

Zoonotic Pathogens in Frozen Red and Poultry Meat imports to Jordan in the period 2015–2019: *Salmonella* Typhimurium, *Salmonella* Enteritidis, *Listeria monocytogenes* and *E. coli* O157:H7

**Tariq Hantash^{1,2*}, Ofosuhene O. Apenteng¹, Ahmad Alhawajreh², Manal Nofal²,
Mohammad Attyah², Reem Zaghal², Håkan Vigre¹**

¹ Division for Global Surveillance, Research Group for Genomic Epidemiology, National Food Institute, Technical University of Denmark, Kemitorvet, 2800 Kgs. Lyngby, Denmark.

² Jordan Food and Drug Administration, Ahmed Al Kayed Al Qatishat St, Shafa Badran, P.O. Box: 11181, Postal Code: 811951, Amman, Jordan.

¹ thantash@hotmail.com

Received: 12/9/2021

Revised: 2/11/2021

Accepted: 1/12/2021

DOI: <https://doi.org/10.31559/CRMI2021.2.2.1>



This file is licensed under a [Creative Commons Attribution 4.0 International](https://creativecommons.org/licenses/by/4.0/)



Zoonotic Pathogens in Frozen Red and Poultry Meat imports to Jordan in the period 2015-2019: *Salmonella* Typhimurium, *Salmonella* Enteritidis, *Listeria* monocytogenes and *E. coli* O157:H7

Tariq Hantash ^{1, 2*}, Ofosuhen O. Apenteng ¹, Ahmad Alhawajreh ², Manal Nofal ², Mohammad Attyah ², Reem Zaghal ², Håkan Vigre ¹

¹ Division for Global Surveillance, Research Group for Genomic Epidemiology, National Food Institute, Technical University of Denmark, Kemitorvet, 2800 Kgs. Lyngby, Denmark.

² Jordan Food and Drug Administration, Ahmed Al Kayed Al Qatishat St, Shafa Badran, P.O. Box: 11181, Postal Code: 811951, Amman, Jordan.

Received: 12/9/2021

Revised: 2/11/2021

Accepted: 1/12/2022

DOI: <https://doi.org/10.31559/CRMI2021.2.2.1>

Abstract: Jordan's Food and Drug Administration Laboratories are responsible for the surveillance of zoonoses in frozen meat imports. Results from the surveillance are stored in Laboratory Food Examination System (LFES) portal. In the period from 2015 to 2019, there was an apparent decrease in the occurrence of microbiological pathogens in imported meat and meat products. Poultry meat was the main product not fulfilling the criteria for compliance. The dominant detected pathogen was *Salmonella* Typhimurium. The other detected pathogens were *Listeria* monocytogenes and *Salmonella* Enteritidis. All red meats were tested for *E. coli* O157:H7 and there were no batches with positive findings. Overall, the occurrence of these pathogens has decreased in the period from 2015 to 2019, which is probably due to the enforcement of food safety guidelines and Hazard Analysis Critical Control Point systems in the slaughterhouses in exporting countries. Still, the occurrence of microbiological pathogens in imported meat and meat products poses a risk for consumers in the region. Recommendations are required for the continuous evaluation and optimization of border inspection.

Keywords: Border inspection; Surveillance; *Salmonella*; Meat

* Corresponding Author

Tariq Hantash

National Food Institute, Technical University of Denmark, and Jordan Food and Drug Administration

E-mail: thantash@hotmail.com

Introduction

Since 2003, inspection of food safety and quality products has been a responsibility of the Jordan Food and Drug Administration (JFDA) (JFDA, Annual Report 2015-2020). The approaches for border inspections in Jordan are document verification, visual inspection, hygiene-qualities, and zoonotic pathogen examination. These inspections are conducted on the sites of 17 ports and airports (JFDA, Annual Report 2020). Selection of batches for microbiological testing was done based on the degree of health risk-based for imported foods, especially frozen meat, using the global Automated System for Customs Data (ASYCUDA) (JFDA, Annual Report 2020). The selection of samples from batches was made convenient by taking samples from different places inside the consignments (in front, middle, back, and sides). For imported food to Jordan, there are six appointed laboratories for food safety-quality compliance testing according to Jordanian specific products' standards (JFDA, Annual Report 2019).

Material and Methods

One of the appointed laboratories, Amman Customs' Food Laboratory, is specialized in testing imported frozen "meat and meat products" for selected organoleptic, chemicals and

microorganisms. The total investigated number of Jordanian frozen meat imports and results from batches detected as contaminated with microbiological zoonosis are stored in the JFDA's Laboratory Food Examination System (LFES) portal as a database. The data used in this study was extracted from this database for the period 2015 to 2019.

In the period from 2015 to 2019, 61,356 batches of frozen meat were imported to Jordan. About 60% of these batches (36,136) were examined in the Amman Customs' Food laboratory (JFDA, Annual Report 2015-2019).

Forty-six percent of all imported products were "red meat and meat products," followed by "poultry meat and meat products" (45%) and "fish and seafood products" (9%). Of the imported batches of different frozen meat and related products, about 40% originate from Brazil, 15% from the USA, 10% from Belgium, and 5% from Ukraine and Turkey each. The remaining 25% originated from about 25 other countries, varying from year to year (JFDA, Annual Report 2015-2020).

The imported meat products, depending on type, are tested for microbiological foodborne pathogens including *Salmonella* species, *Listeria monocytogenes*, and *E. coli* O157:H7. The pathogen-specific test methods are listed in Table 1.

Table (1): List of methods used in JFDA Laboratories for detection microbiological zoonosis in examined 'meat and meat products (red meat and offal) and 'poultry meat and meat products' (poultry meat and offal).

Meat Item	Foodborne Zoonotic Pathogens tested	Method of Analysis, (confirmation)
Red meat	<i>E. coli</i> O157:H7	ISO 16654:2001, (latex test and RT-PCR)
Red meat offal	<i>E. coli</i> O157:H7	ISO 16654:2001, (latex test and RT-PCR)
Poultry meat	<i>Salmonella</i> species, <i>Salmonella</i> Typhimurium, <i>Salmonella</i> Enteritidis	Rapid' <i>Salmonella</i> , (latex test and RT-PCR)
Poultry meat offal	<i>Salmonella</i> species, <i>Salmonella</i> Typhimurium, <i>Salmonella</i> Enteritidis	Rapid' <i>Salmonella</i> , (latex test and RT-PCR)
MDM poultry	<i>Salmonella</i> species, <i>Salmonella</i> Typhimurium, <i>Salmonella</i> Enteritidis	Rapid' <i>Salmonella</i> , (latex test and RT-PCR)
Processed Red meat	<i>Listeria monocytogenes</i>	ISO 11290-2017, (Microscopic and RT-PCR)
Processed Poultry meat	<i>Listeria monocytogenes</i>	ISO 11290-2017, (Microscopic and RT-PCR)

Results and Discussion

In total, out of the 36,136 tested batches in the period 2015 to 2019, 98 batches (0.3%) were identified as non-compliant with either *Salmonella* Typhimurium, *Salmonella* Enteritidis or *Listeria monocytogenes*. The number of batches contaminated with *Salmonella* Typhimurium and *Salmonella* Enteritidis from each country and poultry product categories is present in Table 2. The presence of *Listeria monocytogenes* in examined country-processed poultry and red meat products is presented in table 3. Overall, the main products that were found to be non-compliant were poultry

products, and the dominant detected pathogen was *Salmonella* Typhimurium with a detection rate of 0.5% (78 detected batches out of 15,083 examined frozen poultry products imported batches). The second most frequently detected food pathogen found was *Listeria monocytogenes*, with a detection rate of 0.6% in tested batches (13 detected batches out of 2,094 examined frozen processed poultry and red meat products imported batches). The pathogen with lowest detection rate (0.05%) was *Salmonella* Enteritidis (Table 2). A total of 15,735 batches of imported frozen red meat products were tested for

the presence of *E. coli* O157: H7, with only negative test results.

When comparing the proportion of positive samples for specific products across countries, for chicken parts, the presence of *Salmonella* in parts

from the USA is significantly higher than the presence of *Salmonella* in parts from Brazil, and apparently higher compared to the other countries (Table 2).

Table (2): The product categories that compliant and non-compliant for the *Salmonella* Typhimurium and *Salmonella* Enteritidis tests from 2015 to 2019.

Country-products	No. of samples tested (<i>Salmonella</i> spp.)	No. of positives (<i>Salmonella</i> Typhimurium)	No. of positives (<i>Salmonella</i> Enteritidis)	Positive Proportion (CI) % **
Brazil-Chicken parts	5687	16	1	0.3 (0.2-0.5)
USA [^] -Chicken parts	1995	48	3	2.6 (1.7-3.2)
Turkey-Chicken parts	447	0	1	0.2 (0.0-1.3)
Ukraine-Chicken parts	320	1	0	0.3 (0.1-1.8)
UAE [^] -Chicken parts	73	0	0	0.0 (0.0-5.0)
Turkey- Turkey parts	33	0	0	0.0 (0.0-10.4)
Poland- Turkey parts	15	0	0	0.0 (0.0-20.4)
Belgium-MDM chicken	1228	1	0	0.1 (0.0-0.5)
Brazil-MDM chicken	1058	2	0	0.2 (0.0-0.7)
Turkey-MDM chicken	289	1	0	0.3 (0.0-0.2)
Poland-MDM chicken	44	0	1	2.3 (0.4-11.8)
Brazil-Chicken carcasses	1211	0	0	0.0 (0.0-0.3)
Ukraine-Chicken carcasses	1116	0	1	0.1 (0.0-0.5)
USA [^] - Chicken carcasses	173	0	0	0.0 (0.0-2.2)
France-Chicken carcasses	143	0	0	0.0 (0.0-2.6)
Turkey-Chicken carcasses	98	0	0	0.0 (0.0-3.8)
Argentina-Chicken carcasses	52	0	0	0.0 (0.0-6.9)
USA [^] -Turkey carcasses	28	0	0	0.0 (0.0-12.1)
Russia-Chicken carcasses	22	0	0	0.0 (0.0-14.9)
Brazil-Turkey carcasses	19	0	0	0.0 (0.0- 16.8)
USA [^] -*Duck carcasses	8	1	0	12.5 (2.2-47.1)
Brazil-Chicken livers	903	1	0	0.1 (0.0-0.6)
USA [^] -Chicken livers	109	7	0	6.4 (3.2-12.7)
Turkey-Chicken livers	12	0	0	0.0 (0.0-24.3)

*game birds, [^]USA = United States of America, [^]UAE = United of Arab Emirates.

** Wilson's 95% confidence interval of positive proportion calculated in the R package "PropCIs"

Table (3): The product categories that compliant and non-compliant for *Listeria monocytogenes* examination from 2015 to 2019.

Country-products	No. of samples tested (<i>Listeria monocytogenes</i>)	No. of positives (<i>Listeria monocytogenes</i>)	Positive Proportion (CI) % **
UAE [^] -processed Chicken meat	782	1	0.1 (0.0-0.7)
KSA*- processed Chicken meat	729	9	1.2 (0.7-2.3)
Egypt- processed Chicken meat	33	2	6.1 (1.7-19.6)
Ukraine- processed Chicken meat	24	0	0.0 (0.0-13.8)
Turkey- processed Chicken meat	16	0	0.0 (0.0-20.6)
Kuwait- processed Chicken meat	13	0	0.0 (0.0-24.7)
USA [^] - processed Chicken meat	4	0	0.0 (0.0-49)
Lebanon- processed Chicken meat	3	0	0.0 (0.0-56.2)
KSA*- processed Red meat	170	1	0.6 (0.1-3.3)
Turkey- processed Red meat	340	0	0.0 (0.0-1.1)
Brazil- processed Red meat	52	0	0.0 (0.0-6.9)
UAE [^] - processed Red meat	40	0	0.0 (0.0-8.8)
Kuwait- processed Red meat	20	0	0.0 (0.0-16.1)
USA [^] - processed Red meat	4	0	0.0 (0.0-49)

** Wilson's 95% confidence interval of positive proportion calculated in the R package "PropCIs"

[^]UAE= United Arab Emirates, *KSA= Kingdom of Saudi Arabia, [^]USA= United States of America

According to Figure 1, the presence of *Salmonella* in chicken parts in poultry from the USA has decreased from 2015 to 2019. The presence of *Salmonella* in chicken parts from other countries was stable and low throughout the period.

The general increase in *Salmonella* positive proportion from 2018 to 2019 (Figure 1) was a result of increased detection of *Salmonella* Enteritidis in poultry products. The number of batches positive for *Listeria monocytogenes* varied from zero to nine between the years. (Supplementary material, Table 1).

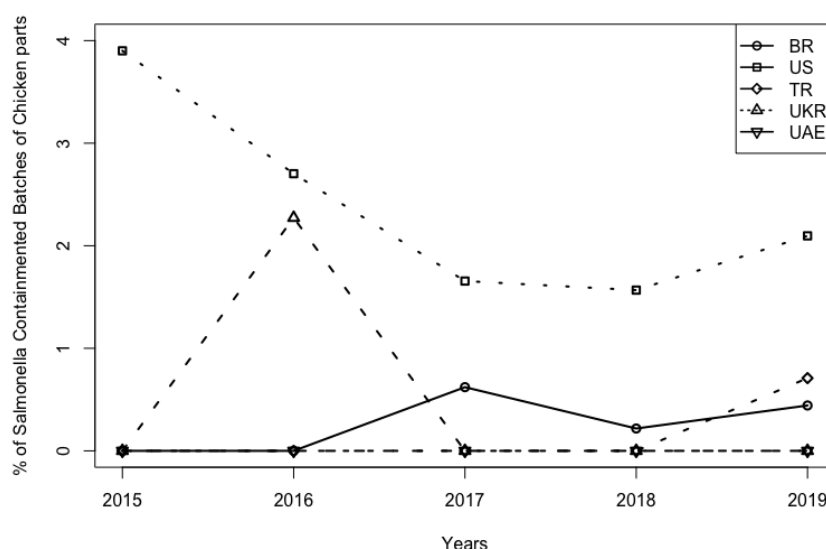


Figure (1): The percentages of *Salmonella*-contaminated batches of imported chicken parts from 2015 to 2019 (BR= Brazil, US= United States, UKR= Ukraine, TK= Turkey, UAE= United Arab Emirates).

In the period from 2015 to 2019, the notifications decreased for *Salmonella* Typhimurium, *Salmonella* Enteritidis in "poultry and meat products" and *Listeria monocytogenes* in "processed meat products". *E. coli* O157: H7 was not reported in the period. This indicates the occurrence of these pathogens is decreasing, probably due to the strict application of food safety rules and Hazard Analysis Critical Control Point systems in food exporting countries.

Although the apparent decrease in the occurrence of microbiological pathogens in imported meat and meat products poses a risk for consumers in the region, including Jordan, as zoonotic agents spread globally within the sophisticated world trade system. This is a motivation for the continuous evaluation and optimization of border control, especially increasing the likelihood of detected batches with lower concentration of zoonotic pathogens. In addition to the direct effect of border control, with the judgments of products that did not meet the recommended food safety requirements being returned or destroyed, it also has a preventive effect, forcing the exporting countries to improve the safety of their exported products continuously.

Conflict of interests: there is no conflict of interests.

References:

1. Jordan Food and Drug Administration. (2015). *Annual report* (Vol. 3). <http://www.jfda.jo/EchoBusV3.0/SystemAssets/PDF/AR/AnnualReports/AnnualReport2015.pdf/>
2. Jordan Food and Drug Administration. (2016). *Annual report* (Vol. 3). <http://www.jfda.jo/EchoBusV3.0/SystemAssets/PDF/AR/AnnualReports/AnnualReport2016.pdf/>
3. Jordan Food and Drug Administration. (2017). *Annual report* (Vol. 3). <http://www.jfda.jo/EchoBusV3.0/SystemAssets/PDF/AR/AnnualReports/AnnualReport2017.pdf/>
4. Jordan Food and Drug Administration. (2018). *Annual report* (Vol. 3). <http://www.jfda.jo/EchoBusV3.0/SystemAssets/PDF/AR/AnnualReports/AnnualReport2018.pdf/>
5. Jordan Food and Drug Administration. (2019). *Annual report* (Vol. 3). <http://www.jfda.jo/EchoBusV3.0/SystemAssets/PDF/AR/AnnualReports/AnnualReport2019.pdf/>
6. Jordan Food and Drug Administration. (2020). *Annual report* (Vol. 3). <http://www.jfda.jo/EchoBusV3.0/SystemAssets/PDF/AR/AnnualReports/AnnualReport2020.pdf/>

Supplementary Material:

Table (1): The compliant and non-compliant product categories of *Listeria* Monocytogenes examination from 2015 to 2019.

Country-products	year	No. of samples tested (<i>Listeria monocytogenes</i>)	No. of positives (<i>Listeria monocytogenes</i>)
UAE-processed Chicken meat	2015	91	1
^Other than UAE- processed Chicken meat	2015	532	0
**All- processed red meat	2015	354	0
Egypt- processed Chicken meat	2016	15	2
*KSA- processed Chicken meat	2016	145	6
*KSA- processed red meat	2016	170	1
^Other than Egypt and KSA- processed Chicken meat	2016	365	0
^Other than KSA- processed red meat	2016	198	0
*KSA- processed Chicken meat	2017	180	1
^Other than KSA- processed Chicken meat	2017	289	0
^Other- processed red meat	2017	157	0
**All- processed Chicken meat	2018	280	0
**All- processed red meat	2018	345	0
*KSA- processed Chicken meat	2019	190	1
^Other than KSA - processed Chicken meat	2019	112	0
**All- processed red meat	2019	187	0

UAE= United Arab Emirates, *KSA= Kingdom of Saudi Arabia, ^other= all imported countries except named one, **All= all imported countries.