biology and life sciences forum

MDPI

Proceeding Paper

Listeria monocytogenes Isolated from Fresh Pork Meat Commercialised in La Plata, Buenos Aires, Argentina †

Raúl E. Iza [1,*], Hernán D. Nievas [1], Camila Aurnague [1], Victorio F. Nievas [1], Santiago Urtizberea [2], Silvana M. Arce [2], Francisco Bucchianeri Faccin [2], Fabiana A. Moredo [1] and Magdalena Costa [3]

[1] Laboratorio de Bacteriología y Antimicrobianos, Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata, La Plata 1900, Buenos Aires, Argentina; hnievas@fcv.unlp.edu.ar (H.D.N.); caurnague@fcv.unlp.edu.ar (C.A.); vfnievas@fcv.unlp.edu.ar (V.F.N.); fmoredo@fcv.unlp.edu.ar (F.A.M.)
[2] Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata, La Plata 1900, Buenos Aires, Argentina; santiagourtizberea@hotmail.com (S.U.); silmaga.a@gmail.com (S.M.A.); fran.buchia99@gmail.com (F.B.F.)
[3] Instituto de Genética Veterinaria "Ing. Fernando N. Dulout" (UNLP-CONICET), Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata, La Plata 1900, Buenos Aires, Argentina; mcosta@fcv.unlp.edu.ar
* Correspondence: riza@fcv.unlp.edu.ar
† Presented at the 3rd International Electronic Conference on Microbiology, 1–3 April 2025; Available online: https://sciforum.net/event/ECM2025.

Abstract

Listeria monocytogenes is one of the most significant foodborne pathogens capable of causing bacteremia. In the present study, a total of 138 pork meat samples were collected from 46 randomly selected butcher shops selling raw and ready-to-eat products in La Plata, Buenos Aires, Argentina. Samples were processed according to internationally recognised standards, resulting in a positivity rate of 32.6%. This constitutes the first report of *L. monocytogenes* in fresh pork meat in the region and provides a strong foundation for control strategies of this microorganism in fresh pork meat retailers in Argentina.

Keywords: *Listeria monocytogenes*; fresh pork meat; butcher shops

check for updates

Academic Editor: Ute Römling

Published: 9 July 2025

Citation: Iza, R.E.; Nievas, H.D.; Aurnague, C.; Nievas, V.F.; Urtizberea, S.; Arce, S.M.; Bucchianeri Faccin, F.; Moredo, F.A.; Costa, M. *Listeria monocytogenes* Isolated from Fresh Pork Meat Commercialised in La Plata, Buenos Aires, Argentina. *Biol. Life Sci. Forum* **2025**, *46*, 2. https://doi.org/10.3390/blsf2025046002

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Listeria monocytogenes is one of the most significant bacterial foodborne pathogens, capable of causing a systemic infection [1]. Its pathogenicity is attributed mainly to the ability to cross critical host barriers, including the placental and blood–brain barriers. In immunocompetent individuals, clinical manifestations range from asymptomatic carriage to mild, self-limiting symptoms. However, in immunocompromised individuals and the elderly, the infection may progress to involve the central nervous system, leading to meningitis, meningoencephalitis, or rhombencephalitis. In pregnant women, infection may lead to foetal loss or severe neonatal disease [2].

The persistence of *L. monocytogenes* in food-processing environments—including surfaces and equipment—has been extensively documented [3,4]. This is primarily attributed to its ability to survive under refrigeration temperatures, tolerate acidic conditions and osmotic stress, and form biofilm, which collectively contribute to its classification as one of the major hazards in the food industry [5]. As a result, *L. monocytogenes* has been frequently isolated from a wide variety of food matrices, including raw and processed meats, unpasteurised dairy products, raw and frozen vegetables, smoked and raw fish, and ready-to-eat (RTE) products [6].

According to the Food and Agriculture Organisation (FAO), pork is the second most consumed type of meat globally. In 2021, global pork consumption reached 104.8 million metric tons [7]. In Argentina, per capita pork consumption has increased by more than 60% over the past decade, rising from 10.40 kg in 2013 to 16.61 kg in 2024 [8,9]. The high protein content, along with essential vitamins and minerals, combined with a nearly neutral pH, makes meat and meat products highly susceptible to the rapid proliferation of foodborne pathogens such as *L. monocytogenes* [10]. Numerous studies have demonstrated that cross-contamination can occur during slaughter and meat processing [11–14]. However, data on the persistence of the pathogen at the retail stage remains limited. At this stage, items like meat grinders, cutting boards, and refrigerators may act as reservoirs, enabling the long-term survival and potential transmission of *L. monocytogenes* [15].

The context of butcher shops in Argentina differs significantly from that of other countries, particularly due to the concurrent sale of raw and ready-to-eat goods within the same retail environment. This practice increases the risk of cross-contamination and creates favourable conditions for the persistence and dissemination of *L. monocytogenes*, representing a relevant public health concern [6].

Given the unique pathogenic characteristics of *Listeria monocytogenes*, the increasing global and national consumption of pork meat and the context of butcher shops in Argentina, this study aimed to determine the occurrence of *Listeria monocytogenes* in fresh pork meat sold at butcher shops in La Plata, Buenos Aires, Argentina.

2. Materials and Methods

This study is part of an observational, transversal, and descriptive research project focused on food safety.

Between August and November 2024, a total of 138 pork meat samples were collected from 46 randomly selected butcher shops in the city of La Plata, Buenos Aires, Argentina. Inclusion required that shops offer fresh pork meat, with no consideration of sales volume. In each establishment, three individual samples were taken (pork chop, leg, and backbone). Samples were placed in sterile polyethene bags, transported in insulated containers maintained at <4 °C, and processed within 4 h of collection. A proportional portion was taken from each sample to form a single pool of 25 g.

Microbiological analysis was conducted according to ISO 11290-1:2017 guidelines [16]. Each 25 g pool was homogenised in 225 mL of Half Fraser broth (Biokar Diagnostics, Beauvais, France) and incubated at 30 °C for 24 h for primary enrichment. Subsequently, an aliquot of 0.1 mL of each enriched culture was transferred to 10 mL of Fraser broth (Biokar Diagnostics) supplemented with 0.1 mL of ferric ammonium citrate at 37 °C for 48 h.

Isolation and presumptive identification were performed on CHROMagar™ Listeria plates (CHROMagar, Paris, France) according to the manufacturer's instructions. One suspect colony (blue with a white halo) for each pool was selected and identified by biochemical test following ISO 11290-1:2017 standards. Initial steps included Gram staining, revealing Gram-positive, slim, short rods or coccobacilli, and a positive catalase reaction. Colonies were then subcultured on blood agar to assess β-haemolysis and subjected to the CAMP test with *Staphylococcus aureus* for further confirmation. Motility was evaluated using motility agar, with incubation at 25 °C for 48 h, and was confirmed by observing an umbrella-like growth pattern. Carbohydrate fermentation was tested using a sugar utilisation panel to distinguish *L. monocytogenes* from other *Listeria* spp., characterised by a positive L-rhamnose (acid formation) and a negative D-xylose reaction.

Finally, identification by Matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry (MALDI-TOF) was conducted using BD™ Bruker MALDI Biotyper® system (Bruker Daltonics, Bremen, Germany).

Confirmed *L. monocytogenes* isolates were subcultured in Brain Heart Infusion (Laboratorios Britania, Buenos Aires, Argentina) supplemented with 15% glycerol and preserved at −20 °C for further analysis.

3. Results and Discussion

In total, 15 out of 46 pools tested positive for *Listeria monocytogenes*, representing a positivity rate of 32.6%. This is the first report of this microorganism in fresh pork meat from butcher shops in Argentina. Among the available literature, most studies report lower contamination rates in pork meat from butcher shops. For example, Luo et al. [15] reported *L. monocytogenes* in 21.5% of minced pork samples and 13.0% of pork cuts in Zigong, China. Only one study, conducted by Kanuganti et al. [17] in Alabama, reported a higher prevalence, with 50.2% positivity in minced pork. The high positivity rate found in the present study highlights the relevance of *L. monocytogenes* as a potential public health hazard in the regional pork supply chain and underscores the need for improved hygiene and monitoring practices in butcher shop environments.

In Argentina, most available data on *L. monocytogenes* contamination in butcher shops focuses on beef. Leotta et al. [18] detected *L. monocytogenes* in 40 out of 86 ground beef samples (46.5%), a considerably lower frequency than the one documented by Figueroa et al. [6], who found a 68.1% positivity rate in various food matrices, with beef products showing the highest prevalence. Although the contamination rate observed in the present study on pork (32.6%) is comparatively lower, it is essential to consider these findings together. In many retail establishments, beef and pork are handled and sold in the same environment, raising concerns about potential cross-contamination between products. These findings support the hypothesis that butcher shops may serve as critical nodes for the amplification and dissemination of *L. monocytogenes* along the meat production and distribution chain.

Barril et al. [19] reported the detection of *L. monocytogenes* in 22.4% of environmental samples collected from butcher shops in Neuquén, Argentina. These results are particularly significant, considering the previously mentioned information that these establishments commonly handle beef, pork, and poultry, alongside RTE products within the same environment. These practices substantially increase the risk of cross-contamination. Considering the prevalence rates reported in beef and environmental samples in our region, it is crucial to emphasise the importance of implementing and continuously monitoring good manufacturing practices (GMPs) and food safety protocols, as well as avoiding the marketing of RTE products in areas where raw meat is processed.

Since 2022, all confirmed cases of listeriosis in Argentina must be reported to the Argentine Integrated Health Information System (SISA) [20], a measure aimed at improving national epidemiological surveillance. In this context, the present study represents the first documented occurrence of *Listeria monocytogenes* contamination in pork meat at retail butcher shops in our country. These findings contribute valuable baseline data to better understand the local prevalence and potential transmission routes of this pathogen.

4. Conclusions

This report provides a strong foundation for developing control strategies for *L. monocytogenes* in fresh pork meat retailers in Argentina. Although this constitutes a first approach, further studies are expected to include whole genome sequencing (WGS) and molecular characterisation in a subsequent stage to identify the serotypes involved and their associated virulence factors, which are a significant public health concern.

Author Contributions: Conceptualisation and methodology, F.A.M. and M.C.; investigation, R.E.I., H.D.N., C.A., S.U., S.M.A. and F.B.F.; resources V.F.N.; writing—original draft preparation, R.E.I. and M.C.; writing—review and editing, F.A.M. and M.C.; project administration and funding acquisition, F.A.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research was partially funded by Universidad Nacional de La Plata, grant number V294.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data may be available upon reasonable request.

Acknowledgments: We thank María Laura Meneses (Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata) and Paula Lorena Martin (Facultad de Ciencias Veterinarias, Universidad Nacional de La Plata) for the identification of the isolates by Matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry (MALDI-TOF).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Lecuit, M. *Listeria monocytogenes*, a model in infection biology. *Cell. Microbiol.* **2020**, *22*, e13186. [CrossRef]
2. Camargo, A.C.; Woodward, J.J.; Nero, L.A. The continuous challenge of characterizing the foodborne pathogen *Listeria monocytogenes*. *Foodborne Pathog. Dis.* **2016**, *13*, 405–416. [CrossRef] [PubMed]
3. Di Ciccio, P.; Rubiola, S.; Panebianco, F.; Lomonaco, S.; Allard, M.; Bianchi, D.M.; Civera, T.; Chiesa, F. Biofilm formation and genomic features of *Listeria monocytogenes* strains isolated from meat and dairy industries located in Piedmont (Italy). *Int. J. Food Microbiol.* **2022**, *378*, 109784. [CrossRef]
4. Silva, A.; Silva, V.; Gomes, J.P.; Coelho, A.; Batista, R.; Saraiva, C.; Esteves, A.; Martins, Â.; Contente, D.; Diaz-Formoso, L.; et al. *Listeria monocytogenes* from food products and food associated environments: Antimicrobial resistance, genetic clustering and biofilm insights. *Antibiotics* **2024**, *13*, 447. [CrossRef] [PubMed]
5. Bucur, F.I.; Grigore-Gurgu, L.; Crauwels, P.; Riedel, C.U.; Nicolau, A.I. Resistance of *Listeria monocytogenes* to stress conditions encountered in food and food processing environments. *Front. Microbiol.* **2018**, *9*, 2700. [CrossRef]
6. Figueroa, Y.; Gentiluomo, J.; Grisaro, A.; Buffoni, M.; Zipenco, N.; Sucari, A.; Buonfiglio, P.; Costa, M. Estudio epidemiológico y serotipificación por PCR múltiple de *Listeria monocytogenes* aislada de matrices alimentarias en Argentina. *Rev. Argent. Microbiol.* **2023**, *55*, 387–394. [CrossRef] [PubMed]
7. Lagarde, J.; Feurer, C.; Denis, M.; Douarre, P.E.; Piveteau, P.; Roussel, S. *Listeria monocytogenes* prevalence and genomic diversity along the pig and pork production chain. *Food Microbiol.* **2024**, *119*, 104430. [CrossRef]
8. Ministerio de Ganadería Agricultura y Pesca. Anuario Porcino—2013. 2013. Available online: https://www.magyp.gob.ar/sitio/areas/porcinos/estadistica/_archivos//000005-Anuario/130000-Anuario%202013.pdf (accessed on 29 May 2025).
9. FADA. Monitor Porcino—2024. 2024. Available online: https://fundacionfada.org/informes/%F0%9F%90%96-salio-el-monitor-porcino-de-abril/ (accessed on 29 May 2025).
10. Gajewska, M.; Bartodziejska, B. Microbial quality of traditional meat products manufactured on a small scale by Polish farms in the Lodz region. *Preprints*, 2024; 1. [CrossRef]
11. Jiang, R.; Wang, X.; Wang, W.; Liu, Y.; Du, J.; Cui, Y.; Zhang, C.; Dong, Q. Modelling the cross-contamination of *Listeria monocytogenes* in pork during bowl chopping. *Food Sci. Technol. Int.* **2018**, *53*, 837–846. [CrossRef]
12. Møller, C.O.A.; Sant'Ana, A.S.; Hansen, S.K.H.; Nauta, M.J.; Silva, L.P.; Alvarenga, V.O.; Maffei, D.; Silva, F.F.P.; Lopes, J.T.; Franco, B.D.G.M.; et al. Evaluation of a cross contamination model describing transfer of *Salmonella* spp. and *Listeria monocytogenes* during grinding of pork and beef. *Int. J. Food Microbiol.* **2016**, *226*, 42–52. [CrossRef] [PubMed]
13. Sorin Bolocan, A.; Oniciuc, E.A.; Alvarez-Ordonez, A.; Wagner, M.; Rychli, K.; Jordan, K.; Nicolau, A.I. Putative Cross-Contamination Routes of *Listeria monocytogenes* in a Meat Processing Facility in Romania. *J. Food Prot.* **2015**, *78*, 1664–1674. [CrossRef]
14. Zwirzitz, B.; Wetzels, S.U.; Dixon, E.D.; Fleischmann, S.; Selberherr, E.; Thalguter, S.; Quijada, N.M.; Dzieciol, M.; Wagner, M.; Stessl, B. Co-occurrence of *Listeria* spp. and spoilage associated microbiota during meat processing due to cross-contamination events. *Front. Microbiol.* **2021**, *12*, 632935. [CrossRef]
15. Luo, L.; Zhang, Z.; Wang, H.; Wang, P.; Lan, R.; Deng, J.; Miao, Y.; Wang, Y.; Wang, Y.; Xu, J.; et al. A 12-month longitudinal study of *Listeria monocytogenes* contamination and persistence in pork retail markets in China. *Food Control* **2017**, *76*, 66–73. [CrossRef]
16. *ISO 11290–1*; Microbiology of Food and Animal Feeding Stuffs–Horizontal Method for the Detection and Enumeration of Listeria monocytogenes—Part 1: Detection Method. International Organization for Standardization: Geneva, Switzerland, 2017.

17. Kanuganti, S.R.; Wesley, I.V.; Gopal Reddy, P.; Mckean, J.; Hurd, H.S. Detection of *Listeria monocytogenes* in pigs and pork. *J. Food Prot.* **2002**, *65*, 1470–1474. [PubMed]
18. Leotta, G.A.; Brusa, V.; Galli, L.; Adriani, C.; Linares, L.; Etcheverría, A.; Sanz, M.; Sucari, A.; Peral García, P.; Signorin, M. Comprehensive evaluation and implementation of improvement actions in butcher shops. *PLoS ONE* **2016**, *11*, e0162635. [CrossRef]
19. Barril, P.A.; Soto, S.A.; Jaureguiberry, M.V.; Gottardi, G.; Bascurd, I.; Leotta, G.A.; Oteiza, J.M. Microbiological risk characterization in butcher shops from the province of Neuquen, Patagonia Argentina. *LWT Food Sci. Technol. Int.* **2019**, *107*, 35–40. [CrossRef]
20. Ministerio de Salud. Comunicación epidemiológica. *Brote en curso de Listeriosis.* 2025. Available online: https://www.argentina.gob.ar/sites/default/files/2024/04/com-epi_brotelisteriosis_2842025.pdf (accessed on 29 May 2025).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.