Ventilated and Unventilated Cooling of Chili in Onsite Foodservice Operations

Grant report presentation prepared for the Foodservice Systems Management Education Council (FSMEC)

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Acknowledgments

- This research was funded in part by a grant from the Foodservice Systems Management Education Council (FSMEC).

Grant Report Presentation Objectives

- Describe the background and rationale for the cooling study.
- State the purpose and research design of the cooling study.
- Discuss the major conclusions and recommendations of the cooling study.

Past Cooling Research Studies: 2005 - 2013

Olds, D., Roberts, K. R., Sauer, K. L., Sneed, J., Shanklin, C. W. (2013). Efficacy of cooling beef taco meat and steamed rice in United States school foodservice operations. *Food and Nutrition Sciences, 4*(7), 735-740.

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Olds, D., Sneed, J. (2005). Cooling rates of chili using refrigerator, blast chiller, and chill stick cooling methods. *Journal of Child Nutrition & Management, 29*(1).

Background & Rationale

1991 **2016**

Background & Rationale

- **The improper cooling of food products is a significant factor contributing to foodborne illness outbreaks in foodservice operations** (Brown et al., 2012; Schaffner et al., 2015; U.S. Food and Drug Administration [FDA], 2009).
- **The 2013 FDA Food Code identifies cooling as a critical control point (CCP) in the prevention of foodborne illness outbreaks** (FDA, 2013).

Onsite Foodservice Practices Can Lead to Foodborne Illness

1) Large quantities of food made in advance
2) **Food cooled and stored**
3) Portions reheated and/or served as needed

Large volumes of food cooling slowly

↓

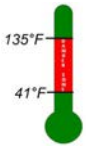
Exponential bacterial growth

↓

Foodborne illness

Background & Rationale

- The 2013 Food and Drug Administration (FDA) Food Code (§ 3-501.14) states that **food shall be cooled from 135°F (57°C) to 70°F (21°C) within two hours and from 135°F (57°C) to 41°F (5°C) within a total of six hours** (FDA, 2013).
- The 2013 FDA Food Code (§ 3-501.15) also recommends that **food being cooled should be left uncovered (FDA, 2013).**



Background & Rationale

- Schaffner et al. (2015) found that during cooling, **covered food products were twice as likely to take longer to cool as uncovered food products**.
- Brown et al. (2012) observed cooling practices in foodservice operations. They found that in **160 of 466 walk-in refrigerators (34.3%) observed, food being cooled was covered**, despite FDA Food Code recommendations (§ 3-501.15) that **food being cooled should be uncovered** (FDA, 2013).
- These studies indicate that **covered cooling of food is both a common and risky practice** in foodservice operations.

Purpose

- **The purpose of this research was to determine if practices commonly used to cool food produced in onsite foodservice operations would meet established 2013 FDA Food Code standards.**

Research Design

- **One food product was tested, chili con carne with beans (Chili con Carne with Beans, USDA Recipe #D-20) from the United States Department of Agriculture (USDA) Recipes for Schools (Institute of Child Nutrition [ICN], 2016).**
- **Ingredients were procured from Gordon Food Service (GFS), Peoria, IL.**
- **Data collection took place in Williams Dining Center kitchen, Bradley University, Peoria, IL from 6/11/16 – 7/30/16.**

Research Design

- **A total of 12 cooling methods were tested.**
- **Chili was cooled uncovered (ventilated) and was also cooled covered (unventilated) with plastic film or aluminum foil.**
- **Uncovered and covered identically-sized containers were cooled concurrently in a walk-in ref[illegible]olication.**

Research Design

- **A thermometer probe was affixed in the geometric center of the pans to measure temperatures of the chili during cooling.**
- **Data were downloaded from logging thermometers and analyzed using Microsoft Excel 2013.**
- **Means and standard deviations of time and temperature data ranges for each cooling method were calculated.**
- **Representative mean time and temperature cooling curves were plotted.**

Research Design

Table 1 – Container Dimensions, Chili Depths/Amounts, Ventilation, and Replications

Container Dimensions	Depth or Amount of Chili	Cooling Method	Ventilation During Cooling	Number of containers used per replication	Number of replications
Stainless Steel Foodservice Pan 12" x 10" x 2 ½"	2 inches	1	Covered	3	3
		2	Uncovered	3	3
Stainless Steel Foodservice Pan 12" x 20" x 2 ½"	2 inches	3	Covered	3	3
		4	Uncovered	3	3
Stainless Steel Foodservice Pan 12" x 10" x 4"	3 inches	5	Covered	3	3
		6	Uncovered	3	3
Stainless Steel Foodservice Pan 12" x 20" x 4"	3 inches	7	Covered	3	3
		8	Uncovered	3	3
20 quart Aluminum Stockpot (12"diameter, 10½" deep)	3 Gallons	9	Covered	1	3
		10	Uncovered	1	3
5 Gallon HDPE* Bucket (12"diameter, 13" deep)	5 Gallons	11	Covered	1	3
		12	Uncovered	1	3

* High-density polyethylene

Results – 12" x 20" x 2 ½" pans

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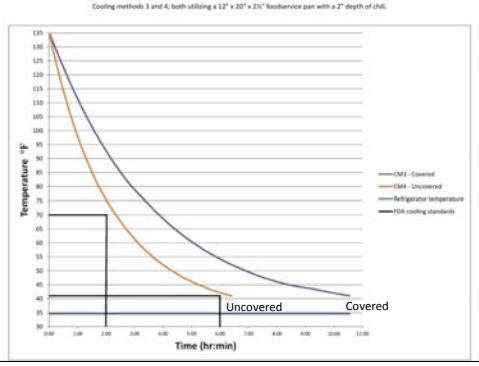
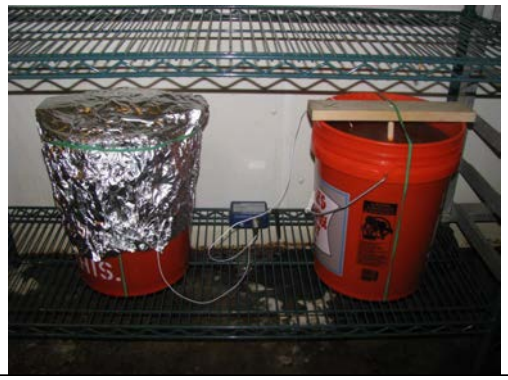


Results – 5 Gallon HDPE Buckets



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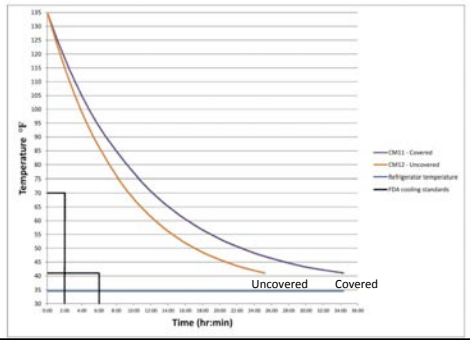

Results

Table 1 – Container Dimensions, Chili Depths/Amounts, Ambient Air Temperatures, Ventilation, Replications, and Cooling Times

Container Dimensions	Depth or Amount of Chili	Mean Walk-In Refrigerator Ambient Air Temperature °F ± SD*	Cooling Method	Ventilation During Cooling	Number of containers used per replication	Number of replications	Mean Cooling Time Hours : Minutes ± SD*	
							135°F to 70°F (2013 FDA Food Code Standard: ≤ 2:00 hr	135°F to 41°F (2013 FDA Food Code Standard: ≤ 6:00 hr
Stainless Steel Foodservice Pan 12" x 10" x 2 ½"	2 inches	34.9 ± 1.20	1	Covered	3	3	3:33 ± 0:25	9:41 ± 1:12
			2	Uncovered	3	3	2:26 ± 0:14	6:36 ± 0:43
Stainless Steel Foodservice Pan 12" x 20" x 2 ½"	2 inches	34.6 ± 1.36	3	Covered	3	3	3:54 ± 0:33	10:42 ± 1:12
			4	Uncovered	3	3	2:21 ± 0:10	6:23 ± 0:33
Stainless Steel Foodservice Pan 12" x 10" x 4"	3 inches	34.5 ± 1.32	5	Covered	3	3	4:53 ± 0:35	13:23 ± 1:24
			6	Uncovered	3	3	3:37 ± 0:20	9:46 ± 0:59
Stainless Steel Foodservice Pan 12" x 20" x 4"	3 inches	34.6 ± 1.30	7	Covered	3	3	4:54 ± 0:34	13:40 ± 1:27
			8	Uncovered	3	3	3:47 ± 0:23	10:15 ± 1:20
20 quart Aluminum Stockpot (12"diameter, 10½" deep)	3 Gallons	34.8 ± 1.50	9	Covered	1	3	7:21 ± 0:12	20:17 ± 1:00
			10	Uncovered	1	3	5:53 ± 0:09	16:12 ± 1:03
5 Gallon HDPE** Bucket (12"diameter, 13" deep)	5 Gallons	34.5 ± 1.44	11	Covered	1	3	12:25 ± 0:18	34:47 ± 1:13
			12	Uncovered	1	3	9:27 ± 0:07	25:12 ± 0:32

*Standard Deviation; ** High-density polyethylene

Discussion

- **The cooling method requiring the shortest mean cooling time from 135ºF to 41ºF was the uncovered 12 inch x 20 inch x 2 ½ inch stainless steel foodservice pan at a 2 inch food product depth (6 hours, 23 minutes).**
- **The cooling method requiring the longest mean cooling time from 135ºF to 41ºF was the covered 5 gallons of chili in a HDPE bucket (34 hours, 47 minutes). This is clearly an unacceptable cooling method that should never be considered for use in any type of foodservice operation.**

Major Conclusions

- **The following major conclusions were made based on the results of this study:**
- **<u>None</u> of the 12 cooling treatments tested in this study met 2013 FDA Food Code (§ 3-501.14) cooling standards.**
- **For <u>all</u> 12 cooling methods tested in this study, covered cooling methods took longer to cool than uncovered cooling methods.**

Recommendations

- **Food should be uncovered while cooling.**
- Foodservice operations should consider purchasing and utilizing blast chillers to cool food products, especially in those operations that cool large volumes of food for reheating and service.
- Materials and programs that provide specific, cost-effective, and easily-implemented recommendations for cooling foods are needed.
- The 2013 Food Code (§ 3-501.15) should be updated to provide more detailed recommendations on cooling methods for food.
- Future studies could explore if cooling food products at 1" depths or on 18" x 26" sheet pans would meet 2013 FDA Food Code cooling standards.

Thank you for your support!

- Foodservice Systems Management Education Council (FSMEC)
  - Grant Funding
- Bradley University Department of Family & Consumer Sciences
  - Equipment
- Bradley University Dining Services
  - Facilities

References

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