IAFP Latino 2024
Simpósio Latinoamericano em Segurança dos Alimentos
Santos - SP - Brasil
11 a 14 Nov, 2024

Evaluation of exposure to Listeria monocytogenes and risk characterization of Listeriosis from the consumption of Semi-hard and Colonia artisanal cheeses in Uruguay

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Listeriosis is a foodborne disease (FBD) of great economic and social impact, caused by the consumption of food contaminated by *Listeria monocytogenes*. In the general population, this pathogen produces mild intestinal manifestations, but in the immunosuppressed population (elderly adults, pregnant women, children under 5 years of age, and individuals with debilitating diseases or with immunosuppressive treatment), it can cause invasive infections with a high fatality rate (16-33%). Listeriosis outbreaks have been linked to various foods, including cheeses and particularly those made with raw milk. Consumption in Uruguay of artisanal cheeses is estimated at 4.3 kg/capita/year. The effect of its physicochemical parameters (pH, a_w) on the growth of *Listeria monocytogenes* and the impact that the consumption of artisanal cheese has on public health, are unknown.

In this study, Semi-hard and Colonia cheeses from 6 different farms were analyzed during their ripening, 18 Semi-hard cheeses were ripped at 10 $\pm$ 1°C until their corresponding sampling. Likewise, 15 Colonia cheeses were ripped at 10 $\pm$ 1°C for 15 days, at 20 $\pm$ 1°C for 11 days and then, at 10 $\pm$ 1°C until analysis. pH, a_w, moisture, sodium chloride, fat, *Listeria* spp. and *L. monocytogenes* were analyzed in 1 wheel at each time of each type of cheese and farms at 0, 15, 30, 45 and 60 days and also for Semi-hard at 75 and 90 days. The results of pH and a_w, together with the following variables: count and prevalence of *Listeria monocytogenes* in the two cheeses, size of portion consumed, rate of growth/decrease of the pathogen in both cheeses, types of population (pregnant, vulnerable population and general) and dose-response models to listeriosis, were characterized by probability distributions. With them, the probabilistic model of exposure to *Listeria monocytogenes* due to the consumption of artisanal cheese was built using the @Risk software. The results were estimated using Monte Carlo simulation with 50,000 iterations. The average pH for the Semi-hard was 5.15 $\pm$ 0.18 and the a_w 0.93 $\pm$ 0.01. For Colonia, the average pH was 5.41 $\pm$ 0.14 and the a_w 0.96 $\pm$ 0.01. For the consumption of each one and assuming an average of 30 g for all populations, the model estimated that the Semi-hard, contained at the time of consumption, 155 colony forming units (CFU) of *Listeria monocytogenes* and the Colonia, 475 CFU . The probabilities of becoming ill were 3.1×10^{-10} and 9.5×10^{-10}in pregnant women, 2.3×10^{-11} and 6.9×10^{-11} in the vulnerable population, and in the general population 1.2×10^{-12} and 3.7×10^{-12} of Semi-hard and Colonia, respectively. Listeriosis cases per year were 2.5×10^{-6} for pregnant women, 2.4×10^{-6} for vulnerable

population and 7.8 x 10^{-7} for the general population for Semi-hard, and for Colonia the values were 36-37 times higher.

The exposure assessment to *Listeria monocytogenes* due to the consumption of Semi-hard and Colonia artisanal cheeses under the established conditions and using the data collected in this work, suggests that the probability of acquiring listeriosis is extremely rare in all population groups.

Agradecimentos: To the National Agency of Research and Innovation (ANII) for funding the master's scholarship and the project FSA_I_2017_1_138945: “Prevalence of Listeria monocytogenes in artisanal cheeses made with raw milk in Uruguay,” within which this research was framed, as well as to all the members of the project team, Latitud-Fundación LATU, and the Ministry of Livestock, Agriculture, and Fisheries of Uruguay (MGAP) for their support.