

Effectiveness of Immersion Treatments with Hydrogen Peroxide in Reducing Microbial Populations on Raw Chicken Carcasses

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Abstract: Poultry is an integral part of food chain, but it may constitute specific problems to public health. Therefore, the current trial was carried out to improve the sanitary status of broiler carcasses throughout application of food grade hydrogen peroxide (H_2O_2) to the chillers used in refrigeration of chicken carcasses prior to its packaging. Total colony count, mould and yeast count, coliform count and *Staph. aureus* counts were determined with and without addition of hydrogen peroxide to chillers water and the reduction percent in the microbial counts were detected. It was concluded that hydrogen peroxide Results indicate superior activity of hydrogen peroxide as a powerful and versatile sanitizer for poultry carcass.

Key words: Hydrogen peroxide · Chicken · Quality · Sanitation

INTRODUCTION

Although poultry constitutes an excellent source of high quality, easily digested animal protein, it is liable to transmit different types of potential pathogens to consumers [1].

The sanitary evaluation of slaughtered birds is based mainly on microbial findings and level of contamination. Many investigations proved that, more than 70% of poultry carcasses are contaminated and the microbial count being more than 300,000 CFU/ml [2].

Many attempts were applied to reduce the microbial contamination of poultry carcasses through using variable chemicals like acetic acid (2.5%), Trisodium phosphate (8%) and/or sodium hypochlorite (800 pm) which resulted in significant reduction in the number of microorganisms [3].

Hydrogen peroxide (H_2O_2) is a colourless aqueous solution, it has the same chemical structure of water, but with extra oxygen molecule, it acts as powerful effective and safe oxidant [4]. H_2O_2 is highly unstable and breaks down into water and single oxygen molecule, oxygen is stable only when the molecules are pairs (O_2). A single oxygen molecule is a strong oxidizing and disinfecting agents [5].

Merck's index [6] indicates that H_2O_2 can be used as water disinfectant which is stronger than chlorine, chlorine dioxide and potassium permanganate.

FDA [7] approved hydrogen peroxide for a septic packaging in the food industry.

Food grade H_2O_2 are widely used (30 ppm) in drinking water in animal and poultry farms in order to reduce the bacterial load. Moreover, H_2O_2 was found to be very beneficial for increasing weight gain using less feed [8].

This trial was applied to assess the effectiveness of H_2O_2 (food grade) in reducing the microbial load on fresh broiler carcasses.

MATERIALS AND METHODS

A total number of 100 broilers carcasses from an automatic poultry slaughter plant in Sharkia, Egypt was taken from one batch (The same flock) And it was expected to have a high degree of similarity after complete preparation (Slaughtering-scalding-defeathering-evisceration) and just before placing in the chillers. Fifty carcasses were placed in the ordinary chiller containing cold water for 60 min (Group A), while the other 50 were placed in another similar chiller containing aqueous solution of 0.1% hydrogen peroxide for the same previous time (Group B).

Preparation of Samples According to Technique Recommended by A.P.H.A. [9]: From each carcass in the two groups, a swab was taken from a limited area (10 cm²) at the surface of the breast region. The swab was

returned into sterile test tubes containing 10 ml of 0.1% sterile peptone water, tubes were identified, kept cold within an insulated container and transferred rapidly to the laboratory under possible aseptic condition, whereas they were subjected to the standard bacteriological examination.

Bacteriological Examination: From each tube and after thorough mixing, ten-fold serial dilutions were prepared, each prepared sample was examined for enumeration of microorganisms on each carcass surface as follow:

Total Colony Count (T.C.C): 0.1 mL from each dilution was evenly spread over the dry surface of standard plate count agar using a sterile bent glass spreader. Only plates contain 30-300 colonies were counted as the total colony per gram of sample according to "APHA" [9].

Total Mould and Yeast Count: 1 mL of each dilution was mixed thoroughly with milted sabaroud dextrose agar at 45°C, after solidification, the plates were incubated at 25°C and examined after 3, 5 days as the yeasts and moulds were counted separately according to "ICMSF" [10].

Coliform Count: Using most probable number technique (MPN) technique according to ICMSF [10].

Staph. Aureus Count: A loopful from each previously prepared serial dilutions was spread over the dry surface of Baird parker agar incubated at 37°C for 48 hours. Plates showing black colonies surrounded by a clear zone were recorded according to APHA [10].

Data were computed and statistically analyzed using least significant different (LSD) [11].

RESULTS

Table 1 shows highly significant reduction in the numbers of total colony count, coliform count and *Staphylococcus aureus* count and non significant decrease in the total mould and yeast count in comparison with the untreated ones.

Table 2 illustrate a very high reduction percent in the T.C.C., coliform count and *Staph. aureus* count and little reduction in the total mould and yeast count as a result of addition of hydrogen peroxide into the water used for chilling broiler carcasses.

Table 1: Surface microbial count of treated and untreated broiler carcasses with hydrogen peroxide 0.1%

	Statistical analysis	Untreated broiler carcasses	Carcasses treated with hydrogen peroxide 0.1%
T.C.C.	Min.	1.8 x 10 ⁴	0.3 x 10 ³
	Max.	3.4 x 10 ⁵	1.5 x 10 ⁴
	Mean	2.3 x 10 ⁵	1.2 x 10 ^{3**}
	± S.E.	± 0.4 x 10 ⁵	± 0.76 x 10 ⁶
Total mould yeast count	Min.	0.7 x 10 ²	0.7 x 10 ²
	Max.	0.7 x 10 ⁶	8.1 x 10 ³
	Mean	2.1 x 10 ³	1.9 x 10 ^{3NS}
	± S.E.	± 0.16 x 10 ⁵	± 0.09 x 10 ³
Coliform count MPN	Min.	0.3 x 10 ³	0.4 x 10 ²
	Max.	0.8 x 10 ⁵	1.9 x 10 ⁴
	Mean	4.3 x 10 ⁴	5.9 x 10 ^{3**}
	± S.E.	± 0.11 x 10 ³	± 0.15 x 10 ³
<i>Staph. aureus</i> count	Min.	0.4 x 10 ⁴	0.1 x 10 ³
	Max.	0.6 x 10 ⁶	0.2 x 10 ⁴
	Mean	8.1 x 10 ³	4.1 x 10 ^{2**}
	± S.E.	± 0.19 x 10 ⁴	± 0.41 x 10 ³

** Highly significant (P<0.01)

NS not significant

Table 2: Mean reduction of surface microbial count of treated carcasses (Group B) from untreated carcasses (Group A)

	T.C.C.	T. mould, yeast count	Coliform count MPN	<i>Staph. aureus</i> count
Group (A)	2.3 x 10 ⁵ ± 0.4 x 10 ⁵	2.1 x 10 ³ ± 0.16 x 10 ⁵	4.3 x 10 ⁴ ± 0.11 x 10 ³	8.1 x 10 ³ ± 0.19 x 10 ⁴
Group (B)	1.2 x 10 ³ ± 0.76 x 10 ³	1.9 x 10 ³ ± 0.09 x 10 ³	5.9 x 10 ³ ± 0.15 x 10 ³	4.1 x 10 ² ± 0.49 x 10 ³
Reduction percentage	97.30%	9.53%	86.3%	94.9%
Mean reduction %			72.01%	

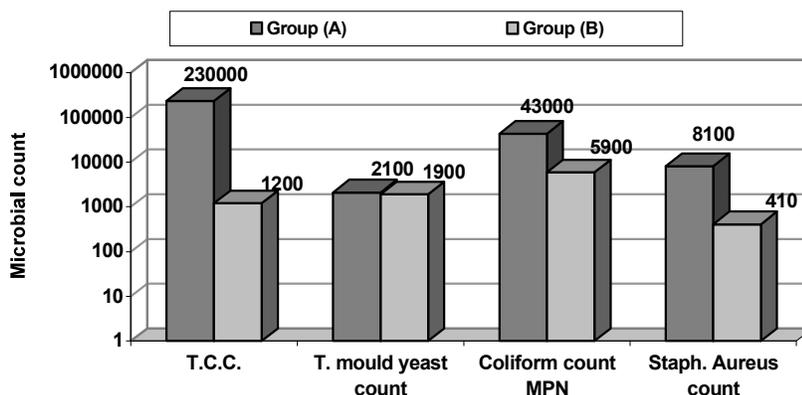


Fig. 1: Mean reduction of surface microbial count of treated carcasses (Group B) from untreated carcasses (Group A)

Fig. 1 shows the high level of contamination in untreated carcasses comparing with the reduced level of contamination after application of hydrogen peroxide.

DISCUSSION

Results presented in Table 1 clearly revealed a highly significant decrease in the total colony count, coliform count and total *Staphylococcus aureus* count on the carcasses treated with 0.1% hydrogen peroxide in comparison with the untreated ones which clearly prove the efficient effect of adding hydrogen peroxide to the water used for carcasses chilling for reducing the level of bacterial contamination. On the other hand, there is a limited effect on the reduction of mould and yeast count.

The results in Table 2 show that using hydrogen peroxide remove 97.30% from the total bacteria contaminating broiler carcasses and 86.3% of coliform and 94.9% from *Staphylococcus aureus* and only 9.53% of mould and yeast. As general, hydrogen peroxide can reduced 72.01% from the all microorganisms contaminating broiler carcasses in addition to its harmless effect as hydrogen peroxide breaks down in the chiller water producing water and free oxygen which is powerful oxidizing agent that have a great effect in killing the microorganisms.

The study prove that the use of hydrogen peroxide in chillers water during broiler carcasses chilling was more efficient than other sanitizers [12].

From the previous results, it could be concluded that the use of hydrogen peroxide (food grade) to the chillers used for chilling of chicken carcasses prior to its packaging, greatly reduce its bacterial load, but little reduction in moulds and yeasts count, so, such superior activity of hydrogen peroxide enabling it to be used as a powerful sanitizer for poultry carcasses to enhance its meat quality.

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