

Contaminación bacteriana de Productos Cárnicos Ovinos Comercializados en la Meseta Central de México

Bacterial Contamination of Sheep Meat Marketed in the Central Mexican Plateau

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RESUMEN

El estudio se realizó para evaluar la contaminación microbiológica de las canales de ovino comercializadas en el Altiplano Central Mexicano, durante el período Primavera - Verano 2012. Se recolectaron muestras en tres expendios mayoristas de las canales de ovino antes de la refrigeración, las manos de los trabajadores, y los cuchillos, utilizando la técnica de hisopo húmedo. Las muestras se analizaron para Cuenta Total de Aerobios Viabiles (TAVC), Cuenta Coliformes Totales (CCT) y Cuenta Coliformes Fecales (FCC), los conteos se determinaron por el método de recuento estándar en placa. Las medias de TAVC de las canales de ovino, las manos del personal, y los cuchillos fueron de $0,99 \pm 0,81$, $0,78 \pm 0,53$ y $1,84 \pm 0,28 \log_{10}$ UFC / mL, respectivamente; no se encontraron diferencias estadísticamente significativas ($P < 0,05$). La media de TCC para las canales fue de $0,74 \pm 0,56 \log_{10}$ UFC / mL y $0,36 \pm 0,48 \log_{10}$ UFC/mL para cuchillos, no se encontraron diferencias estadísticamente significativas ($P < 0,05$). No se detectaron FCC en las canales de ovino, el personal y los cuchillos. Los resultados indicaron buenas condiciones higiénicas y de manipulación durante los canales de comercialización.

Palabras clave: Enfermedades transmitidas por alimentos, seguridad alimentaria, canales de ovinos, TAVC, CCT.

ABSTRACT

The study was conducted to evaluate the sheep carcasses microbiological contamination sold in the Central Mexican Plateau, during Spring- Summer 2012 period. At three wholesalers were collected samples from sheep carcasses, workers' hands, and knives before chilling, using a wet swab sampling. The samples were analyzed for Total Aerobic Viable Count (TAVC), Total Coliforms' Count (TC) and Fecal Coliforms' Count (FCC); the counts were determined by standard plate count methods. The mean \log_{10} TAVC from sheep carcasses, personnel, and knives were of $0,99 \pm 0,81$, $0,78 \pm 0,53$, and $1,84 \pm 0,28$ CFU / ml, respectively without statistically significant difference ($P < 0,05$). For TCC a mean \log_{10} of $0,74 \pm 0,56$ CFU / mL for carcasses and $0,36 \pm 0,48$ CFU/mL from knives were not found statistically significant difference ($P < 0,05$). FCC were not detected for sheep carcasses, personnel, and knives. The results indicated good hygienic conditions and handling during carcasses marketing.

Key words: foodborne illnesses, food safety, sheep carcasses, TAVC, TCC.

INTRODUCTION

Foodborne illnesses (FBI) are widespread around the world and they represent a huge cost in term of human lives and suffering (Waal and Robert, 2005). FBI, although awkward to quantify, for Mexican population health are considered outstanding. Acute infectious diseases transmitted by bacteria, parasites and virus, through one of the possible routes, feeding are an important cause of morbidity in Mexico (FAO, 2002). Food safety is critical for Mexico development, because it has an impact on population health, food trade, and world-wide on the country efficiency and productivity (FAO, 2002).

The meat by its nature and origin is a favorable environment for pathogenic bacteria growth, is also frequently implied in foodborne illnesses introduction (FBI) (Signorini *et al.*, 2006). Poor slaughtering and marketing operations make microbiological contamination easier, due to the contact of meat with dirt, fecal matter and dust (Hernandez *et al.* 2007). This study was carried out to determine the microbial contamination in sheep carcasses sold in Central Mexican Plateau by identifying pathogenic microorganisms during marketing

process, considering the reception of the animal after slaughtering in the wholesales until its sale to the retailers.

MATERIALS AND METHODS

The work was conducted during Spring – Summer 2012 period, in three wholesalers at the municipality of Capulhuac, State of Mexico, located in state center (INEGI, 2009).

Sampling

From three different wholesalers a total of 108 sheep carcasses, 36 workers' hands, and 36 knives swab samples were collected during six weeks. Samples were collected post slaughter and before marketing. Three carcasses were randomly chosen per week from each wholesaler for bacteriological sampling. It was used a non-destructive method, swabs were moistened prior to sample collection, in a sterile broth of 0.1% peptone plus 0.85% NaCl. Four sites of each carcass (flank, thorax lateral, brisket and breast) were swabbed to form a composite sample; each one covered an area of 100cm^2 per sampling site, the total area sampled was 400cm^2 . The swab was rubbed first vertically, then horizontally and finally

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diagonally for 20 seconds across the entire meat surface delineated by a sterile stainless steel template.

The samples were transported in a refrigerated enclosure to the laboratory the same day for microbiological analysis.

Personnel samples were taken from their hands with cotton swabs moistened in 10 mL of buffered peptone water from a surface area of 20cm² marked with a sterile template. The samples were taken from the worker in charge of quartered the sheep carcasses.

Knives used for carcasses quartering were rubbed with a swab moistened in 1 mL of buffered peptone water where the handle is joined with the blade.

The samples were transported in a cooler at refrigeration temperature to the laboratory to be examined within 24 hours after sampling.

Microbiological analyses

Samples were diluted before plating in 0,1% peptone + 0,85% NaCl water, the samples

in the bottles were taken in consideration as 10⁰ dilution.

Diluted samples were inoculated on plate count agar for Total Aerobic Viable Count (TAVC) and incubated at 35°C for 48 h. Total Coliforms Count (TCC) was in red bile glucose agar at 35°C for 24 h. And for the Fecal Coliforms Count (FCC) diluted samples were deposited in the same TCC agar at 45°C for 24 h.

Statistical analysis

Bacterial counts were converted to log₁₀ CFU / mL, and statistically analyzed by Kruskal – Wallis test; with that purpose the statistical package Statgraphics Plus version 5.0 was used.

RESULTS

The mean value for TAVC carcasses samples is 0,99 ± 0,81 log₁₀ CFU / mL and for total coliforms count (TCC) was 0,74 ± 0,56 log₁₀ CFU / mL. Results are shown in Table 1.

Table 1. Mean values of TAVC, TCC and FCC of carcasses samples obtained from three wholesalers.

Microbiological variables	Wholesalers			Mean	P-value
	1	2	3		
TAVC (log ₁₀ CFU / mL ± s)	0,99 ^a ± 0,73	0,95 ^a ± 0,89	1,02 ^a ± 0,86	0,99 ± 0,81	0,84
TCC (log ₁₀ CFU / mL ± s)	0,52 ^a ± 0,59	0,70 ^a ± 0,73	0,59 ^a ± 0,47	0,74 ± 0,56	0,26
FCC (log ₁₀ CFU / mL ± s)	ND	ND	ND		

ND: not detected; ^a different letters within each row denote significant differences; s Standard deviation

For personnel TAVC mean was $0,78 \pm 0,53$, and knives $1,84 \pm 0,28 \log_{10}$ CFU / mL. Concerning total coliforms contamination (TCC), we have got a mean value for knives of

$0,36 \pm 0,48 \log_{10}$ CFU / ml. Fecal coliforms count (FCC) from personnel, and knives were not detected. The results are reported in Table 2.

Table 2. Mean values of TAVC, TCC and FCC of knives and workers' hands obtained from three wholesalers.

ITEM	TAVC	TCC	FCC
	(\log_{10} CFU / ml \pm s)	(\log_{10} CFU / ml \pm s)	(\log_{10} CFU / ml \pm s)
Knives	$1,84 \pm 0,28$	$0,36 \pm 0,48$	ND
Workers' hands	$0,78 \pm 0,53$	ND	ND

ND: Not detected; s: Standard deviation

In general, the carcasses and knives presented greater contamination ($P < 0.05$) of TAVC, TCC than workers' hands.

DISCUSSION

The level of the TAVC is usually accepted as a criterion for microbiological contamination of carcasses and as an indicator microorganism of hygiene (Zweifel and Stephan, 2003). The mean of TAVC during our study was $0,99 \pm 0,81 \log_{10}$ CFU / mL, within the values accepted by Mexican Official Standard NOM-213-SSA1-2002, since it does not apply for this parameter, it can be due to that the product at issue is a food that must be cooked for consumption, eliminating this microorganism group growth. Nevertheless, for Standard 2004 / 471 / CEE was within the values, lower than $3,5 \log_{10}$ CFU / ml. Our results were slightly lower than ones report by Desmarchelier *et al.* (2007) of $1,8 \log_{10}$ CFU /

ml. Likewise the results were inferior to those reported by Sumner *et al.* (2003), Phillips *et al.* (2001), y Zweifel y Stephan (2003), who respectively recorded rates of $2,59 \log_{10}$ CFU / ml, $3,3 \log_{10}$ CFU / ml and $3,0 \log_{10}$ CFU / ml, respectively. Feizullah and Daskalov (2010) quantified rates between $4,09$ and $6,79 \log_{10}$ CFU / cm² in small slaughterhouses and between $4,32$ and $7,20 \log_{10}$ CFU / cm² in great slaughterhouses. Other works showed significantly higher results than ours, such as El-Hadef *et al.* (2005) that reported values of $5,42 \log_{10}$ CFU / mL and Bhandare *et al.* (2007) of $6,06 \log_{10}$ CFU / mL.

Coliform bacteria are often associated with human and animal fecal matter, they are not necessarily disease producing themselves, but can be indicators of organisms that cause adverse health effects (Ray and Bhunia, 2008). Total coliform bacteria are classified as a "primary" standard and have a maximum contaminant level (MCL) of zero colonies per 100 mL (Haque *et al.*, 2008), similarly as for

aerobic mesophiles in the Mexican Official Standard, is indicated not applicable for this microorganism group probably for the same reason. The mean of TCC in our work was $0,74 \pm 0,56 \log_{10}$ CFU / mL, lower than the report by Hernández *et al.* (2007) and Haque *et al.* (2008) with rates of $4,85 \log_{10}$ CFU/mL and $1,03 \log_{10}$ CFU / ml, respectively. Add to this, Phillips *et al.* (2001), Bhandare *et al.* (2005), Byrne *et al.* (2005), Desmarchelier *et al.* (2007), Nouchi y Hamdi (2009), Feisullah and Daslakov (2010), Phillips *et al.* (2008a, 2008b), Bass *et al.* (2011), Phillips *et al.* (2013), Salmela *et al.* (2013) did not detect coliforms bacteria in sheep carcasses.

In addition to carcasses these microorganisms groups are quantified in knives and workers' hands, and the results of the current research for knives were $1,84 \pm 0,28 \log_{10}$ CFU / mL for TVAC, they are lower than those noted by Abdalla *et al.* (2009) of $3,1 \pm 0,4 \log_{10}$ CFU / mL, Bhandare *et al.* (2009) of $5,52 \pm 0,03 \log_{10}$ CFU / cm². Similarly, in the current work, the rate for TCC is of $0,36 \pm 0,48 \log_{10}$ UFC/cm², not being research reports which show the presence of these microorganisms.

When TAVC and TCC are quantified in workers' hands, values of $0,78 \pm 0,53 \log_{10}$ CFU / mL for TAVC were found, and TCC were not detected in the current research. However, Abdalla *et al.* (2007) reported a rate of $3,8 \pm 0,53 \log_{10}$ CFU / mL in workers' hands after evisceration.

Concerning fecal coliforms contamination, we did not detect for carcasses, personnel and knives. These results reflect the care during the manipulation of the channels, as well as the personal hygiene. As for aerobic mesophiles and coliform bacteria in Mexican Official Standard NOM – 213 – SSA1 – 2002, indicate that it do not apply for this microorganisms group.

CONCLUSION

Overall, this study showed that contamination level for sheep carcasses and knives use for cutting, and workers' hands who carried out this work from the three sheep meat wholesalers was considered very low compared to similar studies and Official Standards as 2004 / 471 / CEE and NOM-213-SSA1-2002. For future researches is suggested to carry out TAVC, CCT, FCC analysis in study area small retailers in order to detect in them microorganisms presence.

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