

Chilled broiler carcasses: a study on the prevalence of *Salmonella*, *Listeria* and *Campylobacter*

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Abstract

The demand for safe food has increased in the market in recent years. However, even with technological advances poultry meat is still susceptible to bacterial contamination. This study thus aimed to assess the microbiological quality of chilled broiler carcasses regarding the prevalence of *Campylobacter* spp., *Listeria* spp. and *Salmonella* spp. The study was conducted in poultry slaughterhouses operating under federal inspection in the state of Rio Grande do Sul, Brazil, from January 2011 to February 2013. Six hundred and thirty-two chilled broiler carcasses were analyzed by conventional culture methodology; 452 were tested for the presence of *Salmonella* spp., 100 for *Listeria* spp. and 80 for *Campylobacter* spp. Of this total, 10 samples (2.2%) were found to be contaminated with *Salmonella* spp., 11 (11.0%) with *Listeria* spp., and 29 (36.6%) with *Campylobacter* spp. Although the results have shown a lower contamination rate than that found by other studies, the values obtained represent a problem for public health, stressing the need to effectively implement Good Manufacturing Practices (GMP) in poultry industries in order to reduce the potential risk caused by the microorganisms investigated.

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Introduction

According to the Brazilian Association of Chicken Producers and Exporters, poultry meat has been established as one of the most important sources of animal protein for people in Brazil, where the per capita consumption reached 44 kg in 2012, representing an increase of 5.6% in relation to the previous year. Added to this there was an 11.4% increase in the production of chicken meat in Brazil, which granted the country the third position in the world ranking among producing countries (UBABEF, 2013).

Despite technological advances, poultry meat is still susceptible to bacterial contamination by certain foodborne pathogens. As reported by Jay (1005), the pathogens in poultry production belonging to the genus *Salmonella*, *Campylobacter* and *Listeria* are among the ones deserving special attention. The occurrence and amount of these microorganisms vary according to management conditions during poultry production and the hygienic care taken in the animal slaughtering operations, as well as subsequent handling of carcasses (Carvalho & Cortez, 2005).

Determining these microorganisms is an essential tool for hazard evaluation and further study of the risks associated with food consumption. Therefore,

this study aimed to examine the microbiological quality of chilled broiler carcasses industrialized in the state of Rio Grande do Sul/RS, Brazil, regarding the prevalence of *Campylobacter* spp., *Listeria* spp. and *Salmonella* spp.

Materials and Methods

This study was developed in slaughterhouses operating under Brazilian federal inspection in the state of Rio Grande do Sul. From January 2011 to February 2013, a total of 632 samples of chilled broiler carcasses were collected. The samples were collected on their first day of manufacturing in their original packaging and without changing their selling conditions, transported to the laboratory in ice coolers and analyzed within 24 hours. Microbiological analysis to detect *Salmonella* spp., *Listeria* spp. and *Campylobacter* spp. were performed in duplicates for each product using the conventional culture method described by American Public Health Association - APHA (2001).

Results and Discussion

Table 1 shows the prevalence of *Salmonella* spp., *Listeria* spp. and *Campylobacter* spp. in samples of

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Table 1. Prevalence of the pathogens analyzed in samples of chilled broiler carcasses.

Microorganisms	Number of samples	Number of positive samples
<i>Salmonella</i> spp.	452	10 (2.2%)
<i>Listeria</i> spp.	100	11 (11.0%)
<i>Campylobacter</i> spp.	80	29 (36.3%)

chilled broiler carcasses. In a total of 452 samples, ten (2.2%) were contaminated by *Salmonella* spp. Results with similar values were observed by Tessari *et al.* (2008), who analyzed 116 frozen broiler carcasses from industrial exploitation in the state of São Paulo, detecting the presence of the pathogen in three (2.5%) samples. However, several researchers have found higher values than the ones in this study, with a significant incidence of bacteria in chilled and frozen broiler carcasses. Reiter *et al.* (2007) observed the presence of *Salmonella* spp. in 25.5% of the samples analyzed. Carvalho and Cortez (2005) reported the presence of *Salmonella* spp. in 33 (20.0%) of the samples from a total of 165 tests. Silva *et al.* (2004) observed 43.3% of positivity for this pathogen. Almeida Filho *et al.* (2003) found 18 (45.0%) contaminated samples out of 40 analyzed.

The microorganisms of the genus *Campylobacter* spp. were detected in 36.3% of the samples in the present study. According to Atabay and Corry (1997), Franchin *et al.* (2005) and Franchin *et al.* (2007), broiler carcasses are commonly contaminated with *Campylobacter* spp. in poultry processing plants. Studies have shown elevated levels of this pathogen in carcasses (Maziero and Oliveira, 2010; Stern *et al.*, 1995) and in chilled chicken parts (Rahimi and Tajbakhsh, 2008) ranging from 40 to 100% (Dickins *et al.*, 2002).

The variation in results between the studies hereby presented on quantification of *Salmonella* spp. and *Campylobacter* spp. suggests that the quality of hygiene programs in farms and hatcheries, as well as the quality of slaughterhouses, still falls short of the desired parameters of good practice, although in varying degrees. As reported by Nather *et al.* (2009), the evisceration process is very conducive to increased contamination in slaughter houses, since the exposure of the bird internal organs may result in contamination of the carcass. Reinforcing those findings, Soares *et al.* (2002) observed an increase in the number of Enterobacteriaceae in the carcass after evisceration comparing to other processing stages. Such conclusions corroborate the view of Walsh and Thayer apud Soares *et al.* (2002) when reporting that one of the biggest problems in poultry processing is carcass contamination by fecal matter during evisceration. The study carried out by Rahimi

et al. (2010) also points the chilling stage of carcasses as a probable source of cross-contamination by *Campylobacter* spp. due to the high number of isolated bacteria in the tank water. An effective control, combined with higher volumes of water renewal during the evisceration process, could hence result in lower pathogen counts in slaughter plants.

The prevalence of *Listeria* spp. in the samples was 11.0% (11/100). A number of studies outlined worldwide to verify and map the contamination points by *Listeria* in poultry slaughtering/processing plants show quite discrepant isolation rates (Miettinen *et al.*, 2001; Lúnden *et al.*, 2003; Gudbjornsdóttir *et al.*, 2004). The same can be verified when one compares the data obtained in this study with other Brazilian studies. Nalério *et al.* (2009) observed 33.3% of positivity in chilled broiler carcasses coming from industrial exploitation in the state of Rio Grande do Sul. Chiarin *et al.* (2009) detected 16.9% of positivity for the bacteria in broiler carcasses, while Reiter *et al.* (2005) found the pathogen in 35.6% of the samples from a poultry slaughterhouse line in the south of the country. Pelisser *et al.* (2001) found 21 positive samples out of a total of 48 (43.7%) chilled broiler carcasses from a retailer in the city of Florianópolis/SC.

In study by Nalério *et al.* (2009), this pathogen was isolated in various points of the slaughter plant, as well as during evisceration, pre-chilling, chilling and final product. The fact that there was no isolation of *Listeria* spp. in the birds entering the slaughter plant later found to be contaminated with the pathogen in the final product shows the dispersion of this microorganism and therefore the importance of cross-contamination within the industry. Through the study it was observed that the rate of contamination by *Listeria* spp. increases as broiler processing progresses. The same was reported by Reiter *et al.* (2005), who describe that the contamination of carcasses occurs mainly during or after the evisceration and chilling stages, and also by Barbalho *et al.* (2005), who evaluated a poultry slaughterhouse in Bahia, Brazil, and found contamination in 14.3% of the carcasses already packed, which were not contaminated in the previous steps.

Chiarini *et al.* (2009) and Chasseignaux *et al.* (2002) emphasize that the design and efficient cleaning/disinfection of equipment and utensils used in the chilling plants can reduce the presence of *Listeria* spp. in the final product. Establishments where the cleaning method is not made correctly can contribute to the presence of the pathogen and, from that point on, it can be easily transferred to other plant areas. According to Moltz and Martin (2005),

the presence of biofilms is a potential problem for the food industry because it protects microorganisms from the action of cleaning and disinfection products, acting as a continuous source of microbiological contamination.

Although the results presented have shown a lower contamination rate than that seen in other studies, the risk to consumer health as well as the economic losses associated with these microorganisms make their continuous monitoring a relevant action. The results provide support for the development of strategies aiming the industrial control of the bacteria analyzed. They stress the need to effectively implement the Good Manufacturing Practices (GMP) in poultry industries by keeping, in particular, a meticulous control of the evisceration, chilling and operational hygiene processes as a measure to reduce the contamination levels caused by the microorganisms investigated.

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