Microbiological characterization in market centers from the main municipality of sheep meat commercialization of Mexico

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Objectives: Foodborne illness (FBI) is a worldwide public health problem, one of each ten people in the world get sick from the consumption of food contaminated by microorganisms (viruses, bacteria, or parasites, or by toxic substances that these microorganisms produce). Among the most dangerous microorganisms that we can find mainly in meat, are the group of enteropathogenic bacteria such as *Escherichia coli*, *Shigella* and *Salmonella*; these pathogens are of great importance in human health because they can cause from simple diarrhea to the death of the consumer. Sheep meat is considered one of the most nutritionally important foods for human consumption because it provides an excellent source of calories through its content of essential fatty acids and fats of high biological value, besides its high value protein and being rich in vitamins and minerals. This same composition makes it an ideal environment for microorganisms' growth and propagation, these are the main cause of physicochemical characteristics deterioration and therefore, undesirable sensory changes occur in the smell, texture, and appearance, which are determining factors in the acceptance and final product shelf life. Meat from sheep slaughtered under conditions of good slaughter practice is sterile. Consequently, fresh meat microbiological profile presented to consumers is the sum of bad operations carried out during slaughter, storage, transportation, and distribution. Sheep production in Mexico has historically been aimed at satisfying internal demand, closely linked to traditional cuisine, sheep meat national per capita consumption is 950 g and 95% is made through the typical dish called barbecue and the rest in fine cuts. The State of Mexico is the largest national sheep production, more specifically Capulhuac of Mi- rafuentes, this municipality of 21.5 square kilometers is considered the number one producer at national level in production of sheep meat and fine cuts, in addition to being the largest producer of barbecue. In Capulhuac around 400,000 heads of sheep are slaughtered each year to supply the entire demand of Mexico City and metropolitan area. However, the production and commercialization are carried out in precarious conditions of technology and facilities, being mostly commercialized in the main streets of the municipality, hence the objective of this work was to quantify sheep meat microbiological profile marketed in the municipality of Capulhuac of Mirafuentes.

Materials and Methods: The present study was carried out in Capulhuac of Mirafuentes municipality, a sampling non-destructive method was executed in 30 establishments dedicated to the commercialization of sheep carcasses, including the municipal slaughterhouse. Plate counts were done under Mexican Standards NOM-110-SSA1- 1994 (sample collection), Aerobic Mesophilic (NOM-092-SSA1-1994) and Total Coliforms (NOM-113-SSA1- 1994), temperature and pH were evaluated with a portable potentiometer (HI99163 membrane pH meter, Hanna Instruments, USA) using the technique proposed by Honikel (1998).

Results and Discussion: A significant difference ($P < 0.005$) was found in microorganisms counts from the three types of sheep meat commercial centers. In relation to the count of Aerobic Mesophilic Bacteria (AM) and Total Coliforms (CT) both expressed in $\log_{10}$ CFU/mL, the carcasses marketed in the Municipal Slaughterhouse MA=0.9±0.04 and CT=4.41±1.56, present the lowest microor- ganisms' appearance compared to those marketed in the established Premises MA=4.41±1.56 and CT=2.70±0.52 and Mobile Stalls MA=5.37±1.58 and CT=2.64±0.24. Despite, when relating the results with Temperature ºC (T) of the commercialized carcasses, it can be observed that the Municipal Slaughterhouse sells hot carcasses T=22.36±1.9, in comparison with the other two, Established Premises T=17.89± 3.53 and Mobile Stalls T=16.48±2.82. Regarding Mexican regulations, there is no reference parameter, considering that the consumption of sheep meat is not made raw. However, when these results are compared with the European Community Regulation 2001/471/CE, that indicates as maximum limits AM=3.5 $\log_{10}$ CFU/mL and Enterobacteria=1.5 $\log_{10}$ CFU/mL, only the carcasses marketed in the Municipal Slaughterhouse comply with the permitted parameters.

Conclusions: Even thought that Municipal Slaughterhouse presents the lowest values in microbiological load, these only represent 7% of the total sheep carcasses marketed in the municipality of Capulhuac, which would indicate that 93% are a high-risk factor to generate FBI and thereby affect consumers health.

Key words: sheep meat, aerobic mesophiles, total coliforms, meat safety, barbecue.