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Effect of turmeric powder on decontamination of broiler chicken carcass

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Abstract

Meat-born zoonotic disease is always considered inscrutable for human beings mostly transmitted through the consumption of meat obtained from infected animals or contaminated meat handling or processing. Broiler carcasses can be contaminated during the slaughter process, and along with traditional water washing, decontamination techniques must be adopted to preserve meat safely and maintain quality. The present study aimed to evaluate the effect of turmeric powder on microbial counts in broiler chicken carcasses. The freshly slaughtered broiler carcasses were divided into three groups: Group A (control), Group B and Group C. The group A (control) samples were kept without any preservatives, the group B samples were treated with turmeric powder (1.5%) for 1 minute and group C samples were treated with turmeric powder (1.5%) for 5 minutes. The total plate count, coliform count, *Salmonella*, *E. coli*, yeast, and mould counts were assessed in all groups. The results of the study showed a significant reduction in bacterial counts in the turmeric-treated broiler carcasses, with the reduction being higher in Group C than in Group B. Furthermore, sensory analysis revealed a significant increase in flavor scores for Groups B and C compared to the control group. However, the appearance/colour, juiciness, tenderness, and overall acceptability scores were not influenced by the treatment. To reduce microbial contamination in broiler chicken carcasses, turmeric (*Curcuma longa*) powder (1.5%) with a minimum contact time of 5 minutes was found to be effective.

Keywords: Chicken carcass, turmeric, microbial quality, sensory quality

Introduction

Poultry production is one of the fastest-growing livestock subsectors, and poultry is among the world's primary sources of animal protein. Broiler chicken meat is highly digestible (71.26%), has more biological value (79.00%) and is very well recognized nutritious food due to its essential amino acid content, B - complex vitamins and important minerals but low in fat (<2%) and calories (141kcal/g) (Muthulakshmi, 2022) [17]. In most small-scale poultry processing in India, slaughter is carried out manually using simple tools. After being killed, birds are scalded in hot water and then plucked and eviscerated, mostly by hand. The meat may then be sold dressed (slaughtered, bled and plucked); eviscerated and ready to cook; in poultry parts (legs, wings, etc.); or deboned (muscle, fat and skin only).

Broiler carcasses can become contaminated during the slaughter process. Consumption of contaminated meat can lead to human disease outbreaks caused by zoonotic pathogens such as *Salmonella*, *Campylobacter* spp., and *Listeria*. Meatborne zoonotic diseases may arise from meat obtained from infected animals or from meat contaminated during handling or processing. Decontamination is the technique or process of removing, inactivating or killing pathogens to make an environment clean and safe (Fraise *et al.*, 2008; Godbey, 2014; McDonnell, 2017) [9,11,16]. Washing with water is routinely used in meat processing plants and has been shown to be effective in removing visible contaminants such as soil, feathers, and other debris. The decontamination of meat and poultry carcasses can help to reduce human foodborne infections. However, process hygiene to prevent contamination should never be neglected. Many studies have been conducted on decontamination practices at different stages

of slaughterhouse processes to extend the shelf life of poultry meat and to inactivate pathogenic microorganisms such as *Salmonella spp.* and *C. jejuni* [Del Río 2007; Bolder 1997; Dinçer and Baysal 2004; Northcutt 2007; Smulders and Greer, 1998 and Loretz 2010] [6, 5, 7, 18, 20, 13].

Decontaminants like chlorinated water, lactic acid, etc. employed to minimize the microbial load. Consequently, routine chemical preservatives (sodium benzoate, potassium nitrite, sodium nitrite, sulphur dioxide, erythorbic acid, calcium sorbate) used to control microorganisms leave drug residues that lead to antimicrobial resistance in humans. In recent years, the market trend has changed dramatically as per the consumer's perception and acceptance of natural alternatives over synthetic ones. Turmeric is extensively used as a preservative in food (Shahidi and Ambigaipala, 2015) [19]. The active principle in turmeric powder is

Curcuminoids, Curcumin, Demethoxycurcumin etc., and acts as Antimicrobial, Antioxidant and Anti carcinogenic. (Gupta and Sadhana, 2005 and Mansouri *et al.* 2020) [12, 15]. This study aimed to assess the effect of turmeric powder on reducing microbial counts in broiler chicken carcasses.

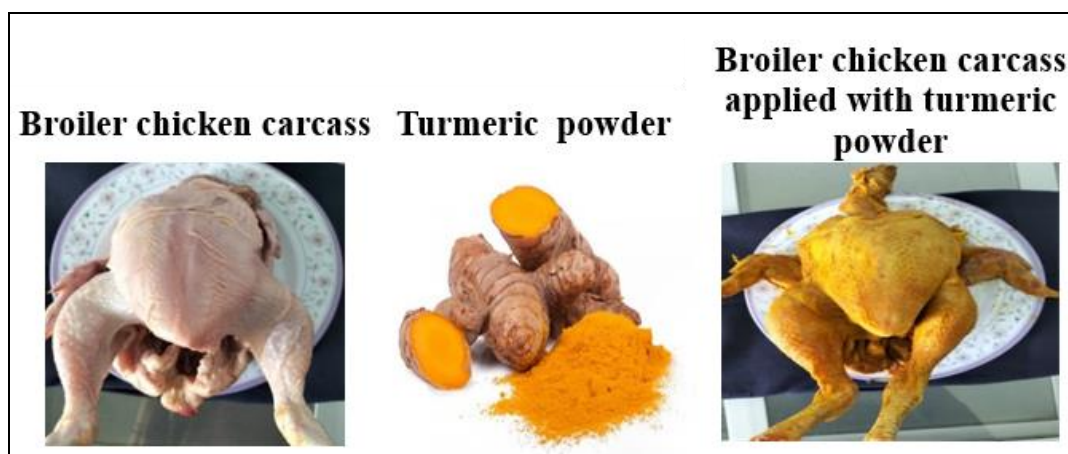
Materials and Methods

Freshly slaughtered broiler carcasses were divided into three groups. The treatment groups were subjected to surface application of 1.5% turmeric powder, with contact times of either 1 minute or 5 minutes. Microbial quality was evaluated by assessing total plate count, coliform count, *Salmonella*, *E. coli* and yeast and mould counts. Additionally, the sensory qualities of the treated samples were analyzed.

Experimental design

Group	Treatments
Group - A	Broiler chicken carcass was collected and kept without any preservatives. (Control)
Group - B	Broiler chicken carcass treated with turmeric powder (1.5%) for 1 minute
Group - C	Broiler chicken carcass treated with turmeric powder (1.5%) for 5 minutes

(Sample size, n = 6)



Results and Discussion

The microbial quality of control and treated broiler chicken carcasses is shown in Figure 1. There was a significant reduction in microbial counts in the decontaminated samples, with Group C showing the highest reduction. The mean total plate count for Group A (Control), Group B (1 minute) and Group C (5 minutes) was 4.28 ± 0.04 , 3.89 ± 0.02 and 3.15 ± 0.10 , respectively. The mean coliform count for Group A (Control), Group B (1 minute) and Group C (5 minutes) was 2.20 ± 0.06 , 1.85 ± 0.09 and 1.55 ± 0.04 , respectively. The mean yeast and mould count for Group A (Control), Group B (1 minute) and Group C (5 minutes) was 2.60 ± 0.09 , 1.46 ± 0.06 and 1.26 ± 0.06 , respectively. *Salmonella* and *E. coli* were not detected in any of the samples.

The results of the present study are in agreement with Arshad *et al.* (2019) [3], who reported that decontaminating chicken meat with 3% turmeric powder significantly reduced microbial counts. However, their study indicated that complete decontamination of coliforms was achieved with a dose of 1 kGy + TP and 2 kGy + TP during all storage intervals (0, 7, and 14 days) in both aerobic and vacuum

packaging. Similar results were reported by Febrianta *et al.* (2021) [8], who stated that chicken breast marinated with 7.5% microencapsulated turmeric extract could extend the shelf life to 9 days at refrigeration temperatures. Madushanka *et al.* (2018) [14] concluded that natural compounds (nutmeg, mace, and cardamom) and organic acids (acetic, citric, and lactic) have antibacterial effects on *S. typhimurium*, making them suitable for poultry meat decontamination. These natural compounds were found to be more effective at destroying *S. typhimurium* compared to chemical compounds. Another study by Ayari *et al.* (2016) [4] demonstrated that combined treatments using bioactive compounds (cinnamaldehyde + ascorbic acid (0.5%, w/w), cinnamaldehyde (1.47%, w/w), or cinnamaldehyde + sodium pyrophosphate decahydrate (0.1%, w/w)) and irradiation significantly reduced the microbial load in meat samples compared to untreated control samples. Present results also agree with those of Aksoy *et al.* (2009) [1], who reported that sumac and hibiscus infusions, as well as thyme and clove hydrodistillates, were effective natural herbal sources for decontamination and extending the shelf life of poultry meat, serving as alternatives to chemical agents.

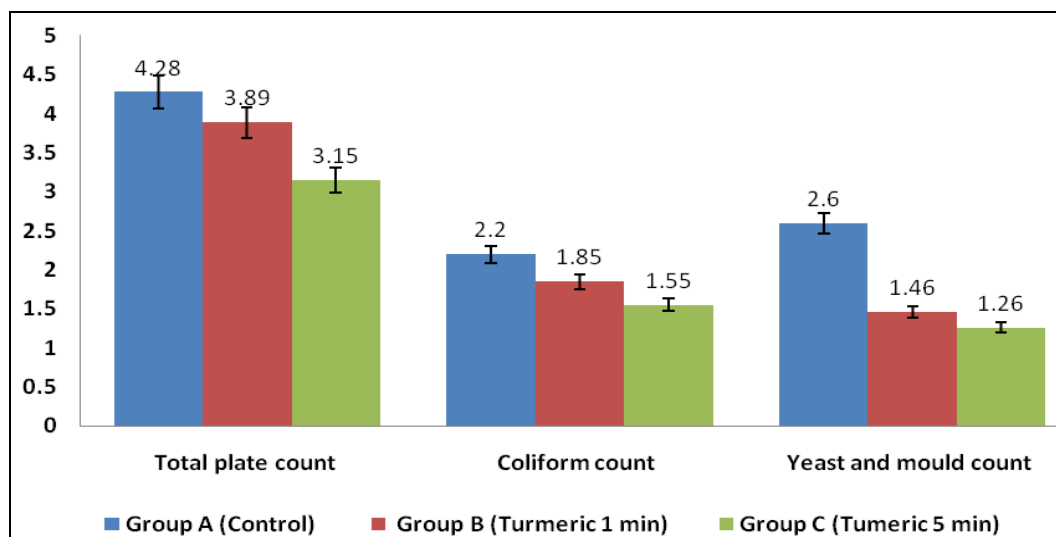


Fig 1: Effect of turmeric powder (1.5%) on the microbial quality of broiler chicken carcass (CFU/cm²)

The sensory qualities of control and treated broiler chicken carcasses are shown in Figure 1. The sensory analysis revealed a significant increase in the flavor scores of treated samples compared to the control samples. However, the appearance/colour, juiciness, tenderness, and overall acceptability scores were not significantly affected by the treatment in any of the groups. The findings of this study correlate with Arshad *et al.* (2019) [3], who reported that in decontamination, overall acceptability scores were higher for turmeric-treated samples than for samples treated with a combination of gamma irradiation and turmeric. Furthermore, Febrianta *et al.* (2021) [8] concluded that chicken breast

marinated with 7.5% microencapsulated turmeric extract exhibited better physico-chemical, antioxidant, microbiological, and sensory properties. Jumayi *et al.* (2022) [2] investigated the potential radical scavenging and antioxidant activities (DPPH and ABTS) of several plant aqueous extracts (*Curcuma longa*, CL; *Myristica fragrans*, MF; *Zingiber officinale*, ZO; *Cymbopogon citratus*, CC; and *Thymus vulgaris*, TV) as well as their mixtures. The results indicated that these plant extracts may be effective against rancidity and could serve as natural antioxidants to prolong the shelf life of cold-stored rabbit meat.

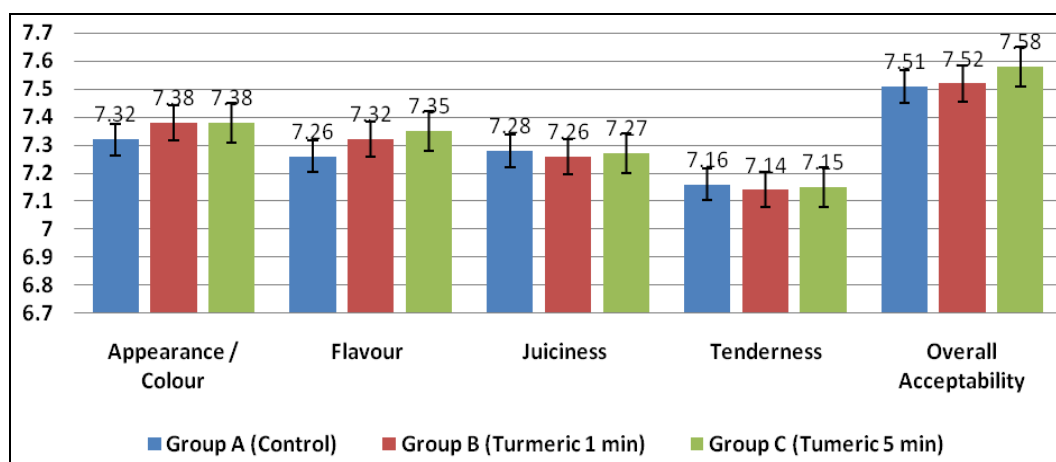


Fig 2: Effect of turmeric powder (1.5%) on the sensory quality of broiler chicken carcass

Conclusion

In order to reduce microbial contamination as well as chemical residues due to chemical decontamination in broiler chicken meat, the application of turmeric (*Curcuma longa*) powder (1.5%) with a minimum contact time of 5 minutes was found to be effective. Lower microbial counts were observed on decontaminated samples. Present research findings will be useful for retail broiler chicken shop.

Conflict of Interest

Not available

Financial Support

Not available

Reference

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