Preliminary Approach about the Microbiological Quality of Eggs Produced in Backyard Poultry, on Sale at the Regional Market Of Chillán, Chile.

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Abstract.

In Chile, the eggs produced in farmyard rearing of hens have a significant place in the preferences of the consumers. However, in many of the backyard flocks where these eggs are produced, the sanitary management of the hens (and their eggs) has severe deficiencies. The main objective of this survey was to perform a preliminary approach about the microbiological quality of the eggs produced on family farms and on sale at the Regional Market, the principal sale location of these products in Chillán, 8th Region of Chile. This research was carried out in October 2004, and consisted in a simultaneous sampling in two of the three premises at the Regional Market of Chillán, where eggs produced by backyard poultry were on sale. The totality of the eggs on sale in both premises (238) was acquired and was analyzed for detection of *Staphylococcus* spp., *Enterobacteriaceae* and *Salmonella* spp. The isolation procedures were made according to the FDA/AOAC/BAM guidelines. In seventy nine percent (79%) of the analyzed eggs, microbial contamination was detected. Of these contaminated eggs, 99% were contaminated by *Enterobacteriaceae* (78% out of the total number of eggs), whose counts varied from 1 x 10^5 to 6.5 x 10^6 CFU/ per gram of egg. Coagulase Negative *Staphylococcus* were isolated in five samples (2.67% of the contaminated eggs) and the counts varied from 1.8 x 10^2 to 2.2 x 10^2 CFU. *Salmonella* spp. was not detected in any of the analyzed eggs.

Introduction.

In Chile, the eggs produced on family farms are considered as a healthy and nutritive food, being an excellent source of high quality proteins. Their consumption is more and more significant, due to the current trend of consumers for the acquisition of more “natural” products (Skewes et al., 2001), where eggs produced in farmyard rearing of hens have a significant place in the preferences of the consumers, paying from a 30% to 50% premium compared to the price of eggs produced in commercial flocks. Often, these eggs are destined to consumption by the children and elderly, on the belief that this kind of eggs taste better and have higher nutritional value than eggs from commercial flocks. However, in many of the backyard flocks where these eggs are produced, the sanitary management of the hens (and their eggs) have severe deficiencies. According to previous research carried out in backyard flocks of Ñuble Province (Latorre et al., 2003; Latorre et al., 2005) it was observed that hens living in backyard flocks are exposed to several potential sources of infection, such as vectors, contaminated food and/or water and close contact with other domestic and wild animals, which are potential reservoirs of pathogens. Furthermore, it was possible to detect the almost total absence of measures for the prevention of avian diseases and poor hygiene both in the nests, where the eggs are laid, and on-farm storage places. Also, in the farms analyzed and in the Regional Market of Chillán,
where the present research was carried out, refrigerated storage and adequate practices in the manipulation of the eggs have not been implemented yet. This increases the probability of the sale of contaminated eggs, whose ingestion would be of a source of risk of foodborne diseases for consumers.

The main objective of this survey was to perform a preliminary approach about the microbiological quality of the eggs produced on family farms and on sale at the Regional Market, the principal sale location of these products in Chillán, 8th Region of Chile.

**Materials and Methods.**

This research was carried out in October 2004, and consisted in a simultaneous sampling in two of the three premises at the Regional Market of Chillán, where eggs produced by backyard poultry were on sale. The third premise was not sampled because both eggs produced in backyard poultry and eggs from commercial flocks were pooled and put on sale, making it impossible to determine their origin.

The totality of the eggs on sale in both premises (238) was acquired, which corresponded to 50 and 188 eggs, respectively.

The eggs were collected using sterile gloves, directly from the places where they were on sale and deposited on sterile bags for sampling and then were transported at 4°C to the Laboratory of Veterinary Microbiology, College of Veterinary Medicine, University of Concepción (Chillán Campus), where they were processed immediately for *Staphylococcus* spp., *Enterobacteriaceae* and *Salmonella* spp. detection. Cracked eggs were excluded from sampling.

The eggs’ surfaces were disinfected (Jones et al, 2002) and the egg contents were collected by aseptically cracking the egg on the rim of a sterilized glass container.

The entire internal contents of the eggs (50 grams, approximately) was deposited individually in a Stomacher bag and 450 ml of Peptone Water was added, obtaining a $10^{-1}$ dilution. Then, the sample was blended for 1 min.

The detection and count of *Staphilococcus aureus* was done injecting 1ml of the $10^{-1}$ dilution into a tube containing 9ml of physiological saline, obtaining 4 consecutive decimal dilutions ($10^{-5}$). For culturing, 1ml of each dilution (in triplicate) was spread onto a Baird Parker Agar plate, which was cultured at 35°C for 40 hours.

Next, the plates having 20-200 colonies were selected and all the colonies whose morphological characteristics were consistent with those indicated for *Staphilococcus Spp.* (Post, 1999) were counted.

The results were recorded as a “presumptive count” and the Coagulase Test was performed on these samples.

The *Enterobacteriaceae* detection and count was made according to the guidelines of the Health Protection Branch, Canada (Szabo, 1997) and the detection of *Salmonella Spp.* were carried out according to the procedures of the FDA/AOAC/BAM (Post, 1997).

The isolated *Enterobacteriaceae* species were characterized by means of Biochemical Tests (Moats, 1980).

**Results.**

In seventy nine percent (79%, 187 eggs) of the analyzed eggs, microbial contamination was detected.

Of these contaminated eggs, 99% (186 eggs) were contaminated by *Enterobacteriaceae* (78% out of the total number of eggs), whose counts varied from $1 \times 10^5$ to $6.5 \times 10^6$ CFU/ per gram of egg (Figure 1).

Among the *Enterobacteriaceae* species isolated, *Escherichia coli, Enterobacter aerogenes, Proteus mirabilis* and *Citrobacter freundii* were identified.
Salmonella spp. was not detected in any of the eggs analyzed. However, Coagulase Negative Staphylococcus were isolated in five samples (2.67% of the contaminated eggs) and the counts varied from $1.8 \times 10^2$ to $2.2 \times 10^2$ CFU.

Four of these five egg samples were contaminated with both Enterobacteriaceae and Staphylococcus spp. Only one of the samples was contaminated exclusively with Staphilococcus Spp. In the remaining contaminated samples, only Enterobacteriaceae were found.

**Figure 1:** Number of contaminated samples and Enterobacteriaceae counts (UFC) in eggs produced in backyard poultry of Ñuble Province, on sale at Regional Market in Chillán, Chile.

![Number of Contaminated Samples and Enterobacteriaceae counts (CFU) in Eggs Produced in Backyard Poultry, on sale at Regional Market in Chillán-Chile](chart.png)

**Discussion.**

In this study, all the eggs on sale in two of the three premises at Regional Market of Chillan were sampled. These eggs had a high proportion of contamination (79% of the analyzed eggs), which is higher than the contamination reported in eggs produced in Chilean commercial poultry flocks (Alexandre et al, 2000). However, these data agree with other reports on microbial contamination of eggs produced in backyard poultry on sale in Ñuble Province (Latorre et al, 2003), where 54% of the analyzed eggs were contaminated with several microorganisms.

According to the data reported by Hammack et al. (1993) and Smith et al. (2000), the contamination of the shell is the main cause of internal contamination of the eggs. On the other hand, faecal contamination facilitates the proliferation of Gram Negative bacteria, which are more able than Gram positives of penetrating through the egg shells.

Previous research carried out in backyard poultry of Ñuble Province (Latorre et al, 2003; Latorre et al, 2005) reported that eggs produced in this kind of productive system and on retail sale often have remained a fairly long time in the nests where the eggs were laid (range from 6 hours to 3 days). Additionally, in 93.3% of the farms analyzed in those investigations, the nests were very wet and abundant presence of chicken faeces was observed inside them.
In the case of the eggs analyzed in this research, it was not possible to obtain this type of data. However, if the conditions of sanitary management in the farms where the eggs were produced were similar to those reported in other farms of Ñuble Province, it could in part explain the high counts of microbial contamination, especially due to *Enterobacteriaceae*, of the eggs on sale at the Regional Market of Chillan.

As additional data, it is relevant to point out that a significant percentage (70%) of the egg shells analyzed in this research, showed the presence of faeces spots and other macroscopic elements (feathers, straw and even blood spots), whose presence has been associated to a higher probability of internal contamination of the eggs (Hammack et al, 1993), not to mention that the Chilean Sanitary Regulation of Food, prohibits the sale of dirty eggs and/or those with the presence of macroscopic elements on their surface (Chilean Sanitary Regulation...2004).

Coagulase-negative staphylococci often are found among the normal flora of human (Kloos and Bannerman, 1994; Von Eiff et al, 1998) and poultry (Kawano et al, 1996; Devriese et al, 1985) skin and mucous membranes; they long have been regarded as harmless skin commensals and dismissed as culture contaminants. In recent years, their potentially important role as pathogens and their increasing incidence have been recognized (Kloos and Bannerman, 1994; Von Eiff et al, 1998; Kawano et al, 1996). The presence of these bacteria in five of the analyzed eggs could be due to an incorrect handling by the vendors or could have an avian origin. In either event, it is not important from the perspective of the transmission of foodborne diseases, because the Coagulase Negative *Staphylococci* did not produce any type of staphylococcal enterotoxin (Rosec et al, 1997).

On the other hand, the high contamination rates of foods with enterobacteriaceae or long storage times and inadequate storage temperatures which allow bacterial growth, could be related to the large number of bacteria, which could be responsible for foodborne diseases in people (Acha and Szyfres, 2001), due to which the consumption of these products could be considered as a risk source, especially if the eggs are consumed raw or partially raw (Humphrey et al, 1989; Humphrey et al, 1991; Tauxe, 1991) or if they are consumed by children or the elderly.

According to the findings obtained in this research, in neither of the sampled premises were the eggs refrigerated, being maintained exposed to the elements at environmental temperatures. The microbiological charge that initially contaminated the eggs had the chance for multiplication as the number of days increased from laying until consumption due to the exhaustion on natural mechanisms of microbiological control inside the shell, and especially if “cold chains”, which inhibit bacterial growth, are not incorporated (Alexandre et al, 2000; Miyamoto et al, 1998; Gast and Holt, 2001; Hammack et al, 1993).

**Conclusion**

The analyzed eggs showed high levels of bacterial contamination. The microbiological charge that initially contaminated the eggs had the chance for multiplication as the number of days from laying until consumption increase and the ingestion of these eggs could be of a source of risk of foodborne diseases for consumers.

**References.**


