

## Anti-microbial Properties of Cinnamon

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Cinnamon (*Cinnamomum cassia*) bark has been used to flavor food since ancient times and is one of the most popular spices because of its distinctive taste. It was also used as a food preservative because of its strong antimicrobial effect. Modern studies have shown cinnamon to be effective against many types of microbes, but especially against *E. coli* O157:H7, a common cause of food borne illness.

There are many scientific citations that document the powerful antimicrobial properties of cinnamon against many pathogens. Some of those papers are cited below:

### References:

1. Inactivation of *Escherichia coli* O157:H7 by cinnamic aldehyde purified from *Cinnamomum cassia* shoot  
  
Kim, H.O; Park, S.W; Park, H.D; *Food microbiology*; **21(1)**; 2004; PP 105-110
2. Antimicrobial effect of spices on the growth of *Yersinia enterocolitica*  
  
Bara, M. T. F.; Vanetti, M. C. D.; *Journal of Herbs Spices & Medicinal Plants*; **3(4)**; 1995; PP 51-58
3. An in vitro evaluation of botanical compounds for the control of the honeybee pathogens *Bacillus larvae* and *Ascosphaera apis*, and the secondary invader *B. alvei*  
  
Calderone, N. W.; Shimanuki, H.; Allen-Wardell, G.; *Journal of Essential Oil Research*; **6(3)**; May-June 1994; PP 279-287
4. Antimicrobial and chemopreventive properties of herbs and spices  
  
Lai, P. K.; Roy, J.; *Current Medicinal Chemistry*; **11(11)**; June 2004; PP 1451-1460
5. A comparison of contact versus aroma inhibition of spices and extracts  
  
Singh, T.; Okafar, H.; Hampikian, G.; Briggs, B.; *Abstracts of the General Meeting of the American Society for Microbiology*; **103**; 2003; PP Q-222
6. Antimicrobial activities of various medicinal and commercial plant extracts  
  
Ates, D. Ayfer; Erdogrul, Ozlem Turgay; *Turkish Journal of Biology*; **27(3)**; 2003; PP 157-162
7. Effect of garlic extract and cinnamon powder on microbial profile and shelf life of minced chicken meat  
  
Yadav, A. S.; Singh, R. P.; Sharma, R. D.; Pandey, N. K.; *Indian Journal of Poultry Science*; **37(2)**; August 2002; PP 193-197

8. Combination of nisin and cinnamon to inactivate *Escherichia coli* O157:H7 in apple juice  
Yuste, J.; Fung, D. Y. C.; *Abstracts of the General Meeting of the American Society for Microbiology*, **102**; 2002; P 366
9. Bactericidal activities of plant essential oils and their components against *Escherichia coli* O157:H7 and *Salmonella enterica* in apple juice  
Mandrell, Robert E.; Levin, Carol; Henika, Phillip; Friedman, Mendel; *Abstracts of Papers American Chemical Society*, **224(1-2)**; 2002; PP AGFD 165
10. A method for identifying plant extracts that inhibit biofilm formation  
Niu, C.; Gilbert, E. S.; *Abstracts of the General Meeting of the American Society for Microbiology*, **101**; 2001; P 586
11. Effect of cinnamon on *Salmonella typhimurium*, *Yersinia enterocolitica*, and *Staphylococcus aureus* in apple juice stored under refrigeration  
Yuste, J.; Ruttan, J.; Fung, D. Y. C.; *Abstracts of the General Meeting of the American Society for Microbiology*, **101**; 2001; PP 567-568
12. In vitro assessment of the antibacterial activity of some Egyptian herbs and spices  
Khafagi, Ishrak K.; Abdel-Kareem, Marwa; *Egyptian Journal of Microbiology*, **35(3)**; 2000; PP 325-341
13. Evaluation of antibacterial activity of some plant oils against *Agrobacterium tumefaciens*  
El-Aziz, F. H. Abd; Hassanein, F. M.; *Phytopathology*, **91(6 Supplement)**; June, 2001; P S37
14. Inhibition of HIV-1 reverse transcriptase by methanol extracts of commercial herbs and spices  
Watanabe, Masahito; Oishi, Kunio; Ogihara, Jun; Kobayashi, Yasuko; Kato, Jun ; *Nippon Shokuhin Kagaku Kogaku Kaishi*, **47(8)**; 2000; PP 642-645
15. Potent antimicrobial activity of volatile oils from some spices  
Vaidya, A.D.B.; Pandita, N.; Calcuttawalla, A.; Bhatt, R. M.; Ayurveda, S. P. ; *Abstracts of the General Meeting of the American Society for Microbiology*, **99**; 1999; PP 10-11
16. Antimicrobial properties of essential oils and spices extracts against food pathogens  
Favre-Bonte, S.; Forestier, C.; Joly, B.; Kamel, C.; *Abstracts of the General Meeting of the American Society for Microbiology*, **99**; 1999; P 524
17. Antimicrobial properties of plant essential oils and essences against five important food-borne pathogens

- Smith-Palmer, A.; Stewart, J.; Fyfe, L.; *Letters in Applied Microbiology*; **26(2)**; 1998; PP 118-122
18. Antibacterial activity of selected fatty acids and essential oils against six meat spoilage organisms
- Ouattara, B.; Simard, R. E.; Holley, R. A.; Piette, G. J-P.; Begin, A.; *International Journal of Food Microbiology*; **37(2-3)**; 1997; PP 155-162
19. Antibacterial and antidermatophyte activities of some essential oils from spices
- El-Kady, I. A.; El-Maraghy, S. S. M.; Mostafa-M, E.; *Qatar University Science Journal*; **13(1)**; 1993; PP 63-69
20. A note on the microbial quality of selected spices
- Kaul, M.; Taneja, N.; *Journal of Food Science Technology*; **26(3)**; 1989; PP 169-170
21. Antibacterial properties of plant essential oils
- Deans, S. G.; Ritchie, G.; *International Journal of Food Microbiology*; **5(2)**; 1987; PP 165-180
22. Bactericidal effect of the essential oil of cinnamon
- Aliev, N. D.; Bairamova, R. A.; Alieva, Z. A.; *Azerbaijdzhanskii Meditsinskii Zhurnal*; **1**; 1986; PP 53-56
23. Antimicrobial properties of spices and herbs
- Zaika, L. L.; *Abstracts of Papers – American Chemical Society*; **191**; 1986
24. Antimicrobial action of essential oils against microorganisms potentially causing opportunistic infections
- Araujo, J. C. L. V. de; Lima, E. de O.; Ceballos, B. S. O. de; Freire, K. R. de L.; Souza, E. L. de; Santos Filho, L.; *Revista de Patologia Tropical*; **33(1)**; 2004; PP 55-64
25. Influence of subinhibitory concentrations of plant essential oils on the production of enterotoxins A and B and alpha -toxin by *Staphylococcus aureus*
- Smith-Palmer, A.; Stewart, J.; Fyfe, L.; *Journal of Medical Microbiology*; **53(10)**; 2004; PP 1023-1027
26. Natural preservatives in poultry meat products
- Yadav, A. S.; Singh, R. P.; *Natural Product Radiance*; **3(4)**; 2004; PP 300-303
27. Effect of cinnamon and garlic extracts on *Aeromonas hydrophila* in raw chicken meat mince
- Yadav, A. S.; Pandey, N. K.; Singh, R. P.; Singh, B. R.; *Journal of Food Science and Technology (Mysore)*; **41(2)**; 2004; PP 213-216

28. Antibacterial activities of naturally occurring compounds against antibiotic-resistant *Bacillus cereus* vegetative cells and spores, *Escherichia coli*, and *Staphylococcus aureus*  
Friedman, M.; Buick, R.; Elliott, C. T.; *Journal of Food Protection*; **67(8)**; 2004; PP 1774-1778
29. Screening for antibacterial properties of some Iranian plants against two strains of *Escherichia coli*  
Bonjar, G. H. S.; *Asian Journal of Plant Sciences*; **3(3)**; 2004; PP 310-314
30. Antimicrobial activity and synergistic effect of cinnamon with sodium benzoate or potassium sorbate in controlling *Escherichia coli* O157:H7 in apple juice  
Ceylan, E.; Fung, D. Y. C.; Sabah, J. R.; *Journal of Food Science*; **69(4)**; 2004; PP FMS102-FMS106
31. Malagasy aromatic plants: essential oils, antioxidant and antimicrobial activities  
Juliani, H. R.; Simon, J. E.; Ramboatiana, M. M. R.; Behra, O.; Garvey, A. S.; Raskin, I.; Eds.-Craker, L. E.; Simon, J. E.; Jatisatienr, A.; Lewinsohn, E.; *Acta Horticulturae*; **629**; 2004; PP 77-81
32. The influence of essential oils on microbiological indicators of meat products  
Tolkunova, N. N.; *Pishchevaya Promyshlennost*; **12**; 2002; PP 56-58
33. Inhibitory activity of spices and essential oils on psychrotrophic bacteria  
Fabio, A.; Corona, A.; Forte, E.; Quaglio, P.; *Microbiologica*; **26**; 2003; PP 115-120
34. Microbial profile and shelf life extension of dressed chickens as influenced by garlic extract and cinnamon powder  
Yadav, A. S.; Pandey, N. K.; Singh, R. P.; Sharma, R. D.; *Indian Journal of Poultry Science*; **37(2)**; 2002; PP 198-201
35. Laboratory evaluation of gaseous essential oils (Part 1)  
Inouye, S.; *International Journal of Aromatherapy*; **13(2/3)**; 2003; PP 95-107
36. Comparative study of antimicrobial and cytotoxic effects of selected essential oils by gaseous and solution contacts  
Inouye, S.; Abe, S.; Yamaguchi, H.; Asakura, M.; *International Journal of Aromatherapy*; **13(1)**; 2003; PP 33-41
37. Antibacterial activity of 11 essential oils against *Bacillus cereus* in tyndallized carrot broth  
Valero, M.; Salmeron, M. C.; *International Journal of Food Microbiology*; **85(1/2)**; 2003; PP 73-81

38. Antibacterial and antifungal properties of essential oils

Kalemba, D.; Kunicka, A.; *Current Medicinal Chemistry*; **10(10)**; 2003; PP 813-829

39. Efficiency of cinnamon bark oil, clove bud oil, and turmeric oil in inhibiting of acne-causing bacteria.

Charoenkul, N.; Rimkeeree, H.; Chompreeda, P.; Dilokkunanant, U.; Changchenkit, C.; *MONOGRAPH TITLE- Proceedings of 41st Kasetsart University Annual Conference, 3-7 February, 2003. Subject: Agro-Industry*; 2003; PP 236-241

40. Antibacterial activity of essential oils and their major constituents against respiratory tract pathogens by gaseous contact

Inouye, S.; Takizawa, T.; Yamaguchi, H.; *Journal of Antimicrobial Chemotherapy*; **47(5)**; 2001; PP 565-573

41. Inhibitory action of cinnamon on *Listeria monocytogenes* in meat and cheese

Menon, K. V.; Garg, S. R.; Mandokhot, U. V.; *Journal of Food Science and Technology (Mysore)*; **39(4)**; 2002; PP 432-434

42. Antimicrobial activity of natural inhibitors against *Salmonella typhimurium*

Mothershaw, A. S.; Al-Ruzeiki, M.; *Sultan Qaboos University Journal for Scientific Research - Agricultural Sciences*; **6(1/2)**; 2001; pp 47-51

43. Medicinal importance of spices grown in North India

Thakral, K. K.; Mangal, J. L.; Rajinder Thakral; *Journal of Arecanut, Spices and Medicinal Plants*; **4(1)**; 2002; PP 53-55

44. Inactivation of *Listeria monocytogenes* Scott A 49594 in apple juice supplemented with cinnamon

Yuste, J.; Fung, D. Y. C.; *Journal of Food Protection*; **65(10)**; 2002; PP 1663-1666

45. Bactericidal activities of plant essential oils and some of their isolated constituents against *Campylobacter jejuni*, *Escherichia coli*, *Listeria monocytogenes*, and *Salmonella enterica*

Friedman, M.; Henika, P. R.; Mandrell, R. E.; *Journal of Food Protection*; **65(10)**; 2002; PP 1545-1560

46. Application of some spices in flavoring and preservation of cookies: 2-antimicrobial and sensory properties of cardamom, cinnamon and clove

Adel, Z. M. B.; Siham, M. M. F.; Ahmed, T. M. E.; Barakat, S. M. M.; *Deutsche Lebensmittel-Rundschau*; **98(7)**; 2002; PP 261-265

47. Antimicrobial effect of essential oils on the seafood spoilage microorganism *Photobacterium phosphoreum* in liquid media and fish products

- Mejlholm, O.; Dalgaard, P.; *Letters in Applied Microbiology*; **34(1)**; 2002; PP 27-31
48. Inhibitory effects of selected Thai spices and medicinal plants on *Escherichia coli* O157 : H7 and *Yersinia enterocolitica*
- Stonsaovapak, S.; Chareonthamawat, P.; Boonyaratanakornkit, M.; *Kasetsart Journal, Natural Sciences*; **34(4)**; 2000; PP 510-517
49. Antimicrobial effect of various combinations of plant extracts
- Hsieh PaoChuan; Mau JengLeun; Huang ShuHui; *Food Microbiology*; **18(1)**; 2001; PP 35-43
50. Antimicrobial effect of cinnamon extract
- Hsieh PaoChuan; *Taiwanese Journal of Agricultural Chemistry and Food Science*; **38(2)**; 2002; PP 184-193
51. Antimicrobial activity of spices
- Bedin, C.; Gutkoski, S. B.; Wiest, J. M.; *Higiene Alimentar*; **13(65)**; 1999; PP 26-29
52. Cinnamon extracts' inhibitory effect on *Helicobacter pylori*
- Mina Tabak; Armon, R.; Ishak Neeman; *Journal of Ethnopharmacology*; **67(3)**; 1999; PP 269-277
53. A novel inhibitor of bacterial endotoxin derived from cinnamon bark
- Azumi, S.; Tanimura, A.; Tanamoto, K. I.; *Biochemical and Biophysical Research Communications*; **234(2)**; 1997; PP 506-510
54. Antimicrobial activity of some plant essential oils against *Listeria monocytogenes*
- Aureli, P.; Costantini, A.; Zolea, S.; *Journal of Food Protection*; **55(5)**; 1992; PP 344-348
55. Antimicrobial effect of CO2 spice extracts. From savory to cinnamon
- Ehrich, J.; Bauermann, U.; Thomann, R.; *Lebensmitteltechnik*; **27(11)**; 1995; PP 51-53
56. Antioxidant aqueous extracts from cinnamon (*Cinnamomum zeylanicum*, Blume) as inhibitors of influenza virus
- Mancini, D. A.; Dias, A. L.; Pinto, J. R.; Mancini, J.; *Brazilian J. Pharm. Sci.*; **35(1)**; 1999; PP 155-160
57. Methods for the evaluation of the antibacterial activity of essential oils
- Lens-Lisbonne, C.; Cremieux, A.; Maillard, C.; Balansard, G.; *Journal de Pharmacie de Belgique (Belgium)*; **42 (Sep-Oct)**; 1987; PP 297-302
58. Combined bactericidal activities of volatile oils and preservatives in oil/water dispersions
- Elkhouly, A. E.; Tawil, G.; Yousef, R. T.; *Acta Pharm. Fenn*; **87(Mar)**; 1978; PP 143-148

59. Effect of oil extracted from some medicinal plants on different mycotoxigenic fungi  
Soliman, K. M.; Badeaa, R. I.; *Food and Chemical Toxicology*, **40(11)**; 2002-11-00; PP 1669-1675
60. Research Note Inactivation of *Listeria monocytogenes* Scott A 49594 in Apple Juice Supplemented with Cinnamon  
Yuste, J.; Fung, D. Y. C.; *Journal of Food Protection*; **65(10)**; 2002-10-00 PP 1663-1666
61. Anti-HIV-1 Activity of Herbs in Labiatae  
Yamasaki, K.; Nakano, M.; Kawahata, T.; Mori, H.; Otake, T.; Ueba, N.; Oishi, I.; Inami, R.; Yamane, M.; Nakamura, M.; Murata, H.; Nakanishi, T.; *Biological & Pharmaceutical Bulletin*; **21(8)**; 1998-08-00; PP 829-833
62. Antimicrobial effect of extracts from Chinese chive, cinnamon, and *corni fructus*  
Mau, J.; Chen, C.; Hsieh, P.; *Journal of Agricultural and Food Chemistry*; **49**; 2001 Jan; PP 183-188
63. Antimicrobial action of essential oils: the effect of dimethylsulphoxide on the activity of cinnamon oil  
Hili, P.; Evans, C. S.; Veness, R. G.; *Letters in Applied Microbiology*; **24**; 1991 Apr; PP 269-275
64. In vitro activity of *Cinnamomum zeylanicum* against azole resistant and sensitive *Candida* species and a pilot study of cinnamon for oral candidiasis  
Quale, J. M.; Landman, D.; Zaman, M. M.; Burney, S.; Sathe, S. S.; *American Journal of Clinical Medicine*; **24**; 1996; PP 103-109
65. Methods for evaluation of antibacterial activity of essential oils: application to essences of thyme and cinnamon  
Lens-Lisbonne, C.; Cremieux, A.; Maillard, C.; Balansard, G.; *Journal de pharmacie de Belgique*; **42**; 1987 Sep-Oct; PP 297-302
66. Isolation, purification, and antibiotic activity of o-methoxycinnamaldehyde from cinnamon  
Morozumi, S.; *Applied and Environmental Microbiology*; **36**; 1987 Oct; PP 577-583
67. Antibacterial Effect of Cinnamon (*Cinnamomum cassia*) Bark Extract against Fish Pathogenic Bacteria  
Mok, J.-S.; Song, K.-C.; Choi, N.-J.; Yang, H.-S.; *Journal – Korean Fisheries Society*; **34(5)**; 2001; PP 545-549

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