Garlic, cold storage and heating effects in controlling Escherichia Coli O157:H7 in ground beef

E. Ceylan
Melvin C. Hunt
Daniel Y.C. Fung
Curtis L. Kastner

Follow this and additional works at: https://newprairiepress.org/kaesrr

Part of the Other Animal Sciences Commons

Recommended Citation

This report is brought to you for free and open access by New Prairie Press. It has been accepted for inclusion in Kansas Agricultural Experiment Station Research Reports by an authorized administrator of New Prairie Press. Copyright 2002 Kansas State University Agricultural Experiment Station and Cooperative Extension Service. Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. K-State Research and Extension is an equal opportunity provider and employer.
Garlic, cold storage and heating effects in controlling Escherichia Coli O157:H7 in ground beef

Abstract
This research evaluated the effect of garlic, cold storage and heating on Escherichia coli O157:H7 in ground beef patties. Ground beef (20% fat) inoculated with E. coli O157:H7 to an initial inoculum level of 8 log10 CFU/g, was mixed with 0.5, 1.0 and 1.5% garlic powder (wt/wt). Samples were stuffed into 1 inch diameter test tubes and incubated at 40°F for 24 hr. Tubes were heated to internal temperatures of 125, 130, 135, 140, 145, 155 and 160°F, and E. coli O157:H7 was enumerated. Garlic addition lowered E. coli O157:H7 survival in ground beef heated to 150 and 155°F, and no organisms were found in beef heated to 160°F. This slight effect may enhance safety of ground beef, but is not a substitute for cooking ground beef to 160°F.

Keywords
Cattlemen's Day, 2002; Kansas Agricultural Experiment Station contribution; no. 02-318-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 890; Beef; Ground beef; E. coli O157:H7; Garlic; Cooked temperature

Creative Commons License
This work is licensed under a Creative Commons Attribution 4.0 License.
GARLIC, COLD STORAGE AND HEATING EFFECTS IN CONTROLLING ESCHERICHIA COLI O157:H7 IN GROUND BEEF

E. Ceylan, D.Y.C. Fung, M. C. Hunt, and C. L. Kastner

Summary

This research evaluated the effect of garlic, cold storage and heating on Escherichia coli O157:H7 in ground beef patties. Ground beef (20% fat) inoculated with E. coli O157:H7 to an initial inoculum level of 8 log_{10} CFU/g, was mixed with 0.5, 1.0 and 1.5% garlic powder (wt/wt). Samples were stuffed into 1 inch diameter test tubes and incubated at 40°F for 24 hr. Tubes were heated to internal temperatures of 125, 130, 135, 140, 155 and 160°F, and E. coli O157:H7 was enumerated. Garlic addition lowered E. coli O157:H7 survival in ground beef heated to 150 and 155°F, and no organisms were found in beef heated to 160°F. This slight effect may enhance safety of ground beef, but is not a substitute for cooking ground beef to 160°F.

(Key Words: Ground Beef, E. coli O157:H7, Garlic, Cooked Temperature.)

Introduction

Enterohemorrhagic Escherichia coli O157:H7 is a foodborne pathogen for which a zero-tolerance in ground beef is established by the United States Department of Agriculture. Serious outbreaks of illness due to E. coli O157:H7 have been associated with consumption of raw or undercooked ground beef.

In addition to their flavoring properties in food, spices have been studied for their antimicrobial properties. Garlic may be a strong antimicrobial agent against foodborne pathogens such as E. coli O157:H7. The objective of this study was to determine the effects of garlic, cold storage and heating in controlling E. coli O157:H7 in ground beef.

Experimental Procedures

Five strains of E. coli O157:H7 (ATCC 35150, 43889, 43894, 43895 and 51657) were grown in Brain Heart Infusion slants (BHI) at 100°F for 24 hr and kept at 38°F until use. Cultures were transferred to BHI broth, incubated at 100°F for 24 hr and centrifuged at 5,000 × g for 15 min. The resulting cell pellet was diluted with 0.1% peptone water and mixed to make a cocktail solution for inoculation into ground beef.

Cocktail solutions (30 ml) were added to 2,000 g of ground beef (20% fat) to achieve an initial inoculum level of ca. 8 log_{10} CFU/g, and mixed thoroughly for 2 min. Inoculated ground beef was mixed 2 more min after garlic powder (0, 0.5, 1.0 and 1.5% w/w) was added. Samples were stuffed into 1 in. diameter test tubes (average sample weight, 26.4 g) and incubated at 38°F for 24 hr.

Ground beef samples in the test tubes were heated in a water bath to reach an internal temperature of 125, 130, 135, 140, 145, 150, 155 or 160°F. Samples were immediately removed from the hot water
bath, placed into an ice bath, then homogenized in 100 ml of 0.1% peptone water for 2 min using a stomacher. Serial dilutions were made using 0.1% peptone water. The enumeration of *E. coli* O157:H7 was performed on Tryptic Soy Agar (TSA), MacConkey Sorbitol Agar (MSA), 202 Agar, TSA-MSA Agar and TSA-202-Agar, TSA-MSA Agar and TSA-202 Agar incubated at 100°F for 24 hr.

**Results and Discussion**

The initial level of *E. coli* O157:H7 was about 8.0 log$_{10}$ CFU/g at 125°F internally. With cooking to 140°F or hotter, the number of *E. coli* O157:H7 was reduced, reaching an undetectable level at 160°F (Figure 1).

At temperatures of 145°F and below, garlic had no effect on *E. coli* O157:H7 (Figure 1). However, at 150°F *E. coli* O157:H7 was reduced to 2.9 log$_{10}$ CFU/g in control samples and to 2.5 and 2.3 log$_{10}$ CFU/g in 1.0 and 1.5% garlic samples, respectively. At 155°F the control samples contained 1.7 log$_{10}$ CFU/g while 1.0 and 1.5% garlic samples contained 1.4 and 1.2 log CFU/g of *E. coli* O157:H7, respectively. Our results show that added garlic powder modestly reduced *E. coli* O157:H7 concentrations, but only when the internal cooking temperature was 150°F or higher.

![Bar chart showing *E. coli* O157:H7 survival at various cooking temperatures with and without 1.5% added garlic powder.](image)

**Figure 1.** *E. coli* O157:H7 Survival at Various Cooking Temperatures, With and Without 1.5% Added Garlic Powder.