10

Bacteriological quality of industrially processed fresh chicken carcasses

OLIVER Mª.A., GUINART N. and MONFORT J.M.
Institut Catala de la Carn (IRTA). Generalitat de Catalunya. Granja Camps i Armet. Monells (Girona) Spain

INTRODUCTION

The shelf-life of meat is largely determined by the initial number of microorganisms present and the temperature of storage. The microbiological quality is a funtion of the bacterial load to wich the carcass was exposed during production on farms and in slaughterhouses. However, adequate refrigeration temperatures resulted in low microbial levels and therefore increased shelf-life. We think that the bacterial load on the surface of broiler carcasses is a reflection of the conditions of hygiene in the abbatoir, as has been stated in KLINGER et al. (1981). LILLARD (1977), SIMARD and AUCLAIR (1982) pointed out that there was a relationship between contamination of meat and levels of microorganisms in water, and water recycling processes were investigated, especially in hight of the increase of contamination water throughout the day. Also in accordance with LAHELEC and MEURIER (1972) it has been shown that cross-contamination takes place at this phase. The same autors considered that cross-contamination is possible from the rubber fingers of the plucking machine, and during the evisceration process. KOTULA and KINNER (1964) state that the evisceration process was also a source of contamination. FOURNAUD and BERTAUD (1.981) point out that control of the inmediate environment was very important in preventing carcass contamination. In the present study levels of contamination of refrigerated carcasses were analysed, in order to stablish the microbiological quality of broiler chickens and determine the factors responsible for contamination in the abbatoir.

MATERIAL AND METHODS

1- ABATTOIRS. Samples were taken from two abattoirs, which produced fresh broilers. In all cases they were slaughtered at 6-7 weeks of age, having a carcass weight of ca 1,6 Kg. Abattoir A. At this abattoir, the processing capacity was 3000-3300 carcasses/h, and the broilers were scalded in a tank at 50 ± 1°C for 150 seconds. Evisceration, classification and storage were carried out in the same room. The carcasses were refrigerated at 0-4°C for one hour. Abattoir B. At this abattoir the processing capacity was 3600-3800 carcasses/h, and the broilers were scalded in a tank at 50 ± 1°C for 120 seconds. The carcasses were douched with water at 11°C after defeathering and evisceration. Evisceration, classification and storage were carried out separately in different rooms at 7-10°C. The carcasses were refrigereted as abattoir A.

2- SAMPLING METHODS. Samples studied were taken from the scalding water and from the broiler carcasses. The water samples were picked up at the beginning, at the middle, and at the end of the working day in abattoir A, wich was visited in 7 ocassions during 3 months. The water samples were taken in previously sterilisated bottles, regarding to keep steril conditions. 355 broilers carcasses from the two abattoirs were analysed between January 1985 and August 1985. The abattoirs were visited on 6 to 8 occasions. On each visit ca 20 refrigerated broiler carcasses were sampled using a swab method (28 cm^2 area) taken from the chest. The swab was introduced in a tube containing peptone water at 0,1%. The samples were carried to the laboratori in a refrigerated container. Salmonella incidence was determined on the skin surface of 50 refrigerated carcasses at abattoir B, visited on 4 occasions from October 1985 to January 1986. In each visit, 10 to 15 carcasses were sampled using the skin portions (4X4 cm^2) maceration method taken from neck and pericloacal zones.

3- MICROBIOLOGICAL ANALYSIS. The employed methods were: for total aerobic plate count at 30°C the "Plate Count Agar"; for total coliform at 37°C the "Violet Reb Bile Agar" and the fecal streptococci at 37°C the "Slanetz & Barley Agar". For Salmonella we used following methods: Pre-enrichement in peptone water, enrichement in "Tetrathionat Brothbase" and in "Modified Rappaport R10 broth". The selection in "Brillant Green Agar" and "S.S. Agar" and the confirmation in "Triple Sugar Iron Agar", "Christensen Agar" and finally by API 20E test.

4- STATISTICAL ANALYSIS. Unless otherwise stated, the common logarithms of the plate count data/cm were used for the analysis. Data was analysed using a two way analysis of variance.

RESULTS AND DISCUSSION

In the tables different subscripts are used to denote significant differences between mean values in the same column. Tabulated values with the same subscript letter do not differ significantly at the 5% level of significance. Microbiological levels of scalding tank water in abattoir A increased significantly during the working day for total aerobic plate count, total coliform and fecal streptococci (Table 1). Water temperature was not a limiting factor on coliform growth. Contamination level were 6.74, 2.70 and 2.91 at the beginning and 7.88, 4.36 and 4.79 cfu/ml at the end of the working day for aerobic plate count, total coliform and fecal streptococci respectively. These hight levels of contamination show a poor recycling conditions and an insuficient cleaning and desinfection procedures of the scalding tank. Our results are higher than those AUCLAIR and SIMARD (1982). We think that the scalding procedures of abattoir A need to be modified. Carcass contamination levels were significantly different for all the microbiological parameters studied between both abattoirs. Higher contamination levels were from at abattoir A. Total aerobic plate count was 4.02 ± 0.37 and 3.36 ± 0.34 for abattoir A and B respectively. The mean counts of total coliform were 1.36 ± 0.48 and 0.81 ± 0.64 and for fecal streptococci 2.18 ± 0.49 and 1.56 ± 0.41 for abattoir A and B respectevely. Abattoir B, having much more production, offered a better hygienic quality and a longer shelf-life of the product. Tables 3 and 4 summarizes the mean results from each visit of individual abattoirs. No seasonal variations were found in B; on other hand, summer and winter contamination levels were significant different in this survey. These results shows that abattoir B had adequatelly maintained refrigeration temperatures and carcass hanling. The analysis of variance showed that there was not a significant visit x abattoir interaction effect for coliforms and streptococci, wich demostrate hygienic differences between both abattoirs. The results of abattoir B are in agreement of those cited by CLARK and LENZ (1969) and AUCLAIR and SIMARD (1982). SURKIEWICZ et al. (1969) obtained higher levels of contamination which agree with our results from abattoir A. Table 5 give the Salmonella incidence in the fifty broiler carcasses sampled from abattoir B by the skin portions maceration method. Salmonella was isolated from 24.5% of the fresh broiler carcasses evaluated. This percentage is relatively low in comparison with d' AOUST et al. (1982) and RENGEL and MENDOZA (1984) and are in agreement with KLINGER and FUCHS (1981). Salmonella recovery depends in a big way of the samplin method. VASSILIADIS et al. (1972) examinated 453 chicken carcasses from the poultry processing plant of Athènes and found 14.8% incidence using the swab method. SURKIEWICZ et al. (1969) obtained 20.5% also by the same method, while by carcass rinsing the incidence increases a lot: VASSILIADIS et al. (1981) isolated 100%; D AOUST et al. (1982) the 93% and RENGEL and MENDOZA (1984) the 91%. We think that presence of Salmone-

lles depends on the contaminated poultry farm surroundings. Furthermore a crossed contamination can occur on-line. However, although our survey demostrates relative acceptable bacterial counts, we feel that it is necessary the utilization of better sanitizing practices in order to obtain a higher product hygienic quality.

ACKNOWLEDGEMENT

The authors would like to express their gratitude to Ecxma. Diputacion Provincial de Girona, for to finance this study.

REFERENCES

AUCLAIR G. & SIMARD R.E., 1982. Niveau de contamination microbienne dans un abattoir de volailles. Can. Inst. Food Sci. technol. J. 15 (3):185:190.

CLARK D.S. & LENTZ C.P., 1969. Microbiological studies in poultry processing plants and Canada Can. Inst. Food Technol. J. 2 (1):1969.

D'AOUST J.Y., STOLLAND P. & BOVILLE A. (1982). Sampliny methods for detection of Salmonella in raw chicken carcasses. J. Food Sci. 47(3):213-216.

FOURNAUD J. and LAURED R., 1972. Contribution à l etude microbiologique des poulets congeles. Rev. Gen. Froid. 63(2):132-136.

FOURNAUD J. & BERTAUD M., 1981. Contamination de l air a l abattoir et qualite bacteriologique des carcasses de bovins. Proceeding of the Europaisher Fleischforscher Kongres in Wien. Austria. B-1, 188.

KLINGER I., BASKER D., MALENCKY, BARKAT G. & EGOZ N., 1981. Microbiological quality of industrially processed frozen broiler chickens in Israel. Refuah vet.,38(4).

KOTULA A.W.,1966. Variability in microbiological samplings of chikens by the swab method.Poultry Sci.45,233-246.

LAHELEC C., MEURIER C., BENNEJEAN G. & CATSARAS M.,1975. A Study of 5920 strains of Psychrotrophic bacteria isolated from chickens. J. Appl. Bact.,38, 89-97.

LAHELEC C.,1983. Quelques aspects du contrôle microbiologique dans les abattoirs de volaille. VI Symposium sur la qualite des viandes de volailles. Ploufragan.

LILLARD H.S. 1977. Microbiological characterization of water for recycling in poultry processing plants. J. Food Sci.,42,168-171.

RENGEL A. & MENDOZA S.,1984. Isolation of Salmonella from raw chiken in Venezuela. J. of Food Protection. 47(3):213-216.

ROSSET R.,1976. Le froid: agent de preservation des qualites de la viande et des produits carne. C.R. Seances Acad. Agric. Fr.,62(9):1-31.

SIMARD R.E. & AUCLAIR G.,1981. Niveau de contamination microbiologique de quelques etabliments d abattage et de charcuterie "Approuve Canada". Can. Inst. Food Technol. J.14(2):128-134.

SURKIEWICZ B., JOHNSTON W., MORAN A. & KRUMMG, 1969. A bacteriological survey of chiken eviscerating plants. Food Technol.23,1066-1069.

VASSILIADIS P., PAPADAKIS J., PATERAKI E., TRICHOPOULOS D., KARABATSOS B. & PAPOUTSAKIS G.,1972. Isolement de Salmonella a partir de carcasses de poulets par enrichissement en bouillon et enrichissement secondaire en milieu de Rappaport. Arch. Inst. Pasteur Hellen. XVIII.

VASSILIADIS P., PAPOUTSAKIS G., AURAMIDIS D., TRICHOPOULOS D. & PAPADAKIS J., 1976. Recherche de Salmonella sur des carcasses de poulets à Athènes en 1976. Arch. Inst. Pasteur Hellen. XXII.

TABLE 1. Effet of samphing time on bacterial contamination from water taken from scald tank at abattoir A.

		TOTAL AEROBIC		TOTAL COLIFORM		FECAL STREPTOCOCCI	
DAY TIME	n	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
AT THE BEGINNING	7	$6,74_a$	$\pm 0,98_a$	$2,70_a$	$\pm 0,25_a$	$2,91_a$	$\pm 0,41_a$
AT THE MIDDLE	7	$7,83_b$	$\pm 0,56_b$	$4,11_b$	$\pm 0,38_b$	$4,45_b$	$\pm 0,17_b$
AT THE END	7	$7,88_b$	$\pm 0,51_b$	$4,37_b$	$\pm 0,31_b$	$4,71_c$	$\pm 0,21_c$

Different subscripts within a column indicate significant differences in numbers (log cfu/ml).

TABLE 2. Comparison of bacterial contamination on broiler carcasses at two abattoirs.

GROUPS	ABATTOIRS (mean values)[1] A	B
TOTAL AEROBIC	4,02 ± 0,37	3,36 ± 0,34
TOTAL COLIFORM	1,36 ± 0,48	0,81 ± 0,64
FECAL STREPTOCOCCI	2,18 ± 0,49	1,56 ± 0,41

1. Each taBULATED VALUE (log cfu/cm^2) includes results from both abattoirs.

TABLE 5. Contamination rate of broiler carcasses with Salmonella at abattoir B.

SAMPLING DATE	N° total examined samples	N° positives samples	%
22-10-85	10	3	30
6-11-85	10	2	20
2-12-85	15	4	27
11-01-86	15	3	20

TABLE 3. Bacterial contamination from refrigerated broiler carcasses at abattoir A[1].

SAMPLING DATE	n	TOTAL AEROBIC $\bar{X}$ S.D.	TOTAL COLIFORM $\bar{X}$ S.D.	FECAL STREPTOCOCCI $\bar{X}$ S.D.
22-02-85	18	$4,06 \pm 0,30_b$	$1,45 \pm 0,618_c$	$1,94 \pm 0,29_a$
19-03-85	20	$3,70 \pm 0,37_a$	$1,02 \pm 0,37_a$	$1,69 \pm 0,30_a$
29-04-85	18	$3,70 \pm 0,25_{ab}$	$1,28 \pm 0,39_{ab}$	$1,78 \pm 0,43_a$
14-05-85	20	$4,07 \pm 0,26_{bc}$	$1,47 \pm 0,58_{bc}$	$2,47 \pm 0,25_b$
21-07-85	20	$4,34 \pm 0,29_c$	$1,42 \pm 0,21_c$	$2,51 \pm 0,16_b$
12-08-85	18	$4,05 \pm 0,37_b$	$1,49 \pm 0,41_c$	$2,75 \pm 0,18_b$

1. Different subscripts within a column indicate significant differences in numbers (log cfu/cm^2).

TABLE 4. Bacterial contamination from refrigerated broiler carcasses at abattoir B[1,2].

SAMPLING DATE	n	TOTAL AEROBIC		TOTAL COLIFORMS		FECAL STREPTOCOCCI	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
16-01-85	18	$3,20_a$	$\pm 0,38$	ND		ND	
20-02-85	19	$3,35_a$	$\pm 0,26$	$0,81_a$	$\pm 0,69$	$1,64_a$	$\pm 0,39$
25-03-85	18	$3,26_a$	$\pm 0,37$	$0,97_a$	$\pm 0,81$	$1,44_a$	$\pm 0,49$
22-04-85	20	$3,30_a$	$\pm 0,27$	$0,71_a$	$\pm 0,59$	$1,53_a$	$\pm 0,38$
29-05-85	18	$3,48_a$	$\pm 0,30$	$1,04_a$	$\pm 0,63$	$1,84_a$	$\pm 0,35$
25-06-85	20	$3,51_a$	$\pm 0,25$	$1,15_a$	$\pm 0,38$	$1,60_a$	$\pm 0,35$
29-07-85	19	$3,13_a$	$\pm 0,43$	$0,52_a$	$\pm 0,57$	$1,38_a$	$\pm 0,46$
21-08-85	19	$3,48_a$	$\pm 0,24$	$0,48_a$	$\pm 0,47$	$1,52_a$	$\pm 0,30$

1- ND: Not determined
2- Different subscripts within a column indicate significant differences in numbers (log cfu/cm^2).