EFFICACY OF DIFFERENT ANTIMICROBIALS TREATMENT ON CHICKEN CARCASS DECONTAMINATION

Ennet Moholisa[1*], Itumeleng Matle[2], Prudence L. Seema[1, 3], Andrew D. Clarke[4]

[1] Agricultural Research Council- Animal Production, Pretoria, South Africa.

[2] Agricultural Research Council- Onderstepoort Veterinary Research, Pretoria, South Africa

[3] University of Venda, Thohoyandou, South Africa

[4] University of Missouri, Columbia, USA

*Corresponding author email: Moholisae1@arc.agric.za

I. INTRODUCTION

During poultry slaughtering carcasses are washed with water on the slaughter floor, under pressure, after weighing and before chilling to minimize microbial contamination. Various chemical agents are added to the final rinse and have been used as antimicrobials for carcasses decontamination over the years [1,2]. These include short chain organic acids, chlorine washes, tri-sodium salts, etc. However, the efficacy of these antimicrobials is still inconclusive [1]. It depends on several factors such as concentration and contact time of antimicrobial solution with chicken samples, the level of attachment of bacterial infection on the chicken skin, method and technology used [3,4]. Hence the aim of this study was to determine the effectiveness of chlorine bleach, tri-sodium citrate, lactic acid, and acetic acid on the microbial populations on chicken carcasses decontamination. These antimicrobials are affordable, and easily accessible to be used by small scale poultry farmers who have limited knowledge and technology.

II. MATERIALS AND METHODS

Chickens were slaughtered at the mobile abattoir owned by small-scale poultry farmer. Ten chicken carcasses were collected immediately after the last rinse that was free of standard decontamination chemical. All chicken carcasses were individually placed in ziploc bags, placed into cooler boxes filled with ice and immediately transported to the Onderstepoort Veterinary Research bacteriology laboratory for microbial analysis. The consensus of the research is that carcass decontamination can reduce the initial levels of bacteria on the surface of the carcasses [1]. Therefore, the chicken skin was used for this experiment. Upon arrival of the chicken carcasses in the laboratory, the skin was removed aseptically from different parts of each of ten broiler carcasses. It was cut into small pieces with sterile scissors. Twenty-five (25) grams of each sample was added into 225 mL of sterile buffered peptone water and four different treatment solutions which included i) Chlorine bleach (0.005 %), ii) Trisodium citrate (2.0 %), iii) Lactic acid (2.0 %), and iv) White vinegar (5.0 % acetic acid) and homogenized in a stomach bag for one minute at speed 6. Further tenfold serial dilutions were made with sterile buffered peptone water. Duplicate plates were made for each sample at each dilution under ISO 6887–1: 2017 standard methods and incubated at 37 °C for 24hrs. Aerobic bacteria were enumerated and expressed as Colony-Forming Units per gram (cfu/g). The mean microbial counts were converted into base-10 logarithms of cfu/g. All data were subjected to an analysis of variance (ANOVA) to test for significant treatment effects using GenStat for Windows 22nd Edition [5]. Fisher's protected t-LSD (Least Significant Difference) was calculated to compare means of significant effects at the 5% level.

III. RESULTS AND DISCUSSION

The results of microbial loads expressed as log cfu/g are presented on Figure 1. Acetic acid treatment had the lowest ($P<0.001$) aerobic plate counts compared to other antimicrobials used in the study. Chlorine bleach, trisodium and lactic acid treatments had the highest bacterial counts (4 log cfu/g),

however the counts were still within the acceptable upper limits of 6 log cfu/g in foodstuffs, according to the South African regulations governing microbiological standards and food stuffs and related matters, Government notice, No. R.692 [6]. Although the concentrations and contact time of the sample with antimicrobial used in this study have been proposed, tested and approved for their use in decontamination systems [2], it is hard to make a direct comparison in concentrations or time. However, it would be assumed that the 5 % acetic acid was more effective in reducing microbial populations than other antimicrobials with lower concentrations within the experiment dimensions. In poultry carcasses decontamination, the amount of concentration and contact time of antimicrobial solution with chicken samples determines the effectiveness of the disinfectant [3,4].

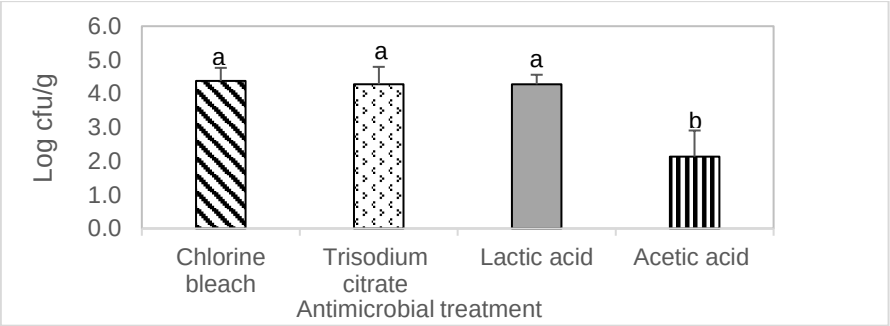

Figure 1. Total Aerobic Plate Counts of each sample expressed as log cfu/g

Means with different superscripts in the same row differ significantly (P<0.05).

IV. CONCLUSION

It is concluded that white vinegar (5% acetic acid) is an effective disinfectant and can be used as an alternative antimicrobial to a well known antimicrobials (chlorinated water, acetic acid and tri-sodium salts) for reduction of the bacterial population of poultry carcasses. Its effectiveness, affordability and accessibility makes it a better preservative for chicken, especially for small scale farmers with limited knowledge and technology in the application of these antimicrobials. However, further studies should be done to ascertain its effectiveness on specific micro-organims commonly associated with fresh chicken.

ACKNOWLEDGEMENTS

United States Department of Agriculture-Foreign Agricultural Services Borlaug fellowship and the University of Missouri's College of Agriculture, Food and Natural Resources (MU-CAFNR) International Programs for financial support. ARC-Biometry for statistical analysis.

REFERENCES

1. Dickson, J. S.; Anderson, M. E. (1992) Microbiological decontamination of food animal carcasses by washing and sanitizing systems: A Review. Journal of Food Protection 55:133-140.
2. Sallam, K. I.; Abd-Elghany, S. M.; Hussein, M. A.; Morar, A.; Morshdy, A. E.; Sayed-Ahmed, M. Z. (2020) Microbial decontamination of beef carcass surfaces by lactic acid, acetic acid, and trisodium phosphate sprays. Biomedical Research International: 2324358, 1-11.
3. Duan, D.; Wang, H.; Xue, S.; Li, M.; Xu, X. (2016). Application of disinfectant sprays after chilling to reduce the initial microbial load and extend the shelf life of chilled chicken carcasses. Journal of Food Sciences: 10: 225 – 368.
4. Zhang, L.; Morey, A.; Bilgili, S. F.; McKee, S. R.; Garner, L. J. (2019). Effectiveness of several antimicrobials and the effect of contact time reducing Salmonella and Campylobacter on poultry drumsticks. Journal of Applied Poultry Research: 28:1143–1149.
5. VSN International. (2022). Genstat for Windows (22nd Edition). VSN international, Hemel Hempstead, UK.
6. Government notice, No. R.692. (1997). Regulations governing microbiological standards and food stuffs and related matters. South Africa. https://www.ehrn.co.za/download/reg_micro.pdf.