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Effect of slaughterhouse hygienic practices on the bacterial contamination of chicken meat

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ABSTRACT

This study consists of a survey to assess the level of compliance with good hygiene practices (GHP) in poultry slaughterhouses in the Biskra region (Algeria) and an assessment of the microbiological quality of poultry carcasses for the consumption. A total of 60 carcasses collected from 6 abattoirs have been microbiological analyzed. The study focused on bacterial count of the total mesophilic aerobic flora (FAMT) and enumeration of fecal Coliforms, *Staphylococcus aureus* and *Salmonella* qualitative research. These analyzes were made according to the French National Organization for Standardization (AFNOR). Survey results showed two categories of slaughtering, the first category represent 16.67% of the poultry carcasses studied is characterized by the observance of principles and standards for slaughter while the second one represent 83.33% of the poultry carcasses and characterized by unsatisfactory hygienic practices. The prevalence of infection by *Salmonella* and *Staphylococcus aureus* at 6 slaughterhouses was 50% and 46.66% respectively. The average contamination for total mesophilic aerobic flora (FAMT), fecal coliforms and *Staphylococcus aureus* is approximately 5.0 log₁₀ CFU / g and 2.18 log₁₀ CFU / g and 1.08 log₁₀ CFU / g, respectively. Statistical analyzes showed a significant impact of the hygienic conditions of the slaughter process on the hygienic quality of poultry carcasses. The application of good hygiene practices (GHP) and the implementation of HACCP in poultry slaughterhouses has become an absolute necessity.

1. Introduction

The poultry slaughterhouse is one of the major critical points with potential effects on the hygiene of poultry meats. During slaughter operations, inter- contamination phenomena occur, which induces proliferation of bacterial pathogens on carcasses initially healthy (INRA, 2007). Special attention must be observed in poultry meat production because of possible contamination from alimentary tracts, water, packaging, utensils and handlers (Ramasastry et al., 1999; Brian, 2001; Nwachukwu and Nnamani, 2013).

Poultry meat is responsible for many zoonotic foodborne infections in the World. Foodborne diseases have a serious impact on the public health and the economic losses due to food poisoning are in billions (Alvarez-Astorga et al., 2002; WHO, 2002).

The objective of this work was to contribute to the evaluation of the poultry meat hygienic quality, but also the slaughterhouse hygienic status in the Biskra region in Southern Algeria.

This study was a part of a survey to assess the level of compliance with good hygiene practices (GHP) in poultry slaughterhouses and secondly, to assess the microbiological quality of chicken carcasses to show the impact of the slaughter hygienic quality on the meat bacterial chickens quality.

2. Materials and methods

2.1. Biological material

Bacteriological analysis was performed on 60 samples of fresh chicken carcasses. These are finished products already packaged and stored in cooling room awaiting shipment (stored in cooling chambers at + 4°C).

2.2. Microbiological analysis

The material consists of the equipments and media usually used in food microbiology laboratories (Vanderzant and Splittstoesser, 1992).

2.3. Sample preparation

The study focused on the analysis of chicken meat prepared in 6 different slaughterhouses in the Biskra district (Algeria) where ten carcasses were collected from each plant. The samples were then packed in sterile bags and carefully transported to the laboratory under cold conditions in the best possible aseptic conditions and within 24 hours to avoid any changes in the microbial population. The study was conducted over a period from February to July 2010.

2.4. Questionnaire

A visit during the slaughterhouses was carried out in each slaughterhouse to answer a number of questions relating to slaughtering characteristics, methods of cleaning, disinfection and slaughterhouse hygiene status in accordance with the method of Alloui and Ayachi, 2012.

2.5. Bacteriological analysis

Bacteriological analysis includes the total aerobic mesophilic flora (FAMT), fecal coliforms (fecal C.), *Staphylococcus aureus* (*S. aureus*) and *Salmonella* spp with the respective limits in CFU / g by the Algerian regulatory, 5.105 log₁₀, 103 log₁₀, 5.102 log₁₀ and absence.

From a mother suspension made 1,10 in Tryptone Salt Water (TSE) for the FAMT, the fecal C. and *S. aureus*, after grinding and homogenization.

The detection of *Salmonella* was done in 4 steps according to the standard ISO 6579, the pre-enrichment, enrichment, isolation and finally the identification.

These analyzes were conducted in accordance with the AFNOR standards in the microbiology laboratory of the Veterinary Department (University of Batna).

2.6. Statistical Analysis

The results of the counts of FAMT, fecal coliforms, S. aureus and were expressed in CFU / g (colony forming units per gram) and then converted to log10 CFU / g (log units of microorganisms per gram).

The results of the questionnaire were submitted to the Factorial Multiple Correspondence Analysis (FMCA), the Hierarchical Clustering (AHC) and bacteriological data Khi2 test. Microbiological data processing is performed by software SPSS.19 to assess contamination levels.

3. Results

3.1 Bacterial contamination of slaughterhouses

Analysis of the questionnaires by the FMCA and the AHC showed two categories of slaughterhouses (Figure 1)

- Category (1), Represent 16.67 % of the analyzed chicken carcasses, characterized by respect for certain principles and slaughtering standards.
- Category (2), Represent 83.33 % of analyzed chicken carcasses, characterized by unsatisfactory hygienic practices.

3.2. Contamination of chicken meat

The prevalence of contamination of poultry carcasses by different bacteria is shown in Table 1.

Table 1
Prevalence of bacterial contamination of chicken carcasses.

	Bacterial characteristics			
	FAMT	fecal C.	S.aureus	salmonella
Number of contaminated samples	60	60	28	30
Prevalence	100%	100%	46,66%	50%

3.3. Effect of slaughtering on bacterial contamination of chicken carcasses

Comparing the levels of bacterial contamination of carcasses with respect to hygiene standards revealed that the sanitary quality of poultry carcasses in category (1) is satisfactory, while in category (2), it is unsatisfactory (Figure 1).

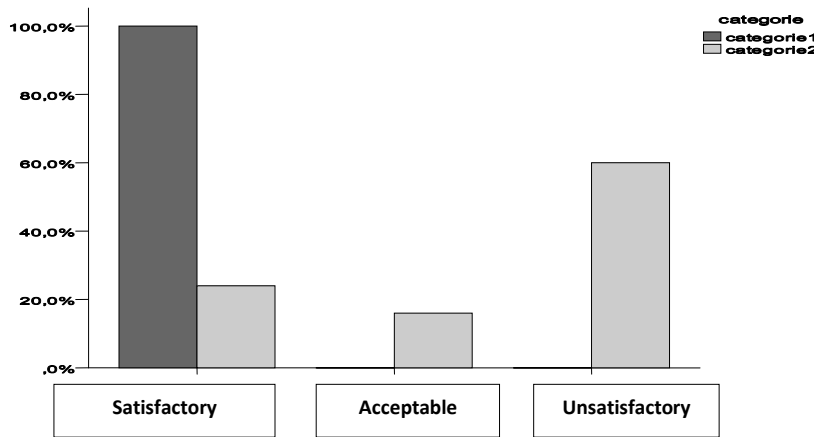


Fig. 1. Level of bacterial contamination in two slaughterhouses categories.

Salmonella contamination is greater for poultry carcasses in category (2) (Figure 2), the Khi2 test showed a significant relationship between the level of contamination by Salmonella and practice in this category and slaughtering.

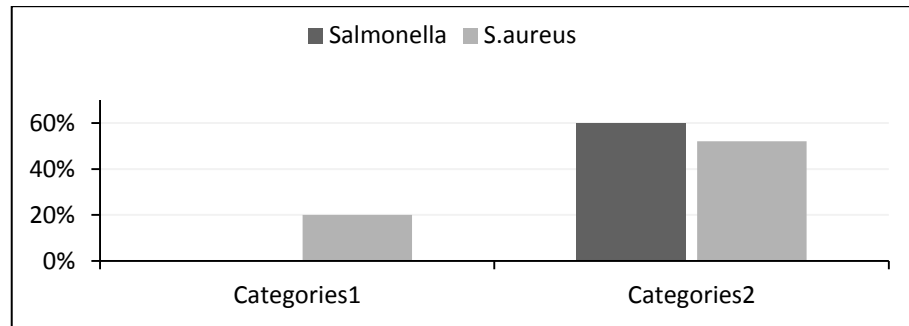


Fig. 2. Prevalence of bacterial contamination in slaughterhouse categories.

Statistical analyses were used to assess the level of contamination of carcasses after slaughtering and characterizations of the isolated germs. We always noted that the level of contamination of carcasses, the highest is in category (2). Category (1) includes carcasses that have a lower level of contamination (Figure 3).

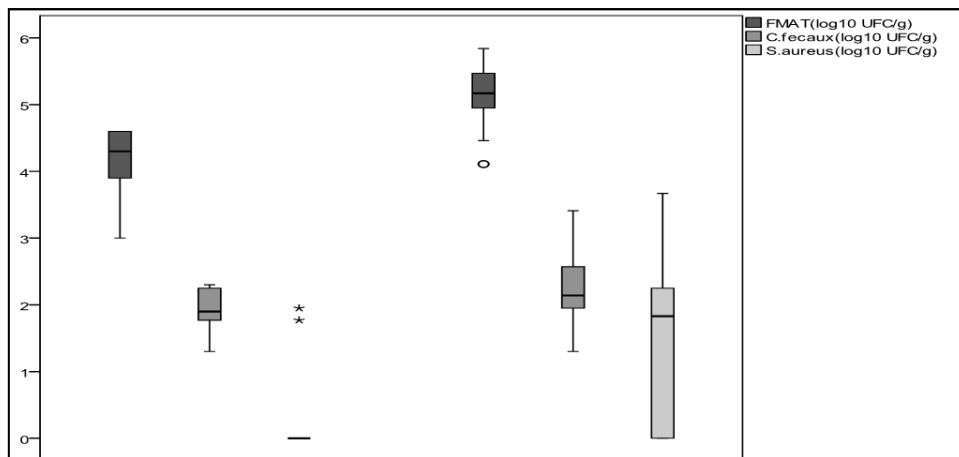


Fig. 3. Effect of slaughtering process on the bacterial contamination of chicken carcasses.

3. Discussion

3.1. Bacterial contamination of slaughterhouses

The prevalence of salmonella contamination at slaughterhouses was 83.33%, this result is close to that advanced by (Elgroud, 2009) is 73.33 %.

3.2. Contamination of chicken meat

- For Salmonella, the prevalence of salmonella found is 50%. Prevalence rates less than that found in our study were 21% in Ethiopia (Molla and Mesfin, 2003) and higher prevalence rates were observed in Thailand (66 %) (Jerngklinchan et al., 1994) cited by (Molla and Mesfin, 2003).

- For Staphylococcus aureus, the prevalence of S. aureus found is 46.66 % and the average contamination load is 1.08 log10 CFU / g. This prevalence is higher than that found by Lidij et al., 2006 (30.30%). Tugan, et al., 2010 found an average of 1.53 log10 contamination CFU / g which is close to our results.

- FAMT , The average load of 60 carcasses is 5.01 log₁₀ CFU / g , it is close to those found by Lidij et al., 2006 (5.23 log₁₀ CFU / g).

- For fecal coliforms, the average load of 60 carcasses is 2.18 log₁₀ CFU / g, it is close to that found by Djaffal, 2007 (2.7 log₁₀ CFU / g).

Elmali and Yaman (2005) reported high level of Salmonella, Staphylococcus, coliforms, aerobic mesophils in raw meat balls of poultry.

3.3. Effect of slaughtering on bacterial contamination of chicken carcasses

Differences in contamination of chickens carcasses noted following categories (1 and 2) are due to differences in the level of compliance with good hygiene practices during slaughtering.

The high rates of contamination are noted in slaughterhouses which are characterized by unsatisfactory hygienic practices.

Among the risk factors with potential effect on the nature and number of microorganisms present in carcasses studied compliance with the water diet, respect the time of the bleeding, the cleanliness of the water used in scalding , clean fingers of workers, precautions taken at the time of evisceration , personal hygiene and the level of slaughterhouse hygiene status. Colin et al., (1993) recommends the use of HACCP in the production of poultry for the detection of risk factors.

4. Conclusion

The results of this study in the Biskra region (Algeria) indicate that the level of compliance with good practices hygienic in slaughterhouses has a significant effect on the bacterial quality of chicken carcasses.

To improve the safety and bacterial quality of chicken meat, the application of good hygiene practices (GHP) and the implementation of HACCP in slaughterhouses poultry is an absolute necessity.

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