Yemeni Journal of Agiculture and Veterinary Sciences
ISSN Online: 2789-1593, Print: 2311-7788
YJAVS- -24.05.02.05
DOI: https://doi.org/10.70022/yjavs.v5i2.2242
Available online at: http://journal.tu.edu.ye/index.php/yjavs/index

Original Article

Effect of Ginger Extract and Polyphosphate on Microbiological Properties of Chicken Meat

Fayez Morshed Al-Taweel, Amin Mohammed Alwaseai*

Biotechnology and Food Technology Department, Faculty of Agriculture, Thamar University, Yemen
** Corresponding author's email address: amin.alwaseai@tu.edu.ye*

KEYWORDS
Chicken Meat, Ginger extract, Microbiological Properties, Polyphosphate

Article history
Received
24th October, 2024
Accepted
15th November, 2024

ABSTRACT
The present study was aimed to evaluate the effect of Trisodium phosphate (TSP), fresh ginger rhizome extract (GE) and their mix on some microbiological properties of chicken meat. The chicken carcasses samples were collected after evisceration processes and before coming in to the immersion chiller, from the production line of private automatic poultry slaughter-house in Dhamar city, Yemen. The chicken `s carcasses were divided into four treatment groups and control: The G-I was acts as control (3 carcasses), G-II (6 carcasses), G-III (6 carcasses) and G-IV (3 carcasses) were dipped in 3 and 5% ginger extracts, 6 and 8% TSP solutions and mix of TSP (6%) and ginger extract (3%) respectively. Measurements were taken before and post treatment at 0, 48 and 72 hrs. at 4±1˚C. The results showed a significant reducing($P<0.05$) in populations of total bacteria counts and *Staphylococcus* by 0.85 and 0.79 log cfu/ml in treated group with 8% TSP; while, in treated groups with 6%, 8% TSP and with the mix of (3% GE + 6 % TSP) caused a significant reduction in *Salmonella* counts by 0.82, 1.05 and 0.89 log cfu/ml respectively. Changes in microbial loads during cold storage indicated that chicken meat group treated with 8% TSP resulted in a significant reduction in total bacterial counts by 3.45 log cfu/ml compared to control group 4.36 log cfu/ml after 48 hrs. of storage at 4±1˚C; while, *Salmonella* count was significantly reduced by 2.46 log cfu/ml as compared to control 3.78 log cfu/ml after 72 hrs. of storage at 4±1˚C. In conclusion, Trisodium phosphate, ginger, and Trisodium phosphate and ginger in combination at different concentration exhibited antibacterial activities in reduction of bacterial counts and load on chicken meat. Trisodium phosphate compound showed more efficacy compared to ginger extracts. The treatments of chicken meat with TSP, GE and their mix increased the shelf life of the meat. Further studies are needed to study the effect of other plant extract on microbiological properties of chicken meat.

INTRODUCTION

The consumption of poultry meat is increasing around the world, due to it is a low in fat, rich in protein and low price (OECD/FAO, 2021; Wang et al., 2023; Henchion et al., 2014; Bordoni and Danesi, 2017). In addition, several key factors contribute to chicken's dominance in the global meat market, including affordability, nutritional value, palatability, and ease of preparation (Petracci, 2022; Shaltout et al., 2023). In spite of, the relative safety and nutritional value of fresh chicken meat, its physicochemical properties make it prone to microbial spoilage. As it is exposed for microbial contamination from various sources (Al-

Maaqar et al., 2023). The presence of foodborne pathogens in poultry represents a significant thrseat to the poultry meat industry due to huge economics caused by these organisms. These pathogenic bacteria, naturally present in the gut of chickens, can contaminate the meat during processing the carcasses in plants, posing a serious health risk to consumers (Maharjan et al., 2019; Tahir et al, 2024). The common pathogenic bacteria associated with poultry are *Salmonella, Campylobacter*, *Staphylococcus aureus*, *E. coli,* and *Listeria,* (Bhaisare et al., 2014). Some treatments are applying for poultry carcasses to improve the microbiological quality parameters such as the treatment with sodium chloride, sodium lactate, Trisodium phosphate and plant extracts. Several plants extracts are used against the bacterial activities on poultry meat such as rosemary, garlic, pineapple and ginger extracts, (Khaled, 2016; Hmiadei et al., 2010).

Ginger contains some volatile compounds such as α-pinene, borneol, camphene, and linalool, which are responsible for antimicrobial activities, (Nychas and Skandamis, 2003; Sa-Nguanpuag et al., 2011). The major pungent components of ginger are gingerone and gingerol, which have strong inhibitory activity against pathogenic bacteria (Park et al., 2008). The ginger essential oil contains amounts of phenolic compounds i.e. eugenol, shogaols, zingerone, gingerdiols and gingerols, which might be responsible for antimicrobial potency (Singh et al., 2008).

In previous studies, the dipping of slices spent hen breasts in 3 and 5% ginger solution with added 2% of salt and stored for 24 hrs at 4˚C showed a significant reduction in population of total bacterial count by 4.83 and 4.16 log cfu/g, respectively, compared to control 6.20 log cfu/g (Zangana and Aljami, 2010). The Treating camel meat chunks with 30% ginger extract by spraying reduced the total bacterial count and *Staphylococcus aureus* count to 3.1×10^5 and 2.5×10^2 cfu/g, respectively, compared to the control counts of 7.8×10^5 and 8.6×10^2 cfu /g, while after 3 days of storage at 4±1˚C the total bacterial count and *Staphylococcus aureus* counts were reduced to 7.9×10^5 and 5.1×10^2 cfu/g compared to the counts in control 5.2×10^6 and 2.4×10^3 cfu/g respectively (Abdeldaiem and Ali, 2014).

Trisodium Phosphate (TSP) is generally known as safe by the US (FDA) and has been approved by USDA-FSIS at levels of 8-12% as an antimicrobial agent on raw chilled poultry carcasses that have been passed for wholesomeness (Capita et al., 2002). Carcasses are either spray or dip in TSP solution for up to 15 sec at 13 -17˚C (Federal Register, 1994).

Treatment of poultry carcasses with TSP was effective in reducing populations of food-borne pathogens including *Salmonella*, *Campylobacter*, *Escherichia coli O157:H7, Listeria* and *Staphylococcus aureus* as well as spoilage bacteria including *Pseudomonas* and *Lactobacillus* (Ledesma et al., 1996; Capita et al., 2002). The dipping of chicken breast samples in 5%, 8% and 10% TSP solutions for 15 min at room temperature 25˚C cause a reducing in the aerobic plate count and *Staphylococcus* counts to 7.69, 6.32, 5.69, 3.56, 3.32 and 2.07 log cfu/g compared to control 8.2 and 4.30 log cfu/g, respectively (Hemmat et al., 2016).

In light of the growing need for safe and healthy food and to limit the proliferation of microorganisms that cause meat spoilage, improving meat quality has become essential. This can be achieved by reducing or eliminating microorganisms, whether they cause spoilage or deterioration of chicken meat. Therefore, the aim of this study was to investigate the effect of Trisodium phosphate (TSP) and fresh ginger rhizome extract (*Zingiber officinale*) extract at different concentration on total counts and load of *Staphylococcus* and *Salmonella* of chicken meat under refrigerated storage.

MATERIALS AND METHODS

Samples Collection

A total of eighteen fresh whole chicken carcasses (30–35 days old and weight of 1100 to 1200g) were randomly, Yemen. Chicken were slaughtered by butcher (bled for 2.22 min), scalded for 1.36 min at 58˚C and mechanically de-feathered for 53 sec. All selected from the production line of private automatic poultry slaughter-house in Dhamar city. Carcasses were collected after the evisceration processes and before coming in to the immersion chiller.

Preparation of chemical solutions and plant extracts

Trisodium phosphate (TSP)

Trisodium phosphate 98% (made in China) was purchased from a local market in Sana'a, Yemen. TSP was used to prepare 6 % and 8% solutions in sterile water.

Ginger extract

Ginger extract was prepared according to the (Indu, et. al. 2006). Fresh ginger rhizomes (Zingiber

officinal) were purchased from a local market in Dhamar city, Yemen. The fresh ginger rhizomes were cleaned, peeled, sliced and washed in sterile water. In order to obtain aqueous extract of the ginger rhizomes, 100g of washed ginger rhizome was crushed using mortar, then blender was used to obtain ginger extract. After then, the extract was filtered through filter paper and sterilized by using a syringe filter (made in Taiwan). This extract was considered as the 100% concentration of the extract. The concentrations of 3% and 5% were made by diluting the concentrated extract with appropriate volumes of sterile water. The extracts were prepared fresh before each trail.

Experimental design and measurements

The chicken`s carcasses were divided into four treatment groups and control as following: The group-I was acts as control (3 carcasses), group -II (6 carcasses), group -III (6 carcasses) and group -IV (3 carcasses) were received treatment through dipped in 6 and 8% TSP solutions, 3 and 5% ginger extracts, and mix of TSP (6%) and ginger extract (3%) respectively for 15 min. at 18±2˚C.

After treatments, the carcasses were removed from the solutions, rinsed with sterile water to remove residual solutions, and drained for 5 -10 min. The carcasses were packed separately in sterile polyethylene bags and stored at 4±1˚C for 48 and 72 hrs. Measurements were taken before and post treatment at 0, 48 and 72 hrs. at 4±1˚C. The results were expressed as log cfu/ml of rinse.

Microbiological analysis

The microbial counts of the carcasses were assessed according to the (Roberts and Greenwood, 2003; Simmons et al., 2003). The carcass rinse method was used as technique for microbiological analysis. The technique in brief, carcasses were shaken for 1-2 min in 500 ml of sterile water in sterilized polyethylene bags (41×41 cm). Twenty-five ml of the rinsing solution was transferred to 225 ml of sterile buffered peptone water and shaken to homogenate carefully. A series of decimal dilutions were made with buffered peptone water from this solution, for the microbiological analysis.

Total bacteria counts

The total bacterial counts were determination by poured method and plate count agar (Himedia Laboratories Pvt. Ltd, India). One ml of the series of decimal dilutions was poured in petri dishes and molten media was added then incubated at 37˚C for 24±2 hrs. under aerobic conditions.

***Staphylococcus* counts**

Staphylococcus counts were determined as described above for total bacterial counts except that media culture were Baird-Parker Agar (Himedia Labs. Pvt. Ltd, India).

***Salmonella spp*. counts**

Salmonella count were determination by poured plate and decimal dilution using Selenite Cysteine Broth with sodium chloride solution (0.9%). 1 ml of decimal dilutions was poured in petri dishes and Salmonella and Shigella agar (SSA) was added (Himedia Labs. Pvt. Ltd, India). The petri dishes were incubated at 37˚C for 24±2 hrs. Colonies with black or black center were counts.

Estimate of microbial load reduction

Microbial counts were transformed to $\log_{10}$ cfu/ml values. The reduction of microbiological load was calculated according to following formula:

Reduction % ($\log_{10}$ cfu/ml) = $W_1 - W_2$

Where: W_1: microbial counts before treatment, W_2: microbial counts after treatment

Statistical Analysis

Microbial counts were transformed to $\log_{10}$ cfu/ml values. The data were subjected to analysis of variance with a confidence level of ($P < 0.05$) and expressed as the mean ± and standard deviation. The comparisons among mean values were carried out by using Duncan's comparison test. The SPSS Statistics Version 22.0 software was used for data analysis.

RESULTS AND DISCUSSION

Effect of TSP, GE and their mix on microbiological properties

Reduction of the microbial load in chicken meat

Table **1.** Shows the treatments results **of** raw whole chicken meat with TSP, GE, their mix and reduction of total bacterial counts of *Staphylococcus* and *Salmonella*.

The treatment of chicken meat with 8% TSP solution exhibited a significant reduction ($P \leq 0.05$) in total bacteria and *Staphylococcus* counts compared to other treated groups. The total bacterial counts (TBC) and *Staphylococcus* counts were reduced to 0.85 and 0.79 log cfu/ml respectively. The treatment with 6% TSP, 3 and

5% GE and their mix solution caused a reducing in the total bacterial counts and *Staphylococcus* counts. The TBC and *Staphylococcus* counts were reduced to 0.72, 0.17, 0.25, 0.78, 0.67, 0.18, 0.29 and 0.72 log cfu/ml in (6%) TSP, (3 and 5%) GE and their mix respectively.

Treatment of raw chicken carcasses at concentrations of 6 and 8% TSP and mix of GE +TSP showed a significant reduction ($P \leq 0.05$) on *Salmonella* counts compared to GE treated groups. These counts were reduced to 0.82, 1.05 and 0.89 log cfu/ml in (6 and 8%) TSP and mix of (GE +TSP), respectively, while they were reduced to 0.1 and 0.21 log cfu/ml in in group treated with 3 and 5% GE extract respectively.

The results of this study indicated that the treated groups with 8%TSP showed the highest reductions on *Salmonella* counts, TBC and *Staphylococcus* counts respectively. The effect of TSP may be due to its high pH (about11 -12) and ionic strength, which can influence the reduction in bacterial counts. The current results are in agreement either in complete or partially with findings of other workers in different geographical regions in the world for example: Lillard (1994; Lillard (1994) in USA; Sampathkumar et al., (2003) in Canada; Capita et al., (2002) in France; Bin Jasass (2008); Sudarshan et al., (2010; Capita et al., (2000); Abdeldaiem and Ali (2014); Hemmat et al., (2016); Singh, (2016); Selvan and Mendiratta (2019); Uysal et al., (2020);) who studied the effect of TSP, Ginger and their mixture in reduction of microbial load/counts of on *Salmonella and Staphylococcus* counts chicken meats in different concentrations and temperature conditions and reported TSP, Ginger and their mixture reduced significantly the total bacterial counts and Staphylococcus and *Salmonella* counts. However, the findings of present result disagreeing with findings of Hutton et al., (1991); Zingano and Aljami (2010). The contrary or consistent between current results and findings of above studies could be attributed to the period of dipping in treatments solutions, addition of salt to treatments solutions, pH, and processing techniques used.

Effects of treatments in microbial load of chicken meat during cold storage

Total bacterial count of chicken meat during cold storage

Table 2. Shows the results treatments of raw whole chicken meat with TSP, GE and their mix on total bacterial count during cold storage. The treatments at concentration of 8% TSP solution exhibited a significant reduction ($P \leq 0.05$) on total bacterial counts compared to control group. These counts were reduced to 3.35 and 3.45 log cfu/ml with 8%TSP solution; while the count in control was 4.32 and 4.36 log cfu/ml after 0 and 48 hrs. of storage at 4±1˚C, respectively. The treatments at concentrations of 6% TSP and the mix of (GE +TSP) showed a significant reduction ($P \leq 0.05$) in TBC in treated group compared to control group. These counts were reduced to 3.54 and 3.52 log cfu/ml TSP and mix of (GE +TSP) respectively, while the count in control was 4.32 log cfu/ml after 0 hrs. of storage at 4±1˚C.

Treatment of raw chicken carcasses with 6 and 8% TSP, 3 and 5% GE and their mix solutions resulted in a reduction in the total bacterial counts of treated groups compared to control. These counts were reduced to (3.71and 3.45), (4.41and 4.33) and (3.68) log cfu/ml, in treated group respectively, while the count in control 4.48 log cfu/ml after 72 hrs of storage at 4±1˚C. However, TBC were reduced to (3.69), (4.30 and 4.26) and (3.65) log cfu/ml in groups treated with (6%) TSP, (3 and 5%) GE and their mix, respectively, while in control was 4.36 log cfu/ml after 48 hrs of storage at 4±1˚C. in addition, the counts were reduced to 4.16 and 4.10 log cfu/ml in groups treated with (3 and 5%) GE solution respectively, after 0 hrs of storage. The higher reduction observed in the group treated with 8% TSP, this may due to the higher concentration used, period of storage and processing technique used.

Similar studied have been carried out on the treatments effect of TSP and GE on total microbial load of chicken meat during cold storage by many workers (Kim et al., (1994); Okolocha and Ellerbroek (2005); Capita et al (2000) ; Del Río et al., (2007); Abdeldaiem and Ali (2014); Khaled (2016); Abdel-Naeem et al., (2022) and researched to similar results. However, the results findings reported by Babatunde and Adewumi (2015) were in discrepancy with above mentioned findings. The reasons behind varying effects of TSP and GE on TBC could be attributed to several factors including contact time, TSP and ginger concentrations, application method, temperature, and exposure period of storage.

***Staphylococcus* count of chicken meat during cold storage**

The results in Table 3. Shows the effects of treatments by TSP, GE and their mix on *Staphylococcus* bacteria count of raw whole chicken meat during cold storage. The treatments with both (6 and 8%) TSP, (3and 5%) GE and their mix solution showed a reducing in *Staphylococcus* counts but not significant ($P<0.05$) compared to control group. These counts were reduced

from 3.75, 4.24 and 3.89 log cfu/ml in the control to (3.12 and 2.86), (3.55and 3.48) and (3.05), (3.49 and 3.12), (4.03and3.94), (3.48), (3.58 and 3.20), (3.77and 3.69) and (3.52) log cfu/ml in (6 and 8%) TSP, (3and 5%) GE and their mix after 0, 48 and 72 hrs of storage at 4±1˚C respectively.

These results indicated that the samples treated with (8%) TSP showed a highest reduction in the numbers of *Staphylococcus* after 48 hrs of storage at 4±1˚C. Similarly, Ledesma et al., (1996) studied the effect of TSP, GE and their mix on *Staphylococcus* bacteria count of chicken meat during storage on *Staphylococcus* counts and reported that the dipping of chicken wings in 10% TSP for 15 sec. at 10˚C caused a significant reduction on *Staphylococcus aureus* count by 80.33% and 54.45% respectively after overnight storage at 4 and 10˚C. Abdeldaiem and Ali, (2014) also reported that the treating of camel meat chunks with 30% ginger extract by spray caused a reducing in the *Staphylococcus aureus* count to 2.5 x 10^2 and 5.1x10^2 cfu/g, compared to control 5.1 x 10^2 and 2.4 x 10^3 cfu/g after 0 and 3 days of storage at 4±1˚C, respectively.

***Salmonella spp.* of chicken meat during cold storage.**

Table 4. Shows the results treatments of raw whole chicken meat by TSP, GE and their mix for reduction *Salmonella* count during cold storage. The treatment at concentration of 8% TSP solution showed a significant decrease ($P \leq 0.05$) in population of *Salmonella* compared to control group. These counts were reduced to 2.45 and 2.46 log cfu/ml; while, the count in control was 3.55 and 3.78 log cfu/ml after 0 and 72 hrs respectively of storage at 4±1˚C. There were no significant differences ($P<0.05$) in the population of *Salmonella* in chicken meat treated group with 8% TSP compared to the control after 48 hrs. of storage at 4±1˚C. This count was reduced from 3.8 log cfu/ml in the control to 2.69 log cfu/ml in 8% TSP treated group. The treatments at the concentrations of 6%TSP, 3 and 5% ginger and their mix exhibited reduction in *Salmonella* counts. These counts were reduced from 3.55, 3.8 and 3.78 log cfu/ml in control group while; 2.75, (3.48 and 3.4), (2.68), (3.09), (3.56 and 3.51), (3.01), (3.28), (3.64 and 3.54) and (3.17) log cfu/ml in groups treated with 6% TSP, 3 and 5%) ginger and their mix respectively after 0, 48 and 72 hrs of storage at 4±1˚C. The higher reduction of *Salmonella* in chicken meat treated group with 8% TSP may be attributable to the increased concentration of TSP used and the storage period.

In this context Kim et al., (1994) reported that the dipping of chicken carcasses inoculated with high levels of *salmonellae* in 10 % TSP solution at either 10 or 5˚C for 15 sec and stored for 6 days at 4˚C caused a significant reduction on *Salmonella* count by1.6 and 1.8 logs on day 1 and day 6 of cold storage respectively. They conclude that the difference in log reductions between the first day and the six days of storage may be due to the supports the residual effect of TSP on bacterial reduction during six-day storage at 4˚C. Fabrizio et al. (2002) reported that the reductions of *Salmonella typhimurium* were 0.9 log10 and 2.17 log10 cfu/ml at both 0 and 7 days of storage at 4˚C respectively, when half carcasses were spray washed with 10% TSP for 45 min (85 psi, 25˚C, 15 sec). Ledesma et al., (1996) reported that the dipping of chicken wings in 10% TSP for 15 sec at 10˚C showed a significant reduction on *Salmonella typhimurium* count by 93.45% and 62.42% after overnight storage at 4 and 10˚C, respectively.

Table 1. Effect of Trisodium phosphate, Ginger extract and their mix on microbial load reduction on chicken meat

Reduction(log cfu/ml)	TSP		Ginger		GE+ TSP
	6%	8%	3%	5%	3 %+6%
Total bacterial count	0.72 ± 0.41abc	0.85 ± 0.25c	0.17 ± 0.25 a	0.25 ± 0.34ab	0.78 ±0.17bc
Staphylococcus	0.67 ± 0.08ab	0.79 ± 0.55b	0.18 ± 0.08 a	0.29 ± 0.28ab	0. 72 ± 0.09ab
Salmonella	0.82 ±0.40b	1.05 ± 0.03b	0.10 ± 0.06 a	0.21 ± 0.01 a	0.89 ± 0.27b

**** Different letters mean significant differences within a column (P ≤ 0.05)***

Table 2. Effect of Trisodium phosphate, Ginger extract and their mix on total bacterial counts of chicken meat during storage

Treatments	Concentrations	Storage time (hrs.)		
		0	48	72
Control	-	4.32 ± 0.54 c	4.36 ± 0.19 b	4.48 ± 0.58 a
TSP	6%	3.54 ± 0.58 ab	3.69 ± 0.74 ab	3.71 ± 0.96 a
	8%	3.35 ± 0.21a	3.45 ± 0.22 a	3.45 ± 0.12 a
Ginger	3%	4.16 ± 0.19 bc	4.30 ± 0.1 b	4.41 ± 0.23 a
	5%	4.10 ± 0.33 abc	4.26 ± 0.48 b	4.33 ± 0.48 a
Mix	3% G + 6% TSP	3.52 ± 0.43 ab	3.65 ± 0.37 ab	3.68 ± 0.52 a

* Different letters mean significant differences within a column (P ≤ 0.05).

Table 3. Effect of Trisodium phosphate, Ginger and their mix on *Staphylococcus* bacteria counts of chicken meat during storage

Treatments	Concentrations	Storage time (hrs.)		
		0	48	72
Control	-	3.75 ± 0.22 a	4.24 ± 0.72 a	3.89 ± 0.95 a
TSP	**6%**	3.12 ± 0.19 a	3.49 ± 0.99 a	3.58 ± 1.23 a
	8%	2.86 ± 0.50 a	3.12 ± 0.55 a	3.20 ± 0.92 a
Ginger	**3%**	3.55 ± 0.57 a	4.03 ± 0.15 a	3.77 ± 0.4 a
	5%	3.48 ± 1.09 a	3.94 ± 0.57 a	3.69 ± 0.52 a
Mix	**3% G + 6% TSP**	3.05 ± 0.04 a	3.48 ± 0.07 a	3.52 ± 0.04 a

**** Different letters mean significant differences within a column (P ≤ 0.05).***

Table 4. Effect of Trisodium phosphate, Ginger and their mix on *Salmonella spp*. counts in chicken meat during storage

Treatments	Concentrations	Storage time (hrs.)		
		0	48	72
Control	**0.0**	3.55 ± 0.37 b	3.8 ± 089 a	3.78 ± 0.68 b
TSP	**6%**	2.75 ± 0.1 ab	3.09 ± 0.45 a	3.28 ± 0.36 ab
	8%	2.45 ± 0.32 a	2.69 ± 0.49 a	2.46 ± 0.7 a
Ginger	**3%**	3.48 ± 0.15 b	3.56 ± 0.15 a	3.64 ± 0.38 b
	5%	3.4 ± 1 b	3.51 ± 0.99 a	3.54 ± 0.58 ab
Mix	**3% G + 6%TSP**	2.68 ± 0.22 ab	3.01 ± 0.19 a	3.17 ± 0.75 ab

** Different letters mean significant differences within a column (P ≤ 0.05).*

CONCLUSIONS AND RECOMMENDATIONS

Trisodium phosphate, ginger, and Trisodium phosphate and ginger in combination at different concentration exhibited antibacterial activities in reduction of bacterial counts of chicken meat. Trisodium phosphate compound showed more efficacy compared to ginger extracts. The treatments of chicken meat with TSP, GE and their mix increased the shelf life of the meat. Further studies are needed to study the effect of other plants extract on microbiological properties of chicken meat.

ACKNOWLEDGEMENTS

The assistance and support offered during collection of samples by component authority at private automatic

poultry slaughter-house in Dhamar city, Yemen are acknowledged.

AUTHORS CONTRIBUTIONS

FMA and AMAl, both authors contributed equally on protocol proposal, collection, processing the specimen, analyzed, interpretation of data and wrote final version of Manuscript. Both Authors have approved this version of the manuscript.

CONFLICTS OF INTEREST

The author(s) declare no conflicts of interest with respect to the authorship and/or publication of this article.

DATA AVAILABILITY

The data are available within text of the article.

ETHICS APPROVAL

This study was conducted after approval from Faculty of Agriculture, Thamar University, Yemen.

FUNDING SOURCE

No funding.

REFERENCES

Abdeldaiem, MH and Ali HGM. 2014. Tenderization of camel meat by using fresh ginger (Zingiber officinale) extract. Food Science and Quality Management. 23.

Abdel-Naeem, HHS, Talaat MM, Imre K, Morar A, Herman V and El-Nawawi, FAM. 2022. Structural changes, electrophoretic pattern, and quality attributes of camel meat treated with fresh ginger extract and papain powder. Foods, 11, 1876.

Al-Maaqar, SM, Al-Johny, BO, AL-Kenani NA, Shater AM, Djadjiti N and Al-Shaeri MA 2023. Molecular and microbial identification of microbiota of processed chicken products: Mini review. Qeios ID: WU2L4F https://doi.org/10.32388/WU2L4F.

Babatunde, OA and Adewumi AO. 2015. Effect of ethanolic extract of garlic, roselle and ginger on quality attributes of chicken patties. Afr. J. Biotechnol, 14 (8): 688- 694.

Bhaisare, DB, Thyagarajan D, Churchil RR and Punniamurthy N. 2014. Bacterial pathogens in chicken meat: Review. Int. J. Life Sci. Res., 2(3): 1-7.

Bin Jasass, FM. 2008. Effectiveness of Trisodium phosphate, lactic acid and acetic acid in reduction of E. coli and microbial load on chicken surfaces. African Journal of Microbiology Research. 2: 050-055.

Bordoni, A, and Danesi F. 2017. Poultry meat nutritive value and human health. In Petracci, M., Berri, C. (Ed). Poultry quality evaluation: Quality attributes and consumer values. Woodhead Publishing.

Capita R, Alonso-Calleja C, Garcı´a-Arias MT, Moreno B and Garcı´a-Ferna´ndez MC. 2000. Effect of Trisodium phosphate on mesophilic and psychrsotrophic bacterial flora attached to chicken carcass skin during refrigerated storage. Food Science and Technology International 6: 345–350.

Capita, R, Alonso-Calleja, C, Garcia-Fernandez MC and Moreno B. 2002. Review: Trisodium phosphate (TSP) treatment for decontamination of poultry. F. Sci. Techno. lint.8:11-24.

Del Río, dE, Panizo-Morán M, Miguel Prieto, Alonso-Calleja C and Capita R. 2007. Effect of various chemical decontamination treatments on natural microflora and sensory characteristics of poultry. International Journal of Food Microbiology 115 .268–280.

Fabrizio, KA, Sharma RR, Demirci A and Cutter CN. 2002. Comparison of electrolyzed oxidizing water with various antimicrobial interventions to reduce Salmonella species on poultry. Poult. Sci. 81:1598-1605.

Federal Register. 1994. Use of Trisodium phosphate on raw chilled poultry carcasses. Fed. Regist. 59, 551–554.

Hemmat, MI, Reham AA, Zakaria IM and El -Sayed AA. 2016. Effect of some microbial decontaminators on chicken carcass. Benha veterinary medical journal 31, (2):181- 188.

Henchion, M, McCarthy M, Resconi VC and Troy D. 2014. Meat consumption: Trends and quality matters. Meat Science, 98(3), 561-568.

Hmiadei, MA, Ghani MF and Salh H. 2010. Effect of salt solutions and enzymic extracts on some quality characteristic of spent hens meat. Journal of Anbar Agricultural Sciences, 8: (4).

Hutton, MT, Koskinen MAA and Hanlin JH. 1991. Interacting effects of pH and NaCl on heat resistance of bacteria spores. J. Food Sci., 56: 821-824.

Indu, MN, Hatha AM, Abirosh C, Hasha U and Vivekanandan G. 2006. Antibacterial activity of some South-Indian spices against serotypes of Escherichia coli, Salmonella, Listeria monocytogenes and *Aeromonas hydrophila*. Brazil. J. Microbial., 37: 153-158.

Khaled, H. 2016. Study the effect of some pretreatments of refrigerated chicken carcasses on extension shelf life and some quality characteristics. Doctoral Dissertation, Damascus University, Syrian Arab Republic.

Kim, JW, Slavik MF, Pharr MD, Raben DP, Lobsinger CM and Tsai S. 1994. Reduction of Salmonella on post-chill chicken carcasses by Trisodium phosphate (Na_3PO_4) treatment. Journal of Food Safety 14: 9–17.

Ledesma, AM, Riemann HP and Farver TB. 1996. Short-time treatment with alkali and/or hot water to remove common pathogenic and spoilage bacteria from chicken wing skin. J Food Prot.59:746–750.

Lillard, HS. 1994. Effect of Trisodium phosphate on salmonellae attached to chicken skin. J. Food Prot,57:465–469.

Maharjan, S, Rayamajhee B, Chhetri VS, Sherchan SP, Panta OP and Karki TB. 2019. Microbial quality of poultry meat in an ISO 22000: 2005 certified poultry processing plant of Kathmandu valley. International Journal of Food Contamination 6:8.

Nychas, GJE and Skandamis PN. 2003. Antimicrobials from herbs and spices. In: Roller, S. (ed.), Natural Antimicrobials for the Minimal Processing of Foods. CRC, New York.

OECD/FAO. 2021. OECD-FAO Agricultural Outlook 2021-2030.OECD Publishing, Paris.

Okolocha, EC and Ellerbroek L. 2005. The influence of acid and alkaline treatments on pathogens and the shelf life of poultry meat. Food Control 16 .217–225.

Park, M, Bae J and Lee DS. 2008. Antibacterial activity of [10]-gingerol and [12]-gingerol isolated from ginger rhizome against periodontal bacteria. Phytother. Res. 22, 1446–1449.

Petracci, M. 2022. Current meat quality challenges for the poultry industry –a review. Animal Science Papers and Reports. 40(3): 253-261.

Roberts, D and Greenwood M. 2003. Practical food microbiology, third edition. Blackwell Publishing Ltd., Massachusetts-USA.

Sampathkumar, B, Khachatourians GG and Korber DR. 2003. High pH during Trisodium phosphate treatment causes membrane damage and destruction of Salmonella enterica Serovar enteritidis. Appl Environ Microbiol; 69:122–129.

Sa-Nguanpuag, KK, Srilaong S, Tanprasert, V and Techavuthiporn C. 2011. Ginger (Zingiber officinale) oil as an antimicrobial agent for minimally processed produce: A case study in shrsedded green papaya. Int. J. Agric. Biol., 13, 895–901.

Selvan, P. and Mendiratta S K.2019. Effect of chemical decontamination on quality of buffalo liver. International Journal of Current Microbiology and Applied Sciences.2729-2742.

Shaltout, FA, Edris SN, Nabil ME and Taha ST. 2023. Bacteriological assessment of some raw, chilled chicken meat cuts in Benha City. Biomed J Sci and Tech Res | BJSTR.MS.ID.008286.

Simmons, M, Fletcheret DL, Berrang ME and Cason JA. 2003. Comparison of sampling methods for the detection of Salmonella on whole broiler carcasses purchased from retail outlets. J. Food Prot. 66(10).

Singh, G, Kapoor IPS, Singh P, de Heluani CS, de Lampasona MP and Catalan CAN. 2008. Chemistry, antioxidant and antimicrobial investigations on essential oil and oleoresins of Zingiber officinale. Food and Chemical Toxicology 46 ,3295–3302.

Singh, P. 2016. Combination of physical and chemical interventions for reduction of loosely and tightly associated bacteria on broiler carcass skin. Doctoral thesis. Michigan State University.

Sudarshan, S, Nadeem FS, Wilfred SR, Shekher RB and Rahunath BV. 2010. Effect aqueous extract and essential oils of ginger and garlic as decontamination in chicken meat. Research Journal of Poultry Sciences 3 (3): 58- 61.

Tahir, MA, Park SH, Anwar MI, Bilal RM, Hussain K, Abbas A., Rehman A. Ghumman NZ, Muneeb M, Mushtaq F, Sugiharto S and Raza MA. 2024. Foodborne pathogens in poultry: a public health concern. International Journal of Agriculture and Biosciences· DOI: 10.47278/book.zoon/2023.034.

Uysal, İA, İncili, GK, Çakmak Ö and Çalicioğlu M. 2020. Effect of in-bag carcass decontamination method on shelf life of whole chicken carcasses packaged in plastic bags. Turkish Journal of Veterinary and Animal Sciences.44:688-694.

Wang, K, Li Y and Sun J. 2023. Quality improvement and comprehensive utilization of abnormal broiler breast meat: A review. Food Materials Research 3:1 https://doi.org/10.48130/FMR-2023-0001.

Zangana, BSR and Aljami, SM.K. 2010. Improving the quality qualitative, sensory and microbial properties of slices spent hens breast using ginger solutions. Euphrsates Journal of Agricultural Science, 2 (4): 239-253.

تأثير مستخلص الزنجبيل والبولي فوسفات على الخواص الميكروبيولوجية للحوم الدواجن

فايز مرشد قايد الطويل، امين محمد احمد الواسعي*
قسم التقانة الحيوية وتكنولوجيا الأغذية، كلية الزراعة، جامعة ذمار.
***للمراسلة:** amin.alwaseai@tu.edu.ye*

الملخص

هدفت الدراسة إلى تقييم تأثير المعاملات بثلاثي فوسفات الصوديوم (Trisodium Phosphate) ومستخلص جذور الزنجبيل الطازج (Fresh Ginger Rhizome Extract)ومزيجهما على بعض الخواص المكروبيولوجية (Total bacterial count, *Staphylococcus* and *Salmonella* counts) للحوم الدجاج. تم جمع عينات ذبائح الدجاج من خط الانتاج بعد مرحلة نزع الأحشاء وقبل دخولها إلى حوض التبريد بالماء. قسمت ذبائح الدجاج الى أربع مجموعات: شملت مجموعة السيطرة (الأولى) وثلاث مجموعات معالجة (الثانية، الثالث، والرابعة)، تضمنت الأولى 3 ذبائح، والثانية والثالثة والرابعة على 6 و6 و3 ذبيحة على التوالي. تم معاملة ذبائح الدجاج (مجموعات المعالجة) بالغمر في محاليل تحتوي على 3% و5% من مستخلص الزنجبيل (GE) و6% و8% من ثلاثي فوسفات الصوديوم (TSP) ومزيجهما (6% TSP +3% GE) لمدة 15 دقيقة عند درجة حرارة 18±2م. تم إجراء العد الميكروبي لذبائح الدجاج قبل وبعد المعاملات وأثناء التخزين بالتبريد عند 4±1م بعد 48 و72 ساعة. أظهرت النتائج حدوث انخفاض معنوي(P<0.05) في أعداد البكتيريا الكلية والمكورات العنقودية (*Staphylococcus* count, total bacterial count) بمقدار 0.85 و0.79 (لو خلية/مل) في العينات المعاملة بـ 8% TSP، بينما المعاملة بـ 6% و8% TSP ومزيج من (3%GE +6% TSP) أدت الى انخفاض معنوي في أعداد السالمونيلا (*Salmonella* count) بمقدار 0.82 و1.05 و0.89 (لو خلية/مل) على التوالي. كما أشارت نتائج دراسة التغير في الحمل الميكروبي في لحوم الدجاج خلال الخزن بالتبريد إلى أن المعاملة بـ 8% TSP أدت إلى انخفاض معنوي في أعداد البكتيريا الكلية بمقدار 3.45 (لو خلية/مل) مقارنة بعينة السيطرة التي كانت 4.36 (لو خلية/مل) بعد 48 ساعة من التخزين عند 4 ±1م، بينما انخفض عدد السالمونيلا معنويا بمقدار 2.46 (لو خلية/مل) مقارنة بعينة السيطرة التي كانت 3.78 (لو خلية/مل) بعد 72 ساعة من التخزين عند 4±1م. خلصت هذه الدراسة الى ان فوسفات ثلاثي الصوديوم والزنجبيل وفوسفات ثلاثي الصوديوم والزنجبيل معا بتركيزات مختلفة، أظهرت فعالية في خفض أعداد السالمونيلا والعدد الكلي للبكتيريا وأعداد المكورات العنقودية، كما أدت إلى تحسين الجودة الميكروبيولوجية للحوم الدجاج خلال فترة الخزن بالتبريد، اظهرت فوسفات ثلاثي الصوديوم أكثر فعالية مقارنة بالمعاملات الأخرى التي استخدمت في هذه الدراسة. يوصى بأجراء المزيد من الدراسات، لدراسة تأثير المستخلصات النباتية الأخرى على الخصائص الميكروبيولوجية للحوم الدجاج.

الكلمات المفتاحية: لحوم الدواجن، مستخلص الزنجبيل، الخواص الميكروبيولوجية، البولي فوسفات.

To cite this article: Al-Taweel, FM and Alwaseai AM. 2024. Effect of Ginger Extract and Polyphosphate on Microbiological Properties of Chicken Meat. Yemeni Journal of Agriculture and Veterinary Sciences; 5(2):23-31.