MICROBIOLOGICAL QUALITY OF MEAT POULTRY FOODS (VISCERA, NECK AND FEET) AT THE RETAIL LEVEL IN PORTUGAL

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I. INTRODUCTION

One of the most widely consumed meat products across the world is poultry meat, both in developed and developing countries [1]. According to the most recent data, global poultry meat consumption reached 14.88 kg per capita in 2023 [2]. Among poultry meat products, broiler carcasses, cuts, and processed products are the most consumed (~75% of total poultry meat) followed by turkey (~25%) [3]. Poultry meat spoils quickly and even under refrigerated conditions *Enterobacteriaceae*, *Pseudomonas* spp., psychrotrophic and mesophilic bacteria are considered potential spoilers of poultry meat [4]. The contamination of poultry meat by deteriorative and pathogen agents are frequently associated with the slaughtering and processing phases. Typically, 1-day-old broiler chicks are obtained from hatching facilities and transported to grow-out facilities, where they are reared for 4 to 8 weeks before being slaughtered. Carcasses and viscera are subsequently further processed and transported to retail facilities. Once reaching retail, broilers can be sold as whole carcasses, cut parts, or further processed chicken products.

This study was conducted with the main aim of assessing the levels of microbiological contamination (deteriorative) of broiler meat (*Gallus gallus*) products namely viscera (liver, heart, gizzard) and feet and neck purchased from retail markets and supermarkets in package or unpacking conditions.

II. MATERIALS AND METHODS

A total of 72 poultry food products (livers, hearts, necks, gizzards, and feet), purchased in local market and supermarkets in North Portugal were analyzed for selected foodborne and spoilage microorganisms. The spoilage microorganisms analyzed were *Enterobacteriaceae*, *Pseudomonas* spp., moulds and yeasts, total mesophilic and psychrotrophic bacteria. ISO methods were applied and after incubation, typical colonies were counted and results were expressed in log cfu/g. For statistical purposes, when the microorganism count was below the detection limit, it was considered zero log cfu/g.

III. RESULTS AND DISCUSSION

Food products from local market displayed higher counts than from supermarkets for all microorganisms investigated. Regarding *S. aureus*, products from the local market presented on average over 1 log cfu/g (2,34 ± 1,53 vs. 1,01 ± 1,20) than supermarket food, except neck samples that accounted ~ 2 log cfu/g (3,54 ± 1,49 vs. 1,63 ± 1,04) more than supermarkets foods. Higher counts were also presented in non-packaged products.

The microbiological evaluation of spoilage microorganisms in the 72 food products purchased at the retail level in Portugal showed that total aerobes at 7ºC and 30ºC, *Enterobacteriacea*, Pseudomonas spp., and yeasts were present in all samples. At least one mould genus was isolated from 30.6% of the samples. Moulds were more prevalent in the neck (33.3%) followed by the liver (28.6%), feet (37.5%), gizzard (35.7%), and heart (18.8%) samples. In total, five different genera of moulds namely,

Acremonium spp., *Cladosporium* spp., *Verticillium* spp., *Fusarium* spp., and *Penicillium* spp. were identified.

Microbiological counts (mean±sd) of different broilers meat products namely, feet, gizzard, heart, liver and neck are presented in table 1.

Table 1. Microbiological counts (mean±sd) of different broiler products (feet, gizzard, heart, liver and neck).

Sample (N)	Total (72)	Feet (16)	Gizzard (14)	Heart (16)	Liver (14)	Neck (12)	*p*
Moulds and yeasts	0.38±0.65	0.49±0.70	0.48±0.797	0.13±0.342	0.43±0.745	0.38±0.57	NS
Enterobacteriacea	4.39±0.10	4.24±1.02	4.40±1.26	4.64±1.10	4.13±0.779	4.56±0.69	NS
Psychrotrophic	6.03±1.21	6.94±0.913	$5.73±1.54^{b}$	$5.79±1.20^{b}$	$5.59±0.864^{b}$	$6.01±0.99^{b}$	P<0.01
Mesophilic	6.12±1.01	$6.93±0.79^{a}$	$5.55±1.23^{b}$	$6.05±0.10^{a}$	$5.77±0.66^{b}$	$6.20±0.77^{a}$	P<0.001
Pseudomonas spp	4.07±1.17	$4.61±0.79^{a}$	$3.74±1.01^{a}$	$4.00±0.82^{a}$	$3.64±0.32^{b}$	$4.14±1.03^{a}$	P<0.001
E. coli	2.36±1.29	$1.78±1.28^{a}$	$1.24±1.08^{ab}$	$2.52±1.02^{acd}$	$2.83±0.85^{ac}$	$3.68±0.77^{d}$	P<0.001

NS: not significant

Mean counts of total mesophilic and total psychrotrophic were ~6 log cfu/g. Enterobacteriaceae, moulds and yeasts counts were similar in all broiler products with mean counts of 4.39 log cfu/g and 3.15 log cfu/g, respectively. Regarding the total mesophilic counts, significant differences (P<0.001) were observed with the liver presenting lower mean counts of 5.77 log cfu/g and feet the higher counts (6.93 log cfu/g). For psychrotrophic counts, feet presented the highest counts (P<0.001). In case of. Concerning E. coli higher counts were observed in the neck, with values of 3.68±0.77 log cfu/g.

The contamination of poultry meat by deteriorative and pathogen agents is frequently associated with the slaughtering and processing phases [5]. Contamination can occur during processing and contact with the facility's equipment (e.g., grinders, belts, and saws), contact with food handlers, and exposure to other environmental sources. During transport, broilers that are transported in the lower cages are soiled with fecal matter and during slaughter, there is no possibility of removing or washing them before sunburn, which, although its water is being removed, does not prevent the contamination of birds' subject to slaughter on the same day.

IV. CONCLUSION

Rearing on-farms, transport to slaughter, slaughter process, and at the retail market are all stages of food production with implications in hygiene and quality, where contamination can occur. The potential routes of microbial contamination of products throughout the poultry production and supply chain is a challenging in the food industry worldwide.

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