for antimicrobial assay: On a nutrient agar medium pure culture preserved for the slants and Petri plates. 13 g/l of the nutrient broth (oxide) appended in well-filtered distill water and homogeneously distributed for inoculum preparation. At 121°C the medium was autoclaved for 15 min. The loop was mixed in the medium with a pure bacterial strain culture and put in a shaker at 37°C for 24 hrs. They kept the inocula at 4°C. The inocula with 1 x 108 spores/ ml was used for further analysis. 28 g/l of nutrient agar (oxide) was well blended and distributed homogenously in the distillation water. With autoclaving at 121°C the medium was sterilized for 15 min. Before the mixture was moved to a sterilized petri plate and poured on sterilized petri dishes, inoculum (100 µL/ml) was combined to medium. Following this small filter paper discs were placed on growth medium having 100 µL of extract. Petri dishes incubated at 37°C for 24 hours for bacterial growth. Extract has microbes and evolved specific zones to inhibit bacterial growth. Area reader used to measure millimeter-inhibition zones [7].

Analysis of chicken pieces

Microbial analysis of chicken pieces: By using total plate count method and the whole procedure is mentioned below.

A normal saline solution was prepared to dilute the samples with NaCl (8.5 g/L) and to autoclave at 121°C for time period of 15 minutes. For media preparation we used, 2.8 g nutrient agar dissolved in 100 ml distilled water. These were mixed to form the media. Then it was incubated in autoclave at 121°C for time of 15 min.

For the formation of samples, 6 sterilized tubes with tagging 10-1 to 10-6 were taken. The evaluation of chicken pieces was performed. 9 ml of saline water was added in tubes. 6 dilutions were made by moving 1 ml sample from first tube and moving

forward it. Then 1 ml dilution was taken by sterile pipette. Sterile glass spreader was used to spread inoculate on plates. Petri dishes were then inverted. After that plates were incubated in incubator at 37°C for 24 hours. Then colonies were counted that were present on plates. Colony was counted by colony forming unit/g is a methods described in [8].The total number of colonies ranged from 30 to 300 with the assistance of the colony counter was counted.

Proximate analysis: After 6 hours proximate analysis of chicken pieces was calculated using their methods as defined in AOAC 2002 [8]. For the determination of moisture content. Methods of AOAC, 2002 was used to assess the moisture content in chicken parts [8]. Petri dish was taken from China and dried on the oven. 5 g of the minced sample was taken in it and cooked at 105°C-107°C for 18 hours in a hot air oven it was takeoff from oven and put in desiccators to prevent absorption of moisture and to maintain moisture. The humidity content was then measured using the formula mentioned below:

Moisture (%)=Weight of sample-(Weight of sample after drying/wt. of sample) × 100

For the determination of crude protein kjeldahl method was used containing digestive mixture. This mix had potassium sulphate, copper sulphate and iron sulphate with 1.5 g sample in dry form. 5 mg that digestive was taken and 30 ml concentration sulphuric acid in kjeldahl flask. Mix was provided with initial heat of 40°C for 10 minutes then 60°C until the green colour was seen. Digested material was then mixed with 250 ml distill water to make a dilution. 10 ml of dilution 40% was prepared NAOH in contrast with 45% boric acid was distilled in distillation assembly. Pink to yellow colour was obtained as end point when ammonia was released completely. Then this mix was titrated with 0.1 N sulphuric acid and its amount was calculated. 6.25 factors were used and nitrogen conversion into protein was evaluated for the crude protein content.

Nitrogen (%)=Volume of H_2SO_4 used × Normality of H_2SO_4. 0014 × Vol of dilution × 100/weight of sample × volume used for titration

Crude protein (%)=%N_2 × 6.25

For fat content determination the method for extraction of fat from chicken was soxhlet which is also describes in AOAC 2002. Extraction of 2 g sample was done to extract n-Hexane by meat. N-Hexane was then evaporated by using rotary evaporator. The remaining was the fat which was calculated and crude fat was obtained.

Crude fat (%)=Weight of sample-(weight of defatted sample/weight of sample) × 100

For ash determination method described in AOAC 2002 was used [8], in which 5g sample was taken in crucible. Crucible containing sample was supposed to flame and then sample was placed in muffle furnace at 550°C-650°C till the end point grey ash colour was obtained. After carrying out from muffle furnace, sample was placed in desiccator in order to avoid moisture. Then ash was calculated by formula.

Ash (%) =Weight of ash/Weight of sample × 100

For evaluation of crude fiber the sample defatted was used with addition of 1.25% sulphuric acid and 1.25% sodium hydroxide solution to carry out 1st digestion. Then residues were ignited in muffled furnace at 550°C. When residues became clear then the readings were noted. The percentage of fibers was calculated using the method defined in AOAC 2002.

Crude fiber (%)=Weight of residue (g)-weight of ash (g)/weight of sample × 100

Assessment of lipid oxidation: For peroxide value the test weighed 5 g and applied to a 250 ml stopped glass flask. Then it was provided with heat at 60°C for 3 min to melt the fat in water bath. After 30 ml of acetic acid chloroform solution (3:2 v/v) added a detailed mixing was performed to extract the fat and homogenize the sample. This sample filtrated by Whatman filter paper for ending meat residues. Using saturated solution of potassium iodide at a concentration of 0.5 ml was performed in this filtrate before being transferred to a plate. This was titrated to a solution with normal concentration of 25 g/l sodium thiosulfate. As an indicator solution starch was added.

POV (meq/kg)=Volume of titration (ml) × normality of sodium thiosulfate solution/wt. of sample (kg) × 100

The Thiobarbituric Acid Reactive Substances (TBARS) were determined. Minced chicken (10 g) was dispersed in a 25 ml solution of trichloroacetic acid (200 g/l TCA in a solution of 135 g/l phosphoric acid) and homogenized for 30 seconds. In a test tube, the sample filter and 2 ml of filtrate have been applied to 2 ml TBA solution (3 g/l). Test tubes incubated in dark for 20 hours at 25°C then the evaluation of absorbance measured using a 532 nm UV-VIS spectrophotometer.

Sensory analysis: Sensory assessment, comprises on colour, taste, firmness of fried chicken, was carried out using a 9 hedonic scale (9=extreme like; 1=extreme dislike) according to the protocol provided to students [9].

Statistical analysis: Statistical analysis was carried out on the data obtained for each parameter to assess the degree of significance and comparison of means [10].

Results and Discussions

Chicken was treated with different concentrations of ginger and was analyzed for 7 days. After that antioxidant was measured. Chicken and ginger was purchased from market.

Antioxidant activity

Antioxidants are the compounds that inhibit lipid peroxidation. They denote their electrons to free radicals. When electron is taken by free radical it does not alter the cell [11]. Ethanolic extract of ginger was used for measuring antioxidant activity by TPC.

Total Phenolic content (TPC) determination: Direct method for measuring antioxidant activity is TPC. TPC content of ginger

ethanol extract is determined by the use of Folin's reagents. Results in mg of gallic acid/100 g of sample are measured. TPC is widely used tool in antioxidant determination due to ascorbic acid in total compounds. Ginger ethanol extract has a TPC value of 119 mg/100 g. Shan and his colleagues had estimated a dry extract weight of TPC 6.2 mg GAE/g [12], and the results are shown in **Table 2.**

Table 2: Phenol content in ginger.

Sample	Phenol Content (mg GAE/ 100 g of extract)
Ginger	119.07

In vitro activity against microbes

Recent foodborne illness originated by pathogenic microbes has resulted in major changes in consumer behavior regarding food safety. However it's the need of time to replace synthetic with natural antioxidants. Ginger has antimicrobial characteristics against *Bacillus subtillus, Staphylococcus aureus, Escerichia coli and Multocida pastereuella. Bacillus Subtillus* inhibition zones (ZI) were 17.4. James argued that ginger stops the activity of the *E. coil* [13], *Proteus spp. Staphylococci, Streptococci, Salmonella* and Meena reported that ginger inhibits carcinogenic *Aspergillus*, a fungus renowned for aflatoxin production as shown in **Table 3** [14].

Table 3: Inhibition zone (mm) of ginger.

Bacteria	Ginger
Bacillus subtillus	11.22
Staphylococcus aureus	12.34
Escerichia coli	12.41
Pastereuellamultocida	12.02

Microbial analysis of refrigerated treated chicken

TPC count in refrigerated treated chicken: In 1986, Gill identified meat deterioration as microbial activity resulting from variations in the odor, taste or appearance of meat. Meat spoilage is due to microbial load significantly shifts in the off smell product due to the 107 cm^2 and 108 cm^2.This can happen in the form of slime or taste and off-odor [15]. From analysis it was evaluated that T3 sample were safe till 5 days. After that spoilage started, as shown in **Table 4** and **Table 5.**

Table 4: Analysis of variance for TPC of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	P
Treatment	2	0.2805	0.14025	0.1	0.9034
Error	18	24.7177	1.3732	-	-
Total	20	24.9982	-	-	-

Table 5: Mean values of treatments for TPC of chicken.

Treatment	Mean
T_1	4.2171
T_2	4.0657
T_3	3.9343
Mean	4.0724
T1=Control; T2=2% Ginger; T3=3% Ginger	

Proximate analysis of refrigerated treated chicken

Protein content: Meat is nitrogenous food consists of essential amino acids which are important for development of human brain [16]. In results it was determined that protein content in chicken pieces varies non-significantly. Maximum protein content was determined in T3 (3% ginger) 28.05% and minimum in T3 (control). Results as shown in **Table 6** and **Table 7** are non-significant and near to results of [16].

Table 6: Analysis of variance for crude protein (%) of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	p
Treatment	2	2.4981	1.24905	1.53	0.2444
Error	18	14.74	1.24905	-	-
Total	20	17.2381	-	-	-

Table 7: Mean values of treatments for crude protein of chicken.

Treatment	Protein content
T_1	27.229
T_2	27.786
T_3	28.057
Mean	27.69
T1=Control; T2=2% Ginger; T3=3% Ginger	

Fat content: Fats provide the body with concentrated energy source; fats make the food more palatable. Fat content in chicken pieces varies non-significantly as shown in table. Fat content was determined maximum in T3 (3% ginger) and minimum in T1 (control). Result of T3 was similar to Mei-chin and Wen-Cheng who calculated mean value 7.6% [17], and the results are as shown in **Table 8** and **Table 9.**

Table 8: Analysis of variance for fat content of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	p
Treatment	2	3.42	1.71	4.54	0.0254
Error	18	6.7857	0.37698	-	-
Total	20	10.2057	-	-	-

Table 9: Mean values of treatments for Fat of chicken.

Treatment	Fat content
T_1	13.357
T_2	14.086
T_3	14.3
Mean	13.914
T1=Control; T2=2% Ginger; T3=3% Ginger	

Moisture content: Result of moisture in chicken pieces is shown in table. Results were determined non-significantly. With respect to the **Table 10** and **Table 11,** highest moisture content was determined in T3 (3%) and lowest in T1 (control). Non-significant results were same as Mei-chin and Wen-Cheng [17].

Table 10: Analysis of variance for moisture content of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	p
Treatment	2	7.5238	3.7619	1.02	0.38
Error	18	66.2857	3.68254	-	-
Total	20	73.8095	-	-	-

Table 11: Mean values of treatments for moisture of chicken.

Treatment	Moisture content
T_1	65.714
T_2	64.714
T_3	64.286
Mean	64.905
T1=Control; T2=2% Ginger; T3=3% Ginger	

Ash content: Ash is very important in meat. It basically provides indication of bone material in raw samples. It also provides quality to meat. Results for meat ash content are shown in table. Results are non-significant. From the results it is determined the maximum ash content is present in T3 (3% ginger) and minimum in T1 (control). Results are close to Partanen who calculated to be 1.79 [18] and the results are as shown in **Table 12** and **Table 13.**

Table 12: Analysis of variance for ash of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	p
Treatment	2	0.23238	0.11619	1.79	0.1948
Error	18	1.16571	0.06476		
Total	20	1.3981			

Table 13: Mean values of treatments for ash of chicken.

Treatment	Moisture content
T_1	1.3429
T_2	1.4857
T_3	1.6
Mean	1.4762
T1=Control; T2=2% Ginger; T3=3% Ginger	

Fiber content: Results of fiber content are present in **Table 14** and **Table 15**. They vary non-significantly. Highest fiber content was calculated in T2 (2% ginger) and minimum in T1 (control). The results were near to Synytsya et al. who determined fibers in meat 1.9% [19].

Table 14: Analysis of variance fiber of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	P
Treatment	2	0.14	0.07	1.93	0.173
Error	18	0.651	0.036	-	-
Total	20	0.791	-	-	-

Table 15: Mean values of treatments for fiber of chicken.

Treatment	Moisture content
T_1	1.329
T_2	1.514
T_3	1.486
Mean	1.443
T1=Control; T2=2% Ginger; T3=3% Ginger	

Lipid oxidation: Nutritional value of meat decreases when there is oxidation in meat. During storage of meat this oxidation process is possible to happen and hence deteriorate the quality of meat. Free radicals are responsible spoilage of meat. By putting and adding natural or artificial antioxidants in meat, lipid oxidation can be inhibited [3].

Thiobarbituric Acid (TBA)

TBA method is used for lipid oxidation determination in meat as used by Raharjo and Sofos. TBA value of meat during storage is shown in table. T3 (3% ginger) gave highest TBA value. TBA value is increased by increased storage conditions. Results are near to Sallam, et al. [16]. Abdel-Hamid, et al. evaluated antioxidant activity at 4°C-18°C [17] and the results are shown in **Table 16** and **Table 17.**

Table 16: Analysis of variance for TBA of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	P
Treatment	2.000	0.006	0.003	1.840	0.188
Error	18.000	0.031	0.002	-	-
Total	20.000	0.038	-	-	-

Table 17: Mean values of treatments for TBA of chicken.

Treatment	Moisture content
T_1	0.347
T_2	0.377
T_3	0.389
Mean	0.371
T1=Control; T2=2% Ginger; T3=3% Ginger	

Sensory evaluation of refrigerated treated chicken

Sensory evaluation is defined as organoleptic testing. From five senses on hedonic scale it is measured for a product. Consumer demand towards sensory characteristics is increasing day by day. It is an important tool in development of product as colour, taste, texture, flavor, and overall acceptability of product matters. Microbiological and nutritional tests are also applied for checking the quality of product. But theses cannot be measured by consumer. Sensory evaluation is that method which consumer can check instantly while purchasing a food product. Chicken pieces were analyzed for 7 days and it was analyzed for sensory evaluation also on 9 hedonic scales.

Colour of chicken pieces: Analysis of chicken pieces was performed for its colour checking and the results are shown in **Table 18 and Table 19**. Colour is first character that any person attracts or rejects for a product. According to results T3 (3% ginger) gave very good results in colour, and results were in favor with Paulo et al. who analyzed that fish meat colour changes towards light [18].

Table 18: Analysis of variance for Colour of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	P
Treatment	2.000	6.381	3.190	5.290	0.016
Error	18.000	10.857	0.603	-	-
Total	20.000	17.238	-	-	-

Table 19: Mean values of treatments for Colour of chicken.

Treatment	Moisture content
T_1	7.286
T_2	7.571
T_3	8.571
Mean	7.810
T1=Control; T2=2% Ginger; T3=3% Ginger	

Flavor of chicken pieces: It is an important parameter in sensory evaluation. It attracts consumer with its joint capability of smell, taste, mouth feel. Results for flavor of chicken meat are shown in table. From results it was analyzed that non-significant results were produced. Best and good flavor was T3 (3% ginger) and bad was of T2 (2% ginger), as shown in **Table 20** and **Table 21.**

Table 20: Analysis of variance for flavor of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	p
Treatment	2.000	8.667	4.333	9.100	0.002
Error	18.000	8.571	0.476	-	-
Total	20.000	17.238	-	-	-

Table 21: Mean values of treatments for flavor of chicken.

Treatment	Moisture content
T_1	7.143
T_2	7.000
T_3	8.429
Mean	7.524
T1=Control; T2=2% Ginger; T3=3% Ginger	

Taste of chicken pieces: In sensory evaluation taste is very important character of a food product. It was also analyzed by judges and results were like that. T2 and T3 were at maximum numbers and T1 at lowest. Results were same like Sallam, et al. [16] His work was on sausages at different concentrations of ginger and the results are presented in **Table 22** and **Table 23.**

Table 22: Analysis of variance for taste of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	p
Treatment	2.000	3.714	1.857	2.660	0.097
Error	18.000	12.571	0.698	-	-
Total	20.000	16.286	-	-	-

Table 23: Mean values of treatments for taste of chicken.

Treatment	Moisture content
T_1	7.286
T_2	7.571
T_3	8.286
Mean	7.714
T1=Control; T2=2% Ginger; T3=3% Ginger	

Texture of chicken pieces: Texture is very important parameter in sensory evaluation. It was analyzed for all the chicken samples as shown in table. Results were T2 and T3 were at maximum marks

with good reviews as shown in **Table 24** and **Table 25**. Results were non-significant and were in favor of Ruiz, et al. [19].

Table 24: Analysis of variance for texture of chicken treatment with ginger extract at refrigeration temperature.

Source	DF	SS	MS	F	P
Treatment	2.000	3.524	1.762	1.950	0.172
Error	18.000	16.286	0.905	-	-
Total	20.000	19.810	-	-	-

Table 25: Mean values of treatments for texture of chicken.

Treatment	Moisture content
T_1	7.286
T_2	7.714
T_3	8.286
Mean	7.762
T1=Control; T2=2% Ginger; T3=3% Ginger	

Conclusion

The assessment of this research work indicates that there is a strong antioxidant function in ginger. Among these, 3% ginger and 2% ginger both obtained the best results. Both showed strong properties inhibiting the free radicals. Control study did not produce as good results as ginger. 3% ginger treated sample was safe at 5th day after that it started spoilage. 2% ginger treated sample was safe till 3rd day but control sample started deterioration after 1st day. All these shows strong antioxidant and antimicrobial activity in refrigerated pieces of poultry. The industry will also use this procedure to improve the consistency of their goods. Thus this study concludes that ginger has high antioxidant and antimicrobial potential and that this spice used at different concentrations to form both natural antioxidants and flavors.

T3 treatment which contained 3 percent ginger was the best in all respects among all treatments. During storage major differences were observed for the Value Of Peroxide (POV) and reactive substance with Thiobarbituric Acid (TBRAS).During storage, colour, flavor and taste have a positive impact on the meat product by adding antioxidants while their impact on interaction is not important.

Results suggested that Total Plate Count (TPC) of chicken pieces increased with the passing of time. During storage substantial variation for TPC was observed which showed that during storage, antioxidants had a positive effect on chicken parts. In addition, industries which use other spices to inhibit lipid oxidation and microbial spoilage can add ginger to their products to further enhance meat product quality.

Funding/Conflict of Interest

We report no funding assistance or conflicts of interests.

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