Microbiological Quality of Carcasses from Healthy Slaughtered Ostriches (Struthio camelus) in Southern Italy

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To obtain microbiological data from ostrich carcasses at slaughter, a total of 130 samples were collected using the double wet/dry swab technique from the thigh and rib site of 65 carcasses. Total bacterial count (TBC) and Enterobacteriaceae were detected at level of 1.35 Log CFU/cm² in the thigh site and 1.62 Log CFU/cm² in the rib site and 0.57 Log CFU/cm² in the thigh site and 0.53 Log CFU/cm² in the rib site, respectively. Campylobacter jejuni was isolated in one rib sample (0.8%). Salmonella derby was isolated in two thigh site samples and one rib site sample (2.3%).

Key words: Campylobacter, Carcasses, Enterobacteriaceae, Ostrich, Salmonella, Total bacterial count.

The ostrich (Struthio camelus var. domesticus) is the largest of all birds and belongs to a small order of birds known as the ratitae or running birds (ostrich, emu, cassowary, rhea, and kiwi). Production and consumption of ostrich meat began in the second half of the last century in South Africa (Paleari et al. 1995). Since then, there has been a significant increase in other countries (Israel, USA, Egypt and Australia) and in Italy as well.

Ostrich meat consumption is having good consideration as alternative to other meats because of its tenderness (low fat contents and collagen) and nutritional value (Alonso-Calleja et al. 2004).

In this context, sanitary status of carcasses is essential to encounter threats such as prevention of contamination during slaughtering through adherence to good hygienic standards. Contaminating organisms can cause bacterial spoilage of the meat and loss of shelf life. Spreading of food-borne pathogens must also be considered. Little information are available in literature, nevertheless pathogens such as Salmonella spp. and Campylobacter spp. have been isolated from ostrich carcasses (Ley et al. 2001; Gaedirelwe et al. 2008). In Italy, where the ostrich industry is developing, birds are usually slaughtered in structures planned for big ruminants. At processing plant, birds are electrically stunned (Paleari et al. 1995) and raised by the legs for sticking and bleeding. Feathers are plucked manually and the carcasses are skinned before evisceration.

The aim of the present study was to get an indication of the hygienic status of carcasses and to assess the prevalence of food-borne pathogens from clinically healthy ostrich carcasses.

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MATERIALS AND METHODS

This study was carried out within four months (January to April 2010) in a small abattoir in Southern Italy. The plant's slaughter process steps included animal holding, electrical stunning, exsanguinations, fastening of the cloacae and defeathering, mechanical air inflation, skinning, upsetting of the carcass, evisceration, dressing and chilling. Every day 10-20 farmed animals were slaughtered. African Black Ostriches of approximately 95 kg of live weight were about 12 months old. A total of 130 samples were collected from the thigh and rib sites of 65 carcasses post evisceration. The double wet/dry swabbing technique was used over a 100 cm² area delimited by a sterile template. Briefly, the wet swabs were rubbed vertically, horizontally, then diagonally across the template surface (20 sec). Swabbing was repeated with dry swabs and subsequently inserted into a sterile transport vials and transported cooled to the laboratory where bacteriological analyses were carried out within 3 hours after sampling.

Microbiological analyses were done by culture after a dilution step. For enumeration of total bacterial count (TBC) an aliquot of each dilution (1 ml) was inoculated onto Plate Count Agar (Oxoid Ltd., Hampshire, UK.) and incubated at 32°C for 48h. Enterobacteriaceae enumeration was obtained by spreading 1 ml of diluted samples in Violet Red Bile Glucose Agar (Oxoid Ltd.) incubated at 37°C for 24 h. Based on their morphology round purple colonies surrounded by a purple halo were considered Enterobacteriaceae colonies. To investigate the presence of Campylobacter spp. a subset (1ml) of sample was inoculated into 10 ml of Campylobacter selective enrichment broth (Oxoid Ltd.) incubated at 42°C for 48 h. Subsequently, a loopful was streaked onto Campylobacter blood-free selective agar (Oxoid Ltd.) supplemented with CCDA Selective Supplement (Oxoid Ltd.) incubated at 37°C for 24 h. Suspicious colonies were subcultured on sheep blood agar (Difco Laboratories; 5% sheep blood, Oxoid Ltd.) incubated at 42°C for 24 h. After Gram staining, slim, gram-negative rods were tested for oxidase and catalase test. Isolates were identified biochemically by using API Campy identification kit in accordance with the manufacturer's instructions (bioMérieux SA, Marcy-l’Etoile, F). Examination for Salmonella spp. was done using a two-step enrichment procedure. Briefly, 1 ml of diluted sample was pre-enriched in 10 ml of Buffered Peptone Water (Oxoid Ltd.) incubated at 37°C for 24 h. Then, 1 ml of the pre-enriched broth was incubated at 37°C for 24 h in 10 ml of Selenite Cystine Broth Base (Oxoid Ltd.) and 0.1 ml was incubated at 41.5°C for 24 h in 10 ml of Rappaport-Vassiliadis Soya Pepton Broth (Oxoid Ltd.). Subsequently one loopful from each enriched broth was spread onto Salmonella Chromogenic Medium (Oxoid Ltd.) supplemented with Salmonella Selective Supplement (Oxoid Ltd.) and onto Xylose-Lysine-Desoxycholate Agar (Oxoid Ltd.). Plates were incubated at 37°C for 24 h. Suspicious colonies were biochemically tested by using the API 20E System in accordance with the manufacturer’s instructions (bioMérieux SA). Isolated strains identified as Salmonella-like colonies were then serotyped. The detection of the somatic O antigen and the flagellar H antigen was done by slide agglutination technique with monovalent and polyvalent antisera (Difco, Fischer Scientific) following the Kauffmann-White scheme (Grimont and Weill 2007). Differentials for sampling site and contamination level were evaluated using T test. Data were analyzed using GraphPad Prism version 5.00 for Windows, GraphPad Software, San Diego California USA.

RESULTS AND DISCUSSION

Using the double wet/dry sampling technique for TBCs, the average contamination post evisceration found in the present study was 1.35 Log CFU/cm² in the thigh site and 1.62 Log CFU/cm² in the rib site with significant differences between sites (p<0.05) (Table 1). The Enterobacteriaceae contamination was found to be 0.57 Log CFU/cm² in the thigh site and 0.53 Log CFU/cm² in the rib site without significative differences (p<0.05) (Table 2). Very little is known in literature about microbiological conditions of ostrich carcasses, nevertheless TBCs found are very low compared with those found by Karama et al. (2003) who reported an average surface counts of 4.21 Log CFU/cm² post evisceration. Differently, TBC reported by Hoffman et al. (2010) was 219.47
CFU/gr on carcasses from a EU export-approved abattoir in South Africa. Carcasses dressed at small abattoirs are reported to carry TBC at mean values of about $10^3$/cm², and Enterobacteriaceae or coliforms at mean numbers ≤ $10$/cm² (Forte et al. 2003; Gill et al. 2000; Severini et al. 2003). The low contamination found in the present study was likely due to good hygiene standards and to the small numbers of processed birds/day.

In view of food-borne pathogen detection, the isolation of Campylobacter spp. was recorded in only one sample from the rib site out of 130 (0.8%) collected samples. The isolate was biochemically identified as Campylobacter jejuni. Reports on the thermotolerant Campylobacter isolation have already been described in our Region where 48 (32%) out 150 cloacal swabs were found to be positive for Campylobacter jejuni (Cuomo et al. 2007). Few reports are reported on Campylobacter spp. on ostrich meat, with the organisms being recovered from 10% of about 200 carcasses (Ley et al. 2001). Salmonella spp. were found in three (2.3%) out of 130 collected samples that is, two from the thigh and one from the rib site. The serotype identified was Salmonella derby. Our results are in accordance with Ley et al. (2001) who found a low prevalence of Salmonellae recovered from ostrich, however such contamination maybe more frequent than those available considering that birds can be infected both on farm and during transportation, and high Salmonella-prevalence has been reported on feather and skin (Gobo and Banda, 1997). To sum up, low contamination of TBC and Enterobacteriaceae was found in the present study from clinically health ostriches at slaughter with good hygiene standards, nevertheless the detection of food-borne pathogens from the carcass surfaces must be elucidated in view of public health aspects.

### References


### Table 1. Total bacterial count (TBC) detected from ostrich carcass surfaces and expressed as Log CFU/cm²

<table>
<thead>
<tr>
<th>Site</th>
<th>Mean Log² CFU/cm²</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thigh</td>
<td>1.35a</td>
<td>1.65</td>
<td>0.7</td>
<td>5.3</td>
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<tr>
<td>Rib</td>
<td>1.62b</td>
<td>1.29</td>
<td>0.6</td>
<td>4.8</td>
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</tbody>
</table>

Values within a row without a common superscript are significantly different at α=0.05

### Table 2. Enterobacteriaceae detected from ostrich carcass surfaces and expressed as Log CFU/cm²

<table>
<thead>
<tr>
<th>Site</th>
<th>Mean Log² CFU/cm²</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thigh</td>
<td>0.57a</td>
<td>1.05</td>
<td>0</td>
<td>4.2</td>
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<tr>
<td>Rib</td>
<td>0.53 a</td>
<td>0.61</td>
<td>0</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Values within a row without a common superscript are significantly different at α=0.05

