

FEBRUARY 2019

MICROBIAL RISKS AND CANADIAN REGULATIONS FOR SPECIALTY ETHNIC FOODS: PORK DINAKDAKAN



Prepared by:

Tina Chen

National Collaborating Centre for Environmental Health



National Collaborating Centre
for Environmental Health

Centre de collaboration nationale
en santé environnementale

WHAT IS PORK DINAKDAKAN?

Dinakdakan is a popular appetizer dish originating from the Ilocos region in the Philippines. This dish typically consists of cooked pig organs such as ears, liver, face, stomach, and/or intestines, but can be made with other cuts of meat. Pig brain is typically used to thicken and bind the ingredients together, although in North America, pig brain is difficult to find so mayonnaise may be used in its place. Raw or lightly cooked meat dishes from the Philippines may be described as “kilawin” or “kinilaw.”

HOW IS DINAKDAKAN PREPARED?

Typically, pig organs (and pig brain if being used) are boiled until tender, then grilled until crispy. They are then chopped into bite-size pieces and combined with mayonnaise and vinegar (if no pig brain is used), or with pig brain and vinegar.

POTENTIAL MICROBIAL FOOD SAFETY RISKS

Pork and pork organ meats

Salmonella, *Campylobacter*, *Trichinella*, *Toxoplasma gondii*, Hepatitis E virus, and *E.coli* O157:H7 and other *E.coli* may be potential hazards in this ethnic food. *Salmonella* and *Campylobacter* commonly reside in the intestinal tract of domestic pig (swine).¹ *Salmonella* is found in environmental samples from multiple places on swine farms such as feed, floors, workers' boots, empty pens, and drains.¹ Organ/offal meats can potentially be contaminated with pathogens either internal or external to the animal carcass during the slaughtering process.^{1,2} Although control methods on swine farms and in slaughtering plants have reduced the prevalence of *Salmonella* found in carcass and environmental samples, reservoirs of pathogens still exist that can potentially contaminate carcasses and eventually reach consumers.¹ At the retail level, practices such as repackaging and grinding may also re-introduce pathogens. Organ/offal meat also has a greater prevalence of *Salmonella* compared to other retail pork products. *Campylobacter* is sensitive to drying

and low temperatures, thus its levels are low in retail pork products. However, cross-contamination with other meat products or the environment is still possible.¹ Many other pathogenic risks exist along the farm-to-retail route. *E.coli* O157:H7 was found in contaminated pork products that led to an outbreak involving 119 cases in 2014³ and 37 cases in 2018⁴ in Alberta.

Trichinella parasites are commonly associated with wild game meats, including wild boar, however have been absent in recent decades in Canadian domestic swine.^{5,6} Improved agricultural practices and better public awareness of the dangers of eating undercooked or raw pork products have lowered reports of trichinellosis.^{5,6} In fact, the risk of acquiring trichinosis from domestic Canadian pork is very low. The last case of trichinellosis from consumption of domestic pork in Canada was in 1980⁶, and the last case of trichinosis in domestic swine was detected in 2013⁷. However, wild boar and wild game meats continue to cause trichinosis outbreaks.⁸ *Toxoplasma gondii* is another re-emerging parasite in pigs, especially in animal-friendly production facilities that allow outdoor access.^{9,10} Hepatitis E virus (HEV) has also been found in pork liver and other pork products.^{11,12} Thorough cooking of HEV-contaminated pork liver for five minutes was shown to be effective to inactivate HEV.¹¹ These microbial hazards highlight the importance of adequate cooking of pork organ meats and prevention of cross contamination by applying HACCP-based food safety programs to reduce the likelihood of foodborne illness.

Mayonnaise

Mayonnaise is commonly used to replace pig brain in places where pig brain is not widely available. Made mainly with oil, raw egg, lemon juice or vinegar, and spices, the main control mechanisms to prevent and reduce pathogen growth in mayonnaise are the use of pasteurized eggs and pH verification of the finished product.¹³ Additionally, several studies have shown that pH level, storage temperature, type of oil used, and type of acidulant used greatly influence the rate of pathogen inactivation.¹⁴ Homemade mayonnaise made with contaminated raw eggs have been linked to salmonellosis outbreaks.^{13,15} Commercially produced

mayonnaise that follows good manufacturing standards and practices is relatively safe due to acidity and low water activity.^{14,16} However, these products are often used repeatedly from the same containers in food service establishments or home settings, thus creating the potential for cross-contamination.¹⁴ Past outbreaks of *Escherichia coli* O157:H7 have been linked to acidic foods such as unpasteurized apple cider and mayonnaise and mayonnaise-based dressings,^{17,18} indicating that it is able to tolerate certain acids and acidic conditions.

Although vinegar is also added to dinakdakan dishes and may have additional bactericidal effect on *Salmonella* and other foodborne pathogens,¹³ variables such as the type and amount of ingredients in different dinakdakan recipes will affect the pH level of the final dish. Combining mayonnaise with other ingredients may produce a buffering effect on the acidity of mayonnaise, thus allowing pathogen growth.¹⁴ Therefore, this dish should be treated as a potentially hazardous food, and appropriate times and temperatures for cooking, holding, and storage must be observed.

ASSOCIATED OUTBREAKS

US CDC foodborne illness data from 1990 to 2000 showed that the number of foodborne illness outbreaks in the US associated with ethnic foods increased from 3% to 11%.¹⁹ Canadian foodborne illness surveillance data from 2008–2014 shows that 26% of foodborne illness outbreaks reported meat as the source; however, data on specific dishes implicated in the outbreaks is not publicly available.²⁰ Canadian data on specific ethnic food items implicated in foodborne illness outbreaks is limited. To date, no available data specifically links outbreaks to pork dinakdakan.²¹ However, pork and pork products have been implicated in foodborne illness outbreaks previously.^{4,21} Based on FoodNet Canada surveillance data, *Listeria monocytogenes* has been found on raw pork meat at the retail level.²² Past outbreaks have also been linked to mayonnaise and mayonnaise-based dressings.^{13,15,17}

FOOD SAFETY RECOMMENDATIONS

Consisting typically of pork organ meat, mayonnaise, and vinegar, pork dinakdakan is considered to be a potentially hazardous food. Pork and pork organ meats should be cooked to at least 74°C, and allowed to rest for three minutes before cutting or consuming.²⁷ Exceptions to this rule using various times and temperatures may be permitted with approval of the responsible inspector.²⁸ Potentially hazardous foods should be stored or displayed at temperatures less than 4°C or more than 60°C.²⁹ Temperatures between 4°C and 60°C are considered to be the “danger zone” in which pathogens can grow to levels that can cause foodborne illnesses.³⁰ Potentially hazardous foods must not be held for more than two hours in the danger zone.³⁰

RELEVANT CANADIAN LEGISLATION

In Canada, the *Food and Drugs Act* governs the safety of foods for human consumption.²³ The sale of unsafe or improperly labelled foods, as outlined in the *Food and Drugs Act*, are prohibited in Canada.²⁴ This includes meat and meat products for sale in Canada, regardless of their origins.

Since January 2019, the *Safe Food for Canadians Act* and the *Safe Food for Canadians Regulations* consolidate the *Canada Agricultural Products Act*, the *Consumer Packing and Labelling Act*, the *Fish Inspection Act*, and the *Meat Inspection Act* in order to strengthen the safety of imported and exported foods, as well as foods traded inter-provincially. One of the main focuses of the Act is to streamline and improving food safety oversight and legislative authority.²⁵

All meats processed in Canada must be from a federally or provincially registered facility.²³ Meat and meat products that are transported between provinces or exported internationally must be processed in federally registered facilities, which are inspected by the Canadian Food Inspection Agency to ensure that the products are in accordance with the appropriate legislation. The *Safe Food for Canadians Regulations*

govern the inter-provincial trade, and import and export of meat products in Canada, and outline the inspection of animal slaughter operations and the standards and requirements for these facilities.²⁶

Within provinces and territories, provincial/territorial governments are responsible for ensuring the safety of the meats and meat products produced in provincially registered establishments.²³ Most of these establishments are small- to medium-sized facilities that are operated locally. Inspection of food service establishments in each province falls under the responsibility of provincial governments and provincial/regional health agencies. Each province and territory has established their own food safety legislation and guidelines.

ACKNOWLEDGEMENTS

The author would like to thank Lorraine McIntyre (BC Centre for Disease Control), Aljosa Trmcic (BC Centre for Disease Control), and Naghmeh Parto (Public Health Ontario) for their invaluable review and feedback for this document.

Photo credits: iStockPhoto

REFERENCES

1. Baer AA, Miller MJ, Dilger AC. Pathogens of Interest to the Pork Industry: A Review of Research on Interventions to Assure Food Safety. *Comp Rev Food Sci Food Safety*. 2013;12. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12001>.
2. Institute of Food Technologists. Chapter IV - Analysis of microbial hazards related to time/temperature control of foods for safety. *Comp Rev Food Sci Food Safety*. Silver Spring, MD: United States Food and Drug Administration; 2003. Available from: <https://www.fda.gov/downloads/food/foodborneillnesscontaminants/ucm545171.pdf>.
3. Honish L, Punja N, Nunn S, Nelson D, Hislop N, Gosselin G, et al. *Escherichia coli* O157:H7 infections associated with contaminated pork products – Alberta, Canada, July–October 2014. *Can Commun Dis Rep*. 2017;43(1). Available from: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/17vol43/dr-rm43-1/assets/pdf/17vol43_1-ar-04-eng.pdf.
4. Alberta Health Services. Updated: E. coli outbreak linked to recall of certain pork products in Alberta - April 28. 2018; Available from: <https://www.albertahealthservices.ca/news/Page14399.aspx>.
5. Centers for Disease Control and Prevention. Parasites - Trichinellosis (also known as Trichinosis): epidemiology & risk factors. Atlanta, GA: U.S. Department of Health and Human Services; 2012 [updated 2012 Aug 8; cited 2019 Feb 14]; Available from: <https://www.cdc.gov/parasites/trichinellosis/epi.html>.
6. Gajadhar AA, Bisaillon JR, Appleyard GD. Status of *Trichinella spiralis* in domestic swine and wild boar in Canada. *Can J Vet Res*. 1997;61(4):256. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/9342448>.
7. Canadian Food Inspection Agency. Trichinellosis - fact sheet. Ottawa, ON: CFIA; 2013 [updated 2013 Mar 11; cited 2019 Feb 22]; Available from: <http://www.inspection.gc.ca/animals/terrestrial-animals/diseases/reportable/trichinellosis/fact-sheet/eng/1330023015817/1330023110684>.
8. Appleyard GD, Gajadhar AA. A Review of Trichinellosis in People and Wildlife in Canada. *Can J Public Health*. 2000;91(4). Available from: <http://journal.cpha.ca/index.php/cjph/article/view/256/256>.
9. Dorny P, Praet N, Deckers N, Gabriel S. Emerging food-borne parasites. *Vet Parasitol*. 2009 Aug 7;163(3):196-206. Available from: <https://doi.org/10.1016/j.vetpar.2009.05.026>.
10. Kijlstra A, Eissen OA, Cornelissen J, Klaske M, Eijck K, Kortbeek T. *Toxoplasma gondii* infection in animal-friendly pig production systems. *Immunol Microbiol*. 2004;45(9). Available from: <https://iovs.arvojournals.org/article.aspx?articleid=2163818>.
11. Feagins AR, Opriessnig T, Guenette DK, Halbur PG, Meng XJ. Inactivation of infectious hepatitis E virus present in commercial pig livers sold in local grocery stores in the United States. *Int J Food Microbiol*. 2008;123(1-2):32-7. Available from: <https://doi.org/10.1016/j.ijfoodmicro.2007.11.068>.
12. Said B, Usdin M, Warburton F, Ijaz S. Pork products associated with human infection caused by an emerging phylotype of hepatitis E virus in England and Wales. *Epidemiol Infect*. 2017;145(12):2417-23. Available from: <https://doi.org/10.1017/S0950268817001388>.
13. Keerthirathne TP, Ross K, Fallowfield H, Whiley H. A review of temperature, pH, and other factors that influence the survival of salmonella in mayonnaise and other raw egg products. *Pathogens*. 2016;5(4):63. Available from: <https://doi.org/10.3390/pathogens5040063>.

14. Beuchat LR. Food safety issues and the microbiology of mayonnaise, salad dressings, acidic condiments, and mayonnaise based salads. In: Heredia N, Wesley I, Garcia S, editors. Microbiologically safe foods: John Wiley & Sons, Inc.; 2008. Available from: <https://doi.org/10.1002/9780470439074.ch17>.
15. Radford SA, Board RG. Review: Fate of pathogens in home-made mayonnaise and related products. Food Microbiol. 1993;10:269-78. Available from: <https://doi.org/10.1006/fmic.1993.1031>.
16. Smittle RB. Microbiological safety of mayonnaise, salad dressings, and sauces produced in the united states: a review. J Food Prot. 2000;63(8):1144-53. Available from: <https://jfoodprotection.org/doi/pdfplus/10.4315/0362-028X-63.8.1144>.
17. Weagant SD, Bryant JL, Bark DH. Survival of Escherichia coli O157:H7 in mayonnaise and mayonnaise-based sauces at room and refrigerated temperatures. J Food Prot. 1994;57(7):629-31. Available from: <https://jfoodprotection.org/doi/pdf/10.4315/0362-028X-57.7.629>.
18. Besser RE, Lett SM, Weber JT, Doyle MP, Barrett TJ, Wells JG, et al. An outbreak of diarrhea and hemolytic uremic syndrome from Escherichia coli O157:H7 in fresh-pressed apple cider. JAMA. 1993;17(2217-20). Available from: <https://www.ncbi.nlm.nih.gov/pubmed/8474200>.
19. Simonne AH, Nille A, Evans K, Marshall MRJ. Ethnic food safety trends in the United States based on CDC foodborne illness data. Rome, Italy: Food and Agriculture Organization of the United States; 2004. Available from: <http://agris.fao.org/agris-search/search.do?recordID=US201400168007>.
20. Bélanger P, Tanguay F, Hamel M, Phypers M. An overview of foodborne outbreaks in Canada reported through Outbreak Summaries: 2008-2014. Can Commun Dis Rep. 2015 Nov;41(11). Available from: <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/15vol41/dr-rm41-11/ar-01-eng.php#footnote1>.
21. Centers for Disease Control and Prevention. National Outbreak Reporting System (NORS). Atlanta, GA: U.S. Department of Health and Human Services; 2018 [updated 2018 Dec 7; cited 2019 Feb 14]; Available from: <https://wwwn.cdc.gov/NorsDashboard/Default.aspx>.
22. Public Health Agency of Canada. FoodNet Canada Annual Report 2013. Ottawa, ON: PHAC; 2013 [updated 2017 Nov 21; cited 2019 Feb 14]; Available from: <https://www.canada.ca/en/public-health/services/publications/food-nutrition/2013-foodnet-canada-annual-report.html>.
23. Canadian Food Inspection Agency. Canada's meat inspection system. Ottawa, ON: CFIA; 2013 [updated 2013 Jul 23; cited 2019 Jan 18]; Available from: <http://www.inspection.gc.ca/food/information-for-consumers/fact-sheets-and-infographics/products-and-risks/meat-and-poultry-products/meat-inspection-system/eng/1374559586662/1374559587537>.
24. Government of Canada. Food and Drugs Act R.S., c. F-27, s. 1. Ottawa, ON: Government of Canada; 1985. Available from: <https://laws-lois.justice.gc.ca/eng/acts/F-27/page-1.html>.
25. Canadian Food Inspection Agency. Safe Food for Canadians Act: an overview. Ottawa, ON: CFIA; 2015 [updated 2015 Apr 22; cited 2019 Jan 22]; Available from: <http://www.inspection.gc.ca/about-the-cfia/acts-and-regulations/regulatory-initiatives-and-notices-of-intent/sfca/overview/eng/1339046165809/1339046230549>.
26. Ministry of the Attorney General. Safe Food for Canadians Regulations (SOR/2018-108). Ottawa, ON: Government of Canada; 2018. Available from: <https://laws-lois.justice.gc.ca/eng/regulations/SOR-2018-108/index.html>.
27. Centers for Disease Control and Prevention. Parasites - Trichinellosis (also known as Trichinosis): prevention & control. Atlanta, GA: U.S. Department of Health and Human Services; 2013 [updated 2013 Dec 13; cited 2019 Feb 14]; Available from: <https://www.cdc.gov/parasites/trichinellosis/prevent.html>.
28. Canadian Food Inspection Agency. Chapter 4 - Meat processing controls and procedures. Ottawa, ON: CFIA; 2018 [updated 2018 Jul 12; cited 2019 Feb 18]; Available from: <http://www.inspection.gc.ca/food/archived-food-guidance/meat-and-poultry-products/manual-of-procedures/chapter-4/eng/1367622697439/1367622787568?chap=0#s8c6>.
29. Government of British Columbia. Food Premises Regulation B.C. Reg. 210/99. Victoria, BC: Government of BC, Queen's Printer; 2016. Available from: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/11_210_99.
30. BC Centre for Disease Control. Ensuring food safety - Writing your own food safety plan - The HACCP way. A guide for food service operators. Vancouver, BC. 2009. Available from: <http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/EH/FPS/Food/EnsuringFoodSafetyHACCPWay.pdf>.

ISBN : 978-1-988234-28-1

This document can be cited as:

Chen, T. Microbial Risks and Canadian Regulations For Specialty Ethnic Foods: Pork Dinakdakan. Vancouver, BC. National Collaborating Centre for Environmental Health. 2019 Feb.

Permission is granted to reproduce this document in whole, but not in part. Production of this document has been made possible through a financial contribution from the Public Health Agency of Canada through the National Collaborating Centre for Environmental Health.



National Collaborating Centre
for Environmental Health
Centre de collaboration nationale
en santé environnementale

© National Collaborating Centre for Environmental Health 2019
200-601 West Broadway, Vancouver, BC V5Z 4C2
Tel: 604-829-2551 | Fax: 604-829-2556
contact@ncceh.ca | www.ncceh.ca