

Microbiological Analysis of Critical Points in the Chicken Industry

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ABSTRACT

This work is focused on identifying microbial contamination in the scalding aseptis and cooling processes as well as in fresh sausages obtained. *Salmonella* was identified in two scald water samples but was absent in the water from chiller and in the final product, which might be explained in terms of chlorine addition and temperature reduction. The analysis revealed that MPN of *Escherichia coli* was in the range of <1-11/mL in the scald water and <1-64/mL in the chiller. *Aeromonas* sp. count showed 5 to 3.5×10^1 CFU/mL in the scald water and 9 to 3.7×10^2 CFU/mL in the chiller, probably due to the psychrophile characteristics of *Aeromonas* and evisceration process. The analysis of fresh sausages chicken revealed a sharp increase in the *Aeromonas* count (2.5×10^3 CFU/g). Results showed the need of including *Aeromonas* analyzes in microbiological tests of foods.

Keywords: *Aeromonas*, bacteria, chicken, microbiology, food quality control

INTRODUCTION

According to the Brazilian Union of Aviculture, the production of chicken in 1998 was around 4.5×10^6 ton, out of which 3.88×10^6 ton was used in internal market with a per capita consumption of 24Kg. The chicken industry presents a potential to increase the production in about 5 to 7%. In order to achieve this goal the Brazilian Industry should increase the amount exported to other market like Europe. Due to requirements of external market, it is necessary to improve the inspection, microbiologic control areas and hygiene (Puperi, 1999).

It is well known that most food poisoning is caused by the presence of *Staphylococcus aureus*, *Clostridium perfringens* or *Salmonella* sp. However, 56 to 70% of the suspected or accepted cases are classified as unknown etiology. From the

70's, several research papers have shown that gastroenteritis, peritonitis and endocarditis were due to *Aeromonas hydrophila* and *A. sobria* (Janda and Duffey, 1988). As public health regulations are becoming continuously strict and punishment increasingly severely, it seems logical and useful to investigate the conditions of food processing concerning contamination.

The most common microorganisms in chicken meat are mesophile and psychrophile bacteria of the animal and of the environment, which are mainly introduced during processing. In general, *A. hydrophila* is considered as an aquatic species, which spreads with the irrigation, laundering, feeding, etc.

Nishikawa and Kishi (1988) found a high number of *Aeromonas* in different food and concluded that the infections caused by this bacterium were mainly related to the contaminated food ingestion

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and not from water. Involved food in some cases of affection for *Aeromonas* have disclosed to levels of contamination of the order of 10^4 to 10^6 CFU/g (Tood, Hardy, Stringer, and Bartholomew, 1991). Fricker and Tompsett (1989) observed *Aeromonas* in 79% of different foods.

In fact, there is a lack of information about the occurrence of *Aeromonas* in food in Brazil, as well as the occurrence of other microorganisms in scalding and chilling water, as coliforms and *Salmonella*, which are responsible for at least 13% of the gastroenteritis. The aim of this work was identify microbial contamination due to *Aeromonas*, *Escherichia coli*, and *Salmonella sp.* in the scalding aseptis and cooling processes as well as in fresh sausages obtained.

MATERIALS AND METHODS

Samples of the scalding and chilling water were collected in the chicken industry on seven different dates. Three samples of chicken sausage from the lots that had contact with the water under investigation were also collected. The analyses of *Aeromonas* was conducted by counting in Starch-ampicilin Agar medium (Palumbo, Morgan, and Buchanan, 1985). The sample were serially diluted (10^{-1} to 10^{-5}), according to standard methods of microbiological food analysis (Silva, Junqueira, and Silveira, 1997). All analyses were carried out in triplicates.

The determination of the Most Probable Number (MPN) of fecal coliforms were performed in three series of three pipes, with dilutions of 10^0 , 10^{-1} and 10^{-2} , using lauril broth sulphate triptosis (LST),

shining green broth (incubated at 32°C) and EC broth (incubated at 44.5°C), for 48 h.

To perform *Salmonella* analysis, first a pre-enrichment in lactosis broth was carried out at 35°C for 24 h. Selective enrichment media tetrathionate broth (TT) and selenite-cystine broth (SC) were incubated at 35°C for 24 h. Then a loopful from each selective enrichment broth culture was streaked in plate with Rambach Agar (Merck) at 35°C for 24 h.

The measurements of temperature and pH in the scalding and chiller water were carried out for each sample.

RESULTS AND DISCUSSION

The presence of *Salmonella sp.* was detected in two samples of the scalding water, but not in chilling water and final product. This could probably be due to the reduction of temperature of the water and addition of 5% of chlorine in chiller, eliminating possible existing contaminations of this bacterium.

The Most Probable Number of fecal coliforms (MPN/mL) varied in the range of < 1 to 11 in the scalding water and from < 1 to 46 in the water of chiller (see Fig. 1), which were acceptable values, but showing a clear enhancement in the chiller, mainly due to evisceration step that occur before the cooling (Roitmann, 1988). Temperature of the scalding water varied from 59 to 62°C, which wont be inhibitory for the majority of the microorganisms, however without capacity of total elimination due to the high microbial load.

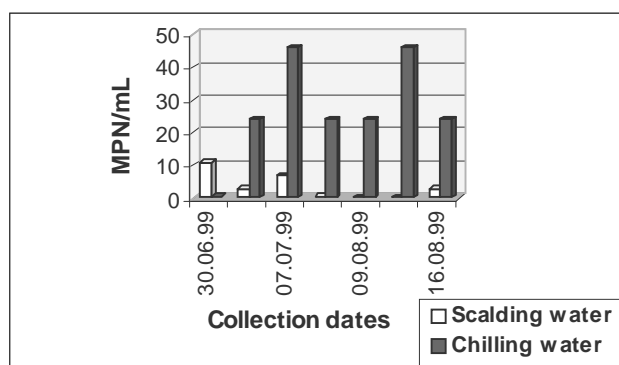


Figure 1 - Fecal coliforms (MPN/ml) in the scald and chilling water analyzed in different dates of collection.

Fig. 2 presents the results obtained in the analyses of *Aeromonas sp.* It was observed that count of *Aeromonas sp.* varied from 0 to 3.5×10^1 CFU/mL (1.54 log CFU/mL) in the scald water and 9 at 4.0×10^1 CFU/mL (0.95 at 1.6 log CFU/mL) in the water of chiller.

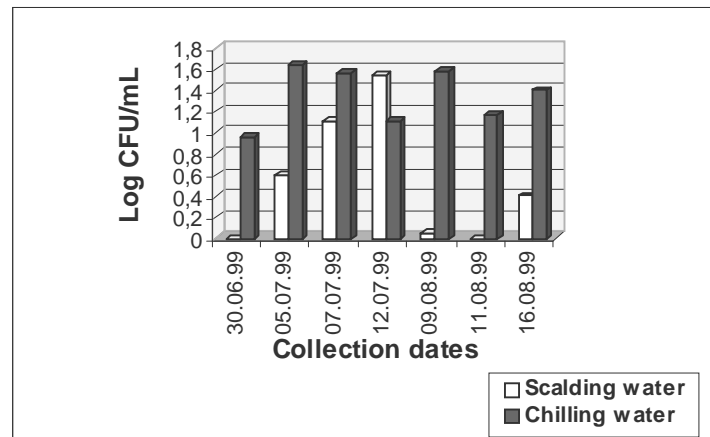


Figure 2 - *Aeromonas* (log CFU/ml) in the scalding and chilling water analyzed in different dates of collection.

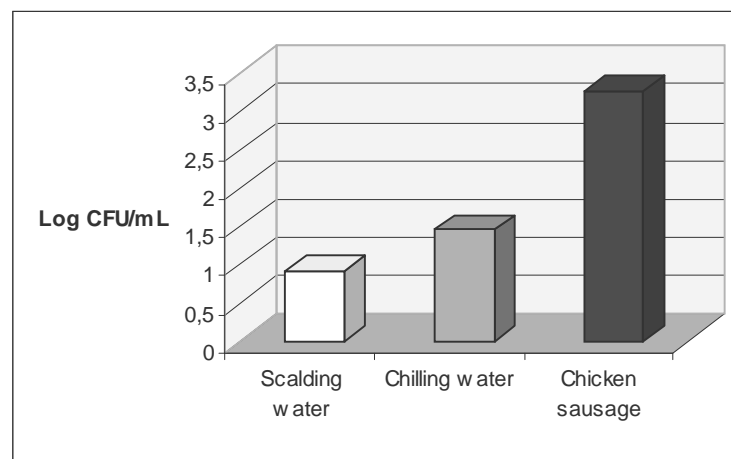


Figure 3 - Average of the growth of *Aeromonas* (log CFU/ml) in the scalding water, to chilling water and chicken sausage.

This reflected the crossed contamination occurred in the evisceration process before the cooling, an also the fact that *Aeromonas* be a bacteria pycrophile. Thus, the evisceration process must be carefully accomplished for the control of this bacterium. A possible alteration of pH of the chilling water could be used as control form, since some reports (Knochell, 1990) indicated the inhibition of *Aeromonas* at 5°C and pH of 5.3 with addition of salt.

Barnhart et al. (1989) showed more contamination in the evisceration process, which the bacterial counts increasing from 28 CFU/mL in laundering

fluids of death animal to 580 CFU/mL in laundering fluids after the evisceration process.

The analyses of the chicken sausages showed absence of *Salmonella* sp. and fecal coliforms with counts up to 110 MPN/g, which was satisfactory conditions for the human consumption (Resolution nº 12 of 2 of January of 2001, of the Agência Nacional de Vigilância Sanitária, ANVISA).

Fig. 3 presents the counts of *Aeromonas*. When compared with the average counts of *Aeromonas* in the scalding and chilling water, an increase was observed in sausage, where the count was up to 1.9×10^3 CFU/g (3.27 log CFU/g).

Fricker and Tompsett (1989) demonstrated that in a total of 563 samples of sausages, half of the samples presented *Aeromonas* sp. Amongst the samples, the meats of chicken (79.3%) and viscera: kidneys and liver (84.3%) presented highest incidence of this bacteria. The high frequency of *Aeromonas* in foods is due to its capacity of growth at low temperature (less than 4 °C), which makes it to grow under normal conditions of storage of meats, fish, milky vegetables, products, etc (Knochel, 1990; Krovacek, Faris and Mansson, 1991; Beuchat, 1991).

The high temperature of the scald water and low chilling temperature associated with the chlorine use are sufficient for the control of fecal coliforms and *Salmonella* levels. However, there were probably the cross infections and psychrophile characteristic of *Aeromonas hydrophila*, which remained viable after the treatments and presented growth in fresh sausages conserved under refrigeration temperature. This fact demonstrated the necessity to include *Aeromonas hydrophila* in the microbiological food evaluations. Currently Holland and Canada demand its determination in drinking waters and are considered test recommended in the United States and some countries of the Europe, as much for waters as for foods.

RESUMO

O objetivo deste trabalho foi identificar a contaminação microbiana no processo de escaldagem, assepsia e resfriamento do frango (chiller), e em linguças de frango produzidas a partir destes. As amostras foram coletadas em um frigorífico de aves, em sete datas e analisadas em triplicata. A presença de *Salmonella* foi detectada em duas amostras da água de escaldagem não estando mais presente na água do chiller e nem no produto final. Isto se deve à redução de temperatura da água e adição de cloro. O NMP de coliformes fecais variou entre < 1 a 11/ml na água de escaldagem e < 1 a 64/ml na água do chiller, que embora em padrões aceitáveis, mostram tendência de acréscimo no chiller, devido principalmente ao processo de evisceração. As contagens de *Aeromonas* variaram de 5 a $3,5 \times 10^1$ UFC/ml na água de escaldagem e 9 a $3,7 \times 10^2$ UFC/ml na água do chiller. Este acréscimo se deve, provavelmente, por *Aeromonas* ser psicrófila e também devido a retirada das vísceras. As análises de linguça de frango mostraram

acréscimo nas contagens de *Aeromonas*, apresentando até $2,5 \times 10^3$ UFC/g. Esta tendência de aumento de crescimento no produto final, aliado a capacidade de causar infecções de *Aeromonas* demonstram a necessidade de incluir a análise destas nas avaliações microbiológicas de alimentos.

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