

Survival of Foodborne Pathogens on Nuts: Tables and References

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Table 1. Storage survival studies of foodborne pathogens on nuts

Table 2. Storage survival studies of foodborne pathogens on nut pastes and seed paste products

Table 1. Storage survival studies of *E. coli* and foodborne pathogens on nuts

Pathogen	Nut	Nut type	Storage temp (°C)	Storage time	Reference
<i>Escherichia coli</i>	almond	flour (ground kernels)	−20	12 months	Cheng and Wang, 2018
		flour (ground kernels)	4	12 months	Cheng and Wang, 2018
		flour (ground kernels)	24	12 months	Cheng and Wang, 2018
	pecan	inshell	0	12 weeks	Beuchat, 1973
		kernel halves	−7	24 weeks	Beuchat, 1973
		kernel halves	0	24 weeks	Beuchat, 1973
		kernel halves	14	24 weeks	Beuchat, 1973
		kernel halves	21	24 weeks	Beuchat, 1973
		kernel halves	30	24 weeks	Beuchat, 1973
		walnut	inshell	ambient	9 months
	kernel (extracted from inshells after storage)	ambient	9 months	Frelka et al., 2016	
		kernel	ambient	8 months	Kokal, 1965
		kernel	9–14	8 months	Kokal, 1965
		kernel	−12	8 months	Kokal, 1965
	<i>Escherichia coli</i> O157:H7	almond	kernel	−19	12 months
kernel			4	12 months	Kimber et al., 2012
kernel			5	11 months	Hokunan et al., 2016
kernel			15	11 months	Hokunan et al., 2016
kernel			24	6 months	Kimber et al., 2012
kernel			25	11 months	Hokunan et al., 2016
hazelnut		inshell	24	12 months	Feng et al., 2018
peanut		kernel	−24	12 months	Brar et al., 2015
		kernel	−20	3 months	Miksch et al., 2012
		kernel	4	3 months	Miksch et al., 2012
		kernel	4	12 months	Brar et al., 2015
		kernel	22	3 months	Miksch et al., 2012
		kernel	22	12 months	Brar et al., 2015

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Pathogen	Nut	Nut type	Storage temp (°C)	Storage time	Reference
<i>Escherichia coli</i> O157:H7 (continued)	pecan	kernel	-24	12 months	Brar et al., 2015
		kernel	4	12 months	Brar et al., 2015
		kernel	22	12 months	Brar et al., 2015
	pistachio	inshell	-19	12 months	Kimber et al., 2012
		inshell	4	12 months	Kimber et al., 2012
		inshell	24	8 months	Kimber et al., 2012
	walnut	inshell	10	7 months	Frelka, 2013
		inshell	10	12 months	Frelka et al., 2016
		inshell	23-25	14 weeks	Blessington et al., 2013b
kernel		23	5 weeks /3 years ¹	Blessington et al., 2012	
Enterohemorrhagic <i>E. coli</i> (EHEC)	almond	kernel	5	11 months	Hokunan et al., 2016
		kernel	15	11 months	Hokunan et al., 2016
		kernel	25	11 months	Hokunan et al., 2016
<i>Listeria monocytogenes</i>	almond	kernel	-19	12 months	Kimber et al., 2012
		kernel	4	12 months	Kimber et al., 2012
		kernel	24	7 months	Kimber et al., 2012
		meal (ground kernels)	4	48 weeks	Zhu et al., 2020
		meal (ground kernels)	22	48 weeks	Zhu et al., 2020
	peanut	kernel	-24	12 months	Brar et al., 2015
		kernel	4	12 months	Brar et al., 2015
		kernel	22	12 months	Brar et al., 2015
	pecan	kernel	-24	12 months	Brar et al., 2015
		kernel	4	12 months	Brar et al., 2015
		kernel	22	12 months	Brar et al., 2015
	pine nut	kernel	25	6 months	Salazar et al., 2019
		pistachio	inshell	-19	12 months
	inshell		4	12 months	Kimber et al., 2012
	inshell		24	7 months	Kimber et al., 2012
	kernel, dry roasted		4	11 months (336 days)	Ly et al., 2020
	walnut	kernel, dry roasted	23	11 months (336 days)	Ly et al., 2020
		inshell	10	7 months	Frelka, 2013
		inshell	10	12 months	Frelka et al., 2016
		inshell	23-25	14 weeks	Blessington et al., 2013b
		kernel	23	5 weeks /15 weeks ¹	Blessington et al., 2012

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Pathogen	Nut	Nut type	Storage temp (°C)	Storage time	Reference	
<i>Salmonella</i>	almond	kernel	-20	6 months /18 months ²	Uesugi et al., 2006	
		kernel	-19	12 months	Kimber et al., 2012	
		kernel	-18	28 days	Xu and Chen, 2023	
		kernel	4	6 months /18 months	Uesugi et al., 2006	
		kernel	4	48 weeks	Abd et al., 2012	
		kernel	4	12 months	Kimber et al., 2012	
		kernel	4	28 days	Xu and Chen, 2023	
		kernel	5	11 months	Hokunan et al., 2016	
		kernel	15	11 months	Hokunan et al., 2016	
		kernel	21	4 weeks	Komitopoulou and Peñaloza, 2009	
		kernel	22	28 days	Xu and Chen, 2023	
		kernel	23	6 months /18 months	Uesugi et al., 2006	
		kernel	23	48 weeks	Abd et al., 2012	
		kernel	23	14 weeks	Blessington et al., 2013a	
		kernel	23	68 weeks/103 weeks	Limcharoenchat et al., 2019	
		kernel	24	12 months	Kimber et al., 2012	
		kernel	25	11 months	Hokunan et al., 2016	
		kernel	35	6 months	Uesugi et al., 2006	
		kernel	35	28 days	Xu and Chen, 2023	
				meal (ground kernels)	4	12 months
			meal (ground kernels)	22	12 months	Zhu et al., 2021
			flour (ground kernels)	21	17 weeks (120 days)	Sharma et al., 2021
		Brazil nut	kernel	8	59 weeks (413 days)	Onarinde, 2021
			kernel	23	59 weeks (413 days)	Onarinde, 2021
			kernel	37	59 weeks (413 days)	Onarinde, 2021
		chestnut	flour (ground kernels)	21	17 weeks (120 days)	Sharma et al., 2021
		coconut	flakes (dehydrated)	25 and/or 7	120 days (in total)	da Silva et al., 2022
		hazelnut	flour (ground kernels)	21	17 weeks (120 days)	Sharma et al., 2021
		peanut	inshell	28	60 weeks (420 days)	Nascimento et al., 2018
			kernel	-24	12 months	Brar et al., 2015
			kernel	-20	3 months	Miksch et al., 2012
			kernel	4	3 months	Miksch et al., 2012
			kernel	4	12 months	Brar et al., 2015
	kernel		22	12 months	Brar et al., 2015	
	kernel		23	3 months	Miksch et al., 2012	
	kernel		28	60 weeks (420 days)	Nascimento et al., 2018	
	kernel		28	6 months (180 days)	Pereira et al., 2020	
	pecan		inshell	-20	78 weeks (~18 months)	Beuchat and Mann, 2010
		inshell	-18	32 weeks	Beuchat and Heaton, 1975	

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Pathogen	Nut	Nut type	Storage temp (°C)	Storage time	Reference
<i>Salmonella</i> (continued)		inshell	-7	32 weeks	Beuchat and Heaton, 1975
		inshell	4	78 weeks (~18 months)	Beuchat and Mann, 2010
		inshell	5	32 weeks	Beuchat and Heaton, 1975
		inshell	21	32 weeks	Beuchat and Heaton, 1975
		inshell	21	78 weeks (~18 months)	Beuchat and Mann, 2010
		inshell	37	78 weeks (~18 months)	Beuchat and Mann, 2010
		kernel halves or pieces	-20	52 weeks	Beuchat and Mann, 2010
		kernel	-24	12 months	Brar et al., 2015
		kernel halves	-18	32 weeks	Beuchat and Heaton, 1975
		kernel halves or pieces	4	52 weeks	Beuchat and Mann, 2010
		kernel	4	12 months	Brar et al., 2015
		kernel halves	5	32 weeks	Beuchat and Heaton, 1975
		kernel halves	21	32 weeks	Beuchat and Heaton, 1975
		kernel halves or pieces	21	52 weeks	Beuchat and Mann, 2010
		kernel	22	12 months	Brar et al., 2015
	kernel halves or pieces	37	52 weeks	Beuchat and Mann, 2010	
	pistachio	inshell	-19	12 months	Kimber et al., 2012
		inshell	4	12 months	Kimber et al., 2012
		inshell	24	12 months	Kimber et al., 2012
	walnut	inshell	25	12 months	Haendiges et al., 2021
		inshell	4	20 weeks /3 years ¹	Blessington et al., 2013b
		inshell	10	7 months	Frelka, 2013
		inshell	10	12 months	Frelka et al., 2016
		inshell	23-25	2 weeks /3 years	Blessington et al., 2013b
		kernel	-20	3 weeks /3 years	Blessington et al., 2012
		kernel	4	3 weeks /3 years	Blessington et al., 2012
kernel		23	3 weeks /3 years	Blessington et al., 2012	
kernel		23	14 weeks	Blessington et al., 2013a	

¹ Multiple studies over a range of storage times.

² 171 days (6 months) or 550 days (18 months).

Table 2. Storage survival studies of foodborne pathogens on nut pastes and seed paste products

Pathogen	Nut	Nut or seed product	Storage temp (°C)	Storage time	Reference
<i>Clostridium botulinum</i>	peanut	peanut spread	30	16 weeks	Clavero et al., 2000
<i>Escherichia coli</i> O157:H7	peanut	peanut butter	4, 25	30 days	He et al., 2011
	sesame	tahini (sesame paste)	10, 21, 37	28 days	Al-Nabulsi et al., 2013
<i>Listeria innocua</i>	sesame	tahini	10, 21, 37	28 days	Al-Nabulsi et al., 2013
<i>Listeria monocytogenes</i>	almond	almond butter	5, 25	12 months	Fay et al., 2023
	hazelnut	hazelnut butter	5, 25	12 months	Fay et al., 2023
	pecan	pecan butter	5, 25	12 months	Fay et al., 2023
	peanut	peanut butter	5, 25	12 months	Fay et al., 2023
		chocolate-peanut spread	20	24 weeks	Kenney and Beuchat, 2004
	sesame	peanut butter	20	24 weeks	Kenney and Beuchat, 2004
		sesame butter	5, 25	12 months	Fay et al., 2023
<i>Salmonella</i>	peanut	peanut butter	4	14 days	Park et al., 2008
		peanut butter	4	30 days	He et al., 2011
		peanut butter	4	14 days	Ban and Kang, 2014
		peanut butter and spread	5	24 weeks	Burnett et al., 2000
		peanut butter	20	4 weeks	Grasso et al., 2010
		peanut paste	20	12 months	Kataoko et al., 2014
		peanut butter and spread	21	24 weeks	Burnett et al., 2000
		peanut butter	22	14 days	Park et al., 2008
		peanut butter	25	2 weeks	Keller et al., 2012
		peanut butter	25	14 days	Ban and Kang, 2014
		peanut butter	25	30 days	He et al., 2011
		peanut butter	25	4 weeks	He et al., 2013
		peanut butter	4, 25, 40	36 months	Flock et al., 2022
	sesame	halva (sesame confection)	6	8 months	Kotzekidou, 1998
		halva	18–20	8 months	Kotzekidou, 1998
		tahini	4	16 weeks	Torlak et al., 2013
		tahini	4	7 days	Xu et al., 2021
		tahini	10	28 days	Al-Nabulsi et al., 2014
		tahini	10	12 months	Osaili et al., 2021
		tahini	21	28 days	Al-Nabulsi et al., 2014
tahini	22	16 weeks	Torlak et al., 2013		
tahini	25	12 months	Osaili et al., 2021		

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Pathogen	Nut	Nut or seed product	Storage temp (°C)	Storage time	Reference
		tahini	25	7 days	Xu et al., 2021
		tahini	37	28 days	Al-Nabulsi et al, 2014
<i>Staphylococcus aureus</i>	sesame	helva (halva)	4	9 months	Sengun et al., 2005
		helva (halva)	20	9 months	Sengun et al., 2005

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References Cited

- Abd, S. J., K. L. McCarthy, and L. J. Harris. 2012. Impact of storage time and temperature on thermal inactivation of *Salmonella* Enteritidis PT 30 on oil-roasted almonds. *J. Food Sci.* 71:M42–M47.
- Al-Nabulsi, A. A., T. M. Osaili, R. R. Shaker, A. N. Olaimat, A. Attlee, M. A. Al-Holy, N. Zein Elabedeen, Z. W. Jaradat, and R. A. Holley. 2013. Survival of *E. coli* O157:H7 and *Listeria innocua* in tahini (sesame paste). *J. Food Agric. Environ.* 11(3-4): 303–306.
- Al-Nabulsi, A. A., A. N. Olaimat, T. M. Osaili, R. R. Shaker, N. Zein Elabedeen, Z. W. Jaradat, A. Abushelaibi, and R. A. Holley. 2014. Use of acetic and citric acids to control *Salmonella* Typhimurium in tahini (sesame paste). *Food Microbiol.* 42:102–108.
- Ban, G.-H., and D.-H. Kang. 2014. Effects of gamma irradiation for inactivating *Salmonella* Typhimurium in peanut butter product during storage. *Int. J. Food Microbiol.* 171:48–53.
- Beuchat, L. R. 1973. *Escherichia coli* on pecans: Survival under various storage conditions and disinfection with propylene oxide. *J. Food Sci.* 38:1063–1066.
- Beuchat, L. R., and E. K. Heaton. 1975. *Salmonella* survival on pecans as influenced by processing and storage conditions. *Appl. Microbiol.* 29:795–801.
- Beuchat, L. R., and D. A. Mann. 2010. Factors affecting infiltration and survival of *Salmonella* on in-shell pecans and pecan nutmeats. *J. Food Prot.* 73(7):1257–1268.
- Blessington, T., E. J. Mitcham, and L. J. Harris. 2012. Survival of *Salmonella enterica*, *Escherichia coli* O157:H7, and *Listeria monocytogenes* on inoculated walnut kernels during storage. *J. Food Prot.* 75:245–254.
- Blessington, T. E., C. G. Theofel, and L. J. Harris. 2013a. A dry-inoculation method for nut kernels. *Food Microbiol.* 33:292–297.
- Blessington, T., C. G. Theofel, E. J. Mitcham, and L. J. Harris. 2013b. Survival of foodborne pathogens on inshell walnuts. *Int. J. Food Microbiol.* 166:341–348.
- Brar, P. K., L. G. Proano, L. M. Friedrich, L. J. Harris, and M. D. Danyluk. 2015. Survival of *Salmonella*, *Escherichia coli* O157:H7, and *Listeria monocytogenes* on raw peanut and pecan kernels stored at –24, 4, and 22°C. *J. Food Prot.* 78:323–332.
- Burnett, S. L., E. R. Gehm, W. R. Weissinger, and L. R. Beuchat. 2000. Survival of *Salmonella* in peanut butter and peanut butter spread. *J. Appl. Microbiol.* 89:472–477.
- Cheng, T., and S. Wang. 2018. Influence of storage temperature/time and atmosphere on survival and thermal inactivation of *Escherichia coli* ATCC 25922 inoculated to almond powder. *Food Control* 86:350–358.
- Clavero, M. R. S., R. E. Brackett, L. R. Beuchat, and M. P. Doyle. 2000. Influence of water activity and storage conditions on survival and growth of proteolytic *Clostridium botulinum* in peanut spread. *Food Microbiol.* 17:53–61.
- da Silva, R. T., D. W. Schaffner, G. T. de Souza Pedrosa, T. M. R. de Albuquerque, J. F. Maciel, E. L. de Souza, V. O. Alvarenga, and M. Magnani. 2022. Survival kinetics, membrane integrity and metabolic activity of *Salmonella enterica* in conventionally and osmotically dehydrated coconut flakes. *International Journal of Food Microbiology* 370:109669.
- Fay, M. L., J. K. Salazar, X. Zhang, X. Zhou, and D. S. Stewart. 2023. Long-term survival of *Listeria monocytogenes* in nut, seed, and legume butters. *J. Food Prot.* 86(6):100094. Available at: <https://doi.org/10.1016/j.jfp.2023.100094>. [almond, hazelnut, peanut, pecan, sesame]
- Feng, L., M. Muiyarakandy, S. Brown, and M. A. Amalaradjou. 2018. Attachment and survival of *Escherichia coli* O157:H7 on in-shell hazelnuts. *Int. J. Environ. Res. Public Health* 15(6):1122 (11 pp). Available at: <https://doi.org/10.3390/ijerph15061122>.
- Flock, G., M. Richardson, D. Pacitto-Reilly, N. Anderson, F. Chen, G. Ahnrud, A. Mendoza, and A. Senecal. 2022. Survival of *Salmonella enterica* in military low-moisture food products during long-term storage at 4, 25, and 40°C. *J. Food Prot.* 85(4):544–552. Available at: <https://doi.org/10.4315/JFP-21-321>.

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- Frelka, J. 2013. The influence of postharvest handling practices on the microbiota of English walnuts (*Juglans regia* L.). M.Sc. thesis. University of California, Davis.
- Frelka, J. C., G. R. Davidson, and L. J. Harris. 2016. Changes in aerobic plate and *Escherichia coli*-coliform counts and in populations of inoculated foodborne pathogens on inshell walnuts during storage. *J. Food Prot.* 79:1143–1153. doi:10.4315/0362-028XJFP-15-553
- Grasso, E. M., J. A. Somerville, V. M. Balasubramaniam, and K. Lee. 2010. Minimal effects of high-pressure treatment on *Salmonella enterica* serovar Typhimurium inoculated into peanut butter and peanut products. *J. Food Sci.* 75(8):E522–E526.
- Haendiges, J., G. R. Davidson, J. B. Pettengill, E. Reed, P. Ramachandran, T. Blessington, J. D. Miller, N. Anderson, S. Myoda, E. W. Brown, J. Zheng, and R. Tikekar, and M. Hoffman. 2021. Genomic evidence of environmental and resident *Salmonella* Senftenberg and Montevideo contamination in the pistachio supply-chain. PLoS ONE 16(11):e0259471. Available at: <https://doi.org/10.1371/journal.pone.0259471>.
- He, Y., D. Guo, J. Yang, M. L. Tortorello, and W. Zhang. 2011. Survival and heat resistance of *Salmonella enterica* and *Escherichia coli* O157:H7 in peanut butter. *Appl. Environ. Microbiol.* 77(23):8434–8438.
- He, Y., Y. Li, J. K. Salazar, J. Yang, M. L. Tortorello, and W. Zhang. 2013. Increased water activity reduces thermal resistance of *Salmonella enterica* in peanut butter. *Appl. Environ. Microbiol.* 79(15):4763–4767.
- Hokunan, H., K. Koyama, M. Hasegawa, S. Kawamura, and S. Koseki. 2016. Survival kinetics of *Salmonella enterica* and enterohemorrhagic *Escherichia coli* on a plastic surface at low relative humidity and on low-water activity foods. *J. Food Prot.* 79:1680–1692.
- Kataoka, A., E. Enache, D. G. Black, P. H. Elliott, C. D. Napier, R. Podolak, and M. M. Hayman. 2014. Survival of *Salmonella* Tennessee, *Salmonella* Typhimurium DT104, and *Enterococcus faecium* in peanut paste formulations at two different levels of water activity and fat. *J. Food Prot.* 77:1252–1259.
- Keller, S. E., E. M. Grasso, L. A. Halik, G. J. Fleischman, S. J. Chirtel, and S. F. Grove. 2012. Effect of growth on the thermal resistance and survival of *Salmonella* Tennessee and Oranienburg in peanut butter, measured by a new thin-layer thermal death time device. *J. Food Prot.* 75:1125–1130.
- Kenney, S. J., and L. R. Beuchat. 2004. Survival, growth, and thermal resistance of *Listeria monocytogenes* in products containing peanut and chocolate. *J. Food Prot.* 67:2205–2211.
- Kimber, M. A., H. Kaur, L. Wang, M. D. Danyluk, and L. J. Harris. 2012. Survival of *Salmonella*, *Escherichia coli* O157:H7, and *Listeria monocytogenes* on inoculated almonds and pistachios stored at –19, 4, and 24°C. *J. Food Prot.* 75:1394–1403.
- Kokal, D. 1965. Viability of *Escherichia coli* on English walnut meats (*Juglans regia*). *J. Food Sci.* 30:325–332.
- Komitopoulou, E., and W. Peñaloza. 2009. Fate of *Salmonella* in dry confectionery raw materials. *J. Appl. Microbiol.* 106:1892–1900.
- Kotzekidou, P. 1998. Microbial stability and fate of *Salmonella* Enteritidis in halva, a low-moisture confection. *J. Food Prot.* 61:181–185.
- Limcharoenchat, P., M. K. James, and B. P. Marks. 2019. Survival and thermal resistance of *Salmonella* Enteritidis PT 30 on almonds after long-term storage. *J. Food Prot.* 82:194–199.
- Ly, V., V. Parreira, A. F. Sanchez-Maldonado, and J. M. Farber. 2020. Survival and virulence of *Listeria monocytogenes* during storage on chocolate liquor, corn flakes, and dry-roasted shelled pistachios at 4 and 23°C. *J. Food Prot.* 83:1852–1862. Available at: <https://doi.org/10.4315/JFP-20-129>.
- Miksch, R., T. Mai, and M. Samadpour. 2012. Survival of *Salmonella* spp. and *Escherichia coli* O157:H7 inoculated in raw peanuts stored at –20, 4, and 23°C, (Abstract P1-166). IAFP Annual Meeting, Providence, RI, July 22–25.
- Nascimento, M. S., J. A. Carminati, K. N. Morishita, D. P. Amorim Neto, H. P. Pinheiro, and R. P. Maia. 2018. Long-term kinetics of *Salmonella* Typhimurium ATCC 14028 survival on peanuts and peanut confectionery products. PLoS ONE 13(2):e0192457.
- Onarinde, B. A. 2021. Survival of *Salmonella* Enteritidis Phage Type 30 on Brazil nuts and pumpkin seeds stored at 8, 23, and 37°C. *J. Food Prot.* 84:2044–2052. Available at: <https://doi.org/10.4315/JFP-20-213>.

- Osaili, T., A. Al-Nabulsi, D. Nazzal, M. Al-Holy, A. Olaimat, R. Obaid, and R. Holley. 2021. Effect of water activity and storage of tahini on the viability of stressed *Salmonella* serovars. *Food Sci. Technol.* 41(1):144–150. Available at: <https://doi.org/10.1590/fst.39219>.
- Park, E.-J., S.-W. Oh, and D.-H. Kang. 2008. Fate of *Salmonella* Tennessee in peanut butter at 4 and 22 °C. *J. Food Sci.* 73:M82–M86.
- Pereira, A. A. M., F. S. Prestes, A. C. M. Silva, and M. S. Nascimento. 2020. Evaluation of the thermal resistance of *Salmonella* Typhimurium ATCC 14028 after long-term blanched peanut kernel storage. *LWT* 117:108701.
- Salazar, J. K., V. Natarajan, D. Stewart, Q. Suehr, T. Mhetras, L. J. Gonsalves, and M. L. Tortorello. 2019. Survival kinetics of *Listeria monocytogenes* on chickpeas, sesame seeds, pine nuts, and black pepper as affected by relative humidity storage conditions. *PLoS ONE* 14(12):e0226362. Available at: <https://doi.org/10.1371/journal.pone.0226362>.
- Santillana Farakos, S. M., R. Pouillot, N. Anderson, R. Johnson, I. Son, and J. Van Doren. 2016. Modeling the survival kinetics of *Salmonella* in tree nuts for use in risk assessment. *Int. J. Food Microbiol.* 227:41–50. Available at: <https://doi.org/10.1016/j.ijfoodmicro.2016.03.014>.
- Sengun, I. Y., O. Hancioglu, and M. Karapinar. 2005. Microbiological profile of helva sold at retail markets in Izmir city and the survival of *Staphylococcus aureus* in this product. *Food Control* 16(10):840–844.
- Sharma, R., A. Singh, and V. Yemmireddy. 2021. Effect of storage relative humidity on the survival kinetics of *Salmonella* spp., in different tree nut flours. *LWT* 152:112365. [almond, chestnut, hazelnut]
- Torlak, E., D. Sert, and P. Serin. 2013. Fate of *Salmonella* during sesame seeds roasting and storage of tahini. *Int. J. Food Microbiol.* 163:214–217.
- Uesugi, A. R., M. D. Danyluk, and L. J. Harris. 2006. Survival of *Salmonella* Enteritidis phage type 30 on inoculated almonds at –20, 4, 23 and 35°C. *J. Food Prot.* 69:1851–1857.
- Xu, S., and H. Chen. 2023. The influence of almond's water activity and storage temperature on *Salmonella* survival and thermal resistance. *Food Microbiology* 113:104269.
- Xu, Y., X. Guan, B. Lin, R. Li, and S. Wang. 2021. Oregano oil, epsilon-polylysine and citric acid assisted inactivation of *Salmonella* in two kinds of tahini during thermal treatment and storage. *Foods* 10:1272. Available at: <https://doi.org/10.3390/foods10061272>.
- Zhu, M., X. Song, X. Shen, and J. Tang. 2020. *Listeria monocytogenes* in almond meal: desiccation stability and isothermal inactivation. *Front. Microbiol.* 11:1689. Available at: <https://doi.org/10.3389/fmicb.2020.01689>.
- Zhu, M., X. Song, H.-C. Tsai, X. Shen, M. Taylor, and J. Tang. 2021. Desiccation and thermal resistance of *Salmonella* and *Enterococcus faecium* NRRL B-2354 in almond meal as impacted by water activity and storage temperature. *Food Control* 126:108037.