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Microbiological characteristics of poultry meats - Results of inspections carried out in the province of Milano, Italy

Silvia Colmegna[1], Anna Invernizzi[1], Anna Lia Mascher[1], Emanuela Corsale[2], Viviana Ferrazzi[2], Guido Grilli[2]

[1]Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia Romagna. Milano, Italy

[2]Dipartimento di Patologia Animale, Igiene e Sanità Pubblica Veterinaria. Università di Milano, Italy

Corresponding author: Dr. Guido Grilli. Dipartimento di Patologia Animale, Igiene e Sanità Pubblica Veterinaria, Sezione di Anatomia Patologica Veterinaria e Patologia Aviare. Università degli Studi di Milano. Via Celoria 7, 20133 Milano, Italy - Tel. +30 02 50318121 - Fax: +30 02 50318106 - Email: guido.grilli@unimi.it

ABSTRACT

Examinations were conducted in terms of microbiological quality/quantity (TMC, Coliforms, *E. coli*, *S. aureus*, Sulphate-reducing *Clostridia*, *B. cereus, Salmonella* spp. and *Lysteria* spp. and *Campylobacter* spp.) on 240 poultry meat samples (chicken, turkey and quail) acquired pursuant to the standards set by the Regional Plan of programming and coordination in the field of operations concerning official inspections of Lombardia animal origin and by a few private companies for self-inspection. The TMC was consistently low and in line with reports in the literature, as was the case with coliforms, *E. coli*, *S. aureus*, sulphate-reducing Clostrides and *B. cereus*. In the case of *Salmonella* spp., only 5 samples tested positive: one for *S. typhimurium* and one for *S. enteritidis* (chicken); only one sample from turkey tested positive for *S. blokley*, and two out of five samples analysed from quail tested positive result for S. *typhimurium.* About 3% of the samples analyzed tested positive for *Listeria monocitogenes*, but they were within the legal limits. Research on *Campylobacter* thermophiles has involved only 50 samples, of which only 5 have tested positive. These results confirm the high quality of hygiene and cleanliness of poultry meat, in accordance with that reported in the national literature and with respect to EU norms.

Key words: Poultry, Turkey, Meat, Microbiological contamination.

RIASSUNTO

CARATTERISTICHE MICROBIOLOGICHE DELLA CARNE E PRODOTTI DERIVATI DI ORIGINE AVICOLA. RISULTATI DEI CONTROLLI EFFETTUATI IN PROVINCIA DI MILANO

Sono stati esaminati, sotto il profilo microbiologico quali/quantitativo (CBT, Coliformi, E. coli, S. aureus*, Clostridi solfito-riduttori,* B. cereus, Salmonella spp. e Lysteria spp. *e* Campylobacter spp.*), 240 campioni di carni avicole (pollo, tacchino e quaglia) conferite in base alle norme previste dal Piano regionale di programmazione e coordinamento degli interventi in materia di controllo ufficiale dei prodotti di origine animale della Lombardia e da alcune aziende private per autocontrollo. La CBT è risultata sempre bassa ed in linea con quanto riportato in bibliografia così come è avvenuto anche per i coliformi,* E. coli, S. aureus*,*

Clostridi solfito riduttori e B. cereus. *Per quanto riguarda* Salmonella spp.*, solo 5 campioni sono risultati positivi: uno a* S. typhimurium *e uno a* S. enteritidis *(pollo), un solo campione di tacchino è risultato positivo a* S. blokley *e due di quaglia su cinque campioni analizzati sono risultati positivi a* S. typhimurium*. Circa il 3% dei campioni analizzati è risultato positivo a* Listeria monocitogenes *ma entro i limiti di legge. La ricerca dei Campylobacter termofili ha interessato solo 50 campioni e solo 5 sono risultati positivi. Questi risultati confermano l'elevata qualità igienico-sanitaria delle carni avicole, in accordo a quanto riportato nella bibliografia nazionale e nel rispetto delle norme comunitarie.*

Parole chiave: *Pollo, Tacchino, Carne, Cariche microbiche.*

Introduction

The recent crises that have hit the meat food department (dioxins, avian flu, BSE, etc.), have great impact on consumption and have highlighted the fact that public opinion is today more attentive and sensitive than in the past, relative to the problems connected to the hygiene/sanitation aspects of animal food origins and the technologies of animal farming (Pignatelli, 2002). This evolution has convinced the European Commission to consider, as a strategic priority, the achievement of the highest possible standards for food safety. Over the years, this legislation has grown and become more specific, extending to all industrial and handicraft activities concerning foods and the obligation to develop a programme of self-inspection, and it has also provided a system of reference for its implementation (EU directive 43/93/CEE "hygiene of food products", received in Italy with the Legislative Decree of 26 May 1997, No. 155). Apart from specific norms on food hygiene, the legislative evolution at the Community level, to the end of major contribution to public health protection, has also taken into consideration zoonosis, or potentially so, zoonotic agents. To that end the formulation of the (CE) Regulation No. 99/2003 concerning the "measures of surveillance of zoonosis and zoonotic agents" was reached and the (CE) Regulation No. 2160/2003 "on the control of salmonella and other specific zoonotic agents present in foods". Moreover, the (CE) Regulation No. 2073/2005 of 15 November 2005, Attachment I, sets the criteria for safety relative to the microbiological load of food products, in particular as far as the presence of pathogenic micro-organisms are concerned. This regulation, apart from stabilising microbiological criteria, sets the norms for implementation, which the operators in the food sector must respect with regard to the applications of general and specific hygienic measures (art. 4 of the CE Regulation No. 852/2004). Coming into effect the 1st of January 2006, the CE Regulation No. 2073/2005 microbiological criteria previously defined autonomously by individual Member States will be coordinated on a European level and applicable to the food produced and in free circulation within the Common Market. The aim of the present research has been to evaluate the microbe contamination of samples of poultry meat and of the related products deriving from them, consigned to the Local Health Organisation, and from private farms for self-inspection in the Province of Milano.

Material and methods

The research was carried out at the laboratories of food Microbiology at the headquarters in Milano at the Istituto Zooprofilattico of Lombardia and Emilia Romagna in the years from 2005-2008, and it has taken into consideration the consignment of meat and raw products of the Local Health Unit, conducted according to the "Regional plan of programming and coordination of

interventions relating to official control of products originating from animals" edited by the General Management of Health for the Lombardia Region and by the individual companies for self-inspection.

The microbiological analyses that were executed, of a qualitative and quantitative type, were conducted following the methodology set forth by Zavanella (2000) and accredited laboratory methodology and, when required by regulation, the ISO methods set forth in Regulation CE No. 2073/2005.

Quantitative analyses

In the quantitative microbe research, the following bacteria were searched for, expressed in colony-forming unit/g (CFU/g) of the sample: total microbial count, Coliforms, *E. coli*, *S. aureus*, Faecal Streptococchi, Sulphate-reducing Clostrides, anaerobes and *B. cereus*. The quantitative research for Listeria was effectuated solely in the event of a positive result from the qualitative research.

Qualitative analyses

For this type of analysis, with the entry in force of Regulation (CE) No. 2073/05, it is necessary for the official/legal samples, in which research for *Salmonella* spp. and *Listeria monocytogenes* are the subject, the application of the standardised testing method (ISO), as set forth in the above-cited Regulation. For the genus Salmonella we proceeded, in the case of positive results, to identification of the species. For the samples not subject to this obligation, we resorted to equivalent accredited methods (Zavanella, 2000).

Results and discussion

The study has taken into consideration all the meat, poultry-based products, turkey and quail samples that arrived at the laboratory during the period from 01/19/05 to 10/30/08.

There were examined 180 chicken samples (forequarters, leg, whole chicken, breast, filet, muscle, wings and roast), 66 turkey samples (muscle, thigh, breast, leg, wing, roast, cutlet and sausage), 5 quail samples (muscle).

In all, controls were conducted on 251 samples for a total of 550 analyses, though the same number of analyses was not conducted on all samples.

With regard to total microbial counts, almost half of the controlled samples of chicken and turkey show a low contamination (<1000 CFU/g) and only a few samples had high microbe contamination; in particular, the maximum value found is of $6x10^8$ CFU/g in a turkey cutlet sample. It is to be noted, from a legislative point of view, there have been no reference limits established specifically regarding poultry meats. The Regulation CE 2073/2005 refers solely the values of total bacterial contamination regarding minced meat and meat preparations that must be within a *range* of $5x10^5$ - $5x10^6$ CFU/g. These data, however, coincide with that reported in the literature (Tompkin, 1983; Pasqual Anderson, 1992) whereas they are shown to be much higher with respect to that recently found by Teldeschi (2002) in samples of meat from chicken and products derived from chicken.

As for *Coliform* totals, 70% of the chicken samples show a load <30 CFU/g, and only 13% have loads superior to 100 CFU, for a maximum of 3000 CFU in a chicken leg sample. These results are super-imposable with regard to turkey, apart from a sample of cutlet in which there was a load of $22x10^5$ CFU/g.

For *E. coli* the analyses presented results lower than the threshold level of the analyses (<30CFU/g) in more than 90% of the samples. The few positive samples, however,

remain within the limits set by Regulation CE 2073/2005 with regard to preparations based on meat. Our results are shown to be lower than those recently reported by De Giusti *et al.* (2007).

95.3% of the analysed samples do not demonstrate contamination by *Staphylococcus aureus*, while the remaining 4.7% demonstrate low contamination equal to 30 CFU/g (chicken muscle and turkey leg). Vural *et al*. (2006) reported positive in 65% of the poultry samples while De Giusti *et al*., (2007) did not find detectable loads. In the United States contamination by these bacteria involves only 6.4% of the samples (Jackson *et al.,* 2007). The analyses have not shown *Clostridium perfringens* and *B. cereus* (limits of the analyses <30 CFU/g). The Sulphate-reducing Clostrides anaerobes, in this case *C. perfringens*, are reported in moderate quantities by Lindblad *et al.* (2006) and agree with our results just as it also does with respect to *B. cereus.*

With regard to *Salmonella* spp., only two samples (both chicken legs) in 180 (l.1%) gave positive results: one to *S. typhimurium* and one to *S. enteritidis*; only one turkey sample resulted positive, however, to *S. blokley* and two out of five of the quail samples analysed resulted positive to S. *typhimurium.* Also Lindblad *et al*. (2006) reports a contamination in the carcasses of chicken slaughtered in Sweden less than 0.8%. This low prevalence was expected because the poultry industry consists of groups typically integrated with a pyramidal structure, at the top of which there are players that are kept *Salmonella free* (Ceruti *et al*., 2003, 2004). Around 3% of the samples analysed resulted positive to *Listeria monocitogenes* but within the legal limits (Regulation CE 2073/2005) recently fixed at 100 CFU/g. The search for *Campylobacter* thermophiles involved only 50 samples and only 5 were positive. This data contrasts with the data of Ricci *et al*. (2006) which during a focused monitoring plan found very high prevalences both by cloacal swabs (83.33% of samples were positive) and directly from carcasses (77.9%

Table 1. Chicken samples analysis results (measured in CFU/g).

Chicken samples	Samples number	TMC	*Clostridia*	*S. Aureus*	*Coliforms*	*E. Coli*
Chicken	6	nt	<30	<30	<30	nt
Bust	35	271,000	<30	nt	<30	<30
Drumsteak	57	413,000	<30	<30	3000	<30
Breast	61	3,310,000	nt	nt	62	<30
Breast fillet	4	300,000	nt	nt	nt	30
Muscle	7	750	<30	30	<30	<30
Wings	7	45,000	nt	<30	337	<30
Roast	3	225,000	nt	<30	<30	nt
Tot./Average	180	$13x10^5$	<30	<30	985	<30

nt: not tested.

Table 2. Turkey samples analysis results (measured in CFU/g).

Turkey samples	Samples number	TMC	*Clostridia*	*S. aureus*	Coliforms	*E. Coli*
Rump	13	5,458,000	<30	<30	<30	30
Breast	9	183,000	nt	<30	<30	<30
Drumsteak	5	nt	nt	30	1768	90
Wings	4	nt	nt	nt	<30	nt
Muscle	6	300	nt	<30	<30	30
Roast	20	1,463,000	<30	<30	195	<30
Turkey chop	7	12,213,200	nt	<30	75.000	nt
Sausages	2	nt	nt	nt	<30	nt
Tot./Average	66	$28x10^5$	<30	<30	$8x10^3$	15

nt: not tested.

prevalence); the isolated strains belonged prevalently to the species *C. jejuni*. The sampling, however, was executed on carcasses removed directly from slaughter without refrigeration or freezing. These latter two systems of conservation appear to determine a notable reduction in the contamination of meats. Therefore, on the one hand the data probably obtained overestimated results with respect to actual contamination in poultry found in commerce, but on the other hand, however, it must not be forgotten that *Campylobacter* is a micro-organism characterised as infectious to man in low doses and, therefore, a few hundreds of CFU can be sufficient to cause alimentary toxic infection.

Conclusions

The contamination data obtained here are in line with or even less than those reported in the cited literature and fall within very high qualitative parameters, clearly within the limits set by national legislation. Such results should not be surprising considering the increased attention of the poultry industry toward the preventive and prophylactic systems, both during factory farming of the poultry species for meat and during the slaughtering phase and preparation of their products, thus confirming the efforts made to pursue the objectives proposed by the HACCP system by the strict bio-safety standards adopted and the principle of control of the supply chain "from farm to table". With regard to Salmonella, the prevention starts already at the breeding of the poultry which, besides being tested, are subjected to specific immunisation plans, overall for infections by *S. enteritidis* and *S. gallinarum,* in putting into action all that is planned also by the Regulation (CE) No. 2160/2003 on the control of salmonella and other zoonotic agents specifically present in food. In conclusion, we believe the hygienic-sanitary quality of poultry meats produced in our territory are optimum and in conformity with the provisions of current legislation.

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