

The Center of Excellence for
FOOD SAFETY RESEARCH IN
CHILD NUTRITION PROGRAMS

Evaluating the Effectiveness of Cooling Techniques in Chili Con Carne with Beans

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Abstract

Introduction & Purpose: Large quantity recipes are commonly used in child nutrition programs. Improper cooling of food is a major contributing factor to foodborne illnesses. Requirements in the FDA's Food Code 2013 state food should cool from 135°F to 70°F (57.2°C to 21.1°C) within two hours and from 135°F to 41°F (57.2°C to 5°C) within a total of six hours. Cooling foods within these time and temperature parameters is essential to prevent foodborne illness outbreaks, especially for vulnerable populations like children. Identifying cooling methods that are effective and feasible is an important component to reduce public health risks. This research is a continuation of previous studies to determine the effectiveness of cooling methods used in school nutrition programs by identifying which procedures best meet cooling requirements in the Food Code.

Methods: Chili was cooked to 165°F, portioned to 5.1 cm (2-inch) or 7.6 cm (3-inch) depths in stainless steel steam table pans, and cooled to 140-135°F. Pans were covered with a single layer of foil, two layers of foil, or left uncovered; and cooled in a walk-in freezer (-4°F, -20°C) or on an ice bath placed in a walk-in refrigerator (39°F, 4°C). Temperatures were monitored every 60 seconds for 8 hours. **Results:** At 2 hours, a significant difference was found between the freezer and ice bath ($p<.0001$); the depths of the pans ($p=0.0082$), and the pan covering method ($p<.0001$). Three cooling methods reached the 70°F (21.1°C) as recommended by FDA. By 6 hours, a significant difference was found between the depths of the pans ($p=0.0083$) and the pan covering method ($p=0.0020$). Five cooling methods reached 41°F (5°C).

Conclusions: Three cooling methods met Food Code requirements: uncovered 2-inch and 3-inch pans in the ice bath and uncovered 2-inch pan in the freezer. This study provides information about best practices for cooling large quantities of food following the Food Code 2013 guidelines using commercial kitchen equipment. Using the most effective practices to cool food can strengthen food safety practices in schools by preventing the growth of potential pathogens and, therefore, protecting students from foodborne illnesses.

Statement of Purpose

The purpose of this study was to determine if common cooling methods used in child nutrition programs for met the Food Code 2013 cooling guidelines.

Methods examined included:

- Ice bath in walk-in cooler
- Walk- in freezer
- Pan coverings
- Product depth

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Methods

- Chili recipe met nutritional standards for the National School Lunch Program
- Chili was cooked to 165°F, cooled to 140-135°F before temperature monitoring
- Twelve treatments (n=3) tested all combinations of three factors:
 - Cooling method: walk in freezer (10% capacity) and ice bath in walk-in cooler (10% capacity)
 - Chili depth: 2 and 3-inch depth (commercial full-size stainless steel steam table pans)
 - Pan coverings: uncovered, single foil layer, double foil layer (standard weight food service aluminum foil)
- Chili temperatures were monitored every 60s for 8h (EasyLog thermocouple USB data logger, Lascar)

Results

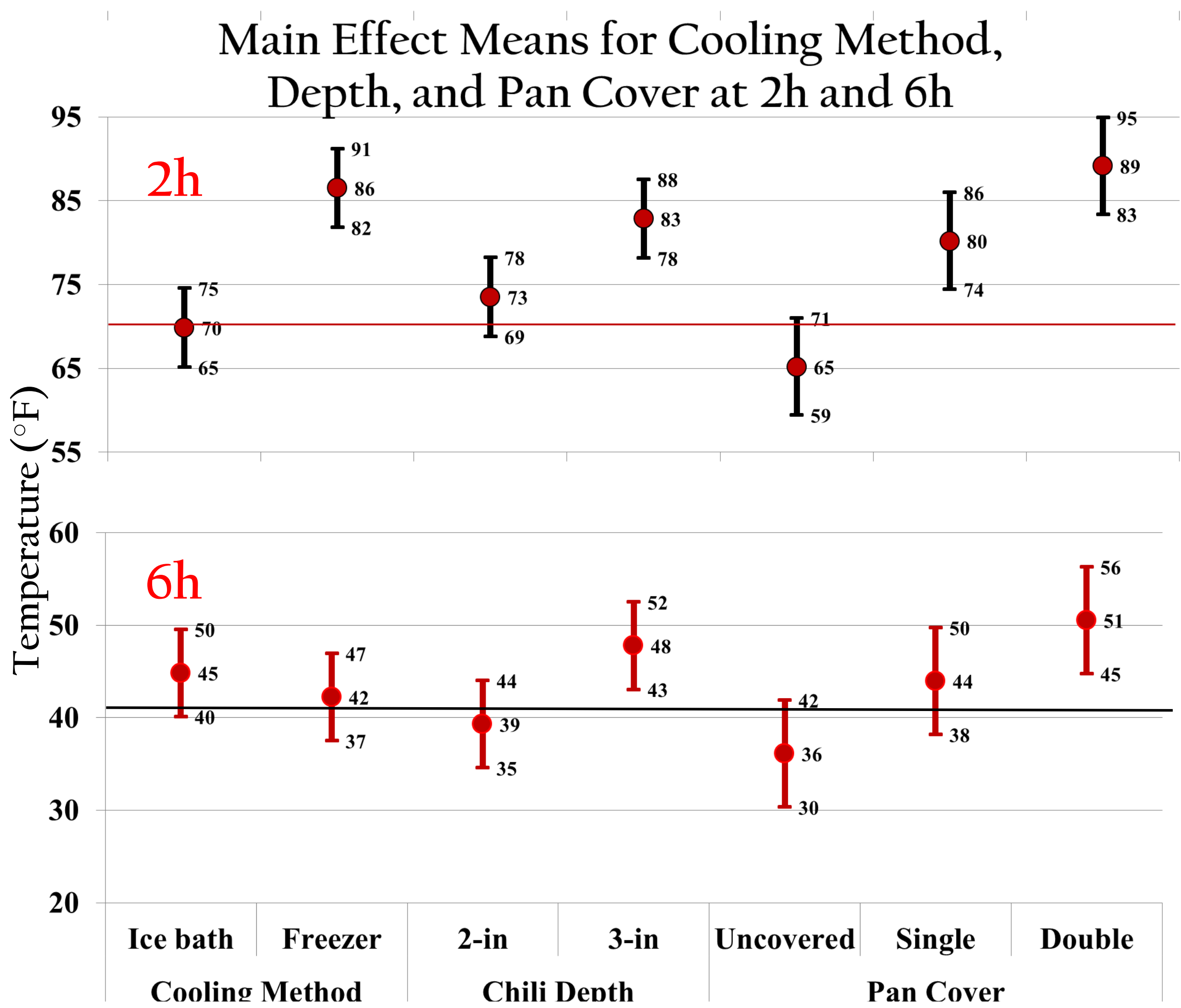


Figure 1. Main effect means for cooling method, chili depth and pan covering. Mean temperature of uncovered pans was below 70°F at 2h and below 41°F at 6h. Ice bath means reached 70°F at 2h. Mean for 2-in chili depth was below 41°F at 6h.

Results, Continued

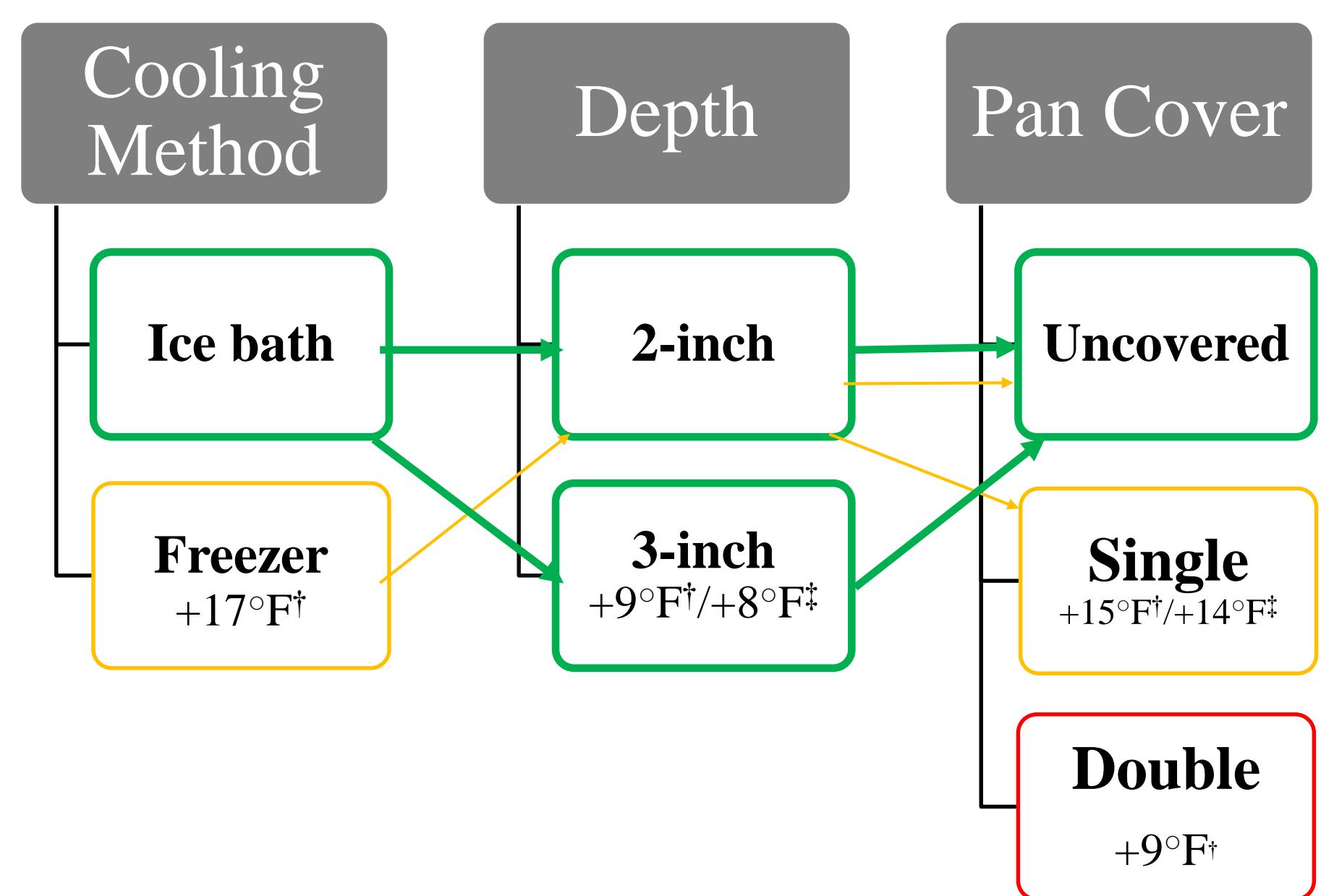


Figure 2. Factor combinations meeting Food Code 2013. Cooling factors in green met standards when combined. Factors in yellow met a part, but not all, of the standard. Factors in red did not meet standards.

†Significant temperature difference for the main effect at 2h. ‡Significant temperature difference for the main effect at 6h.

Three Way Treatments	2h	Lower	Upper	6h	Lower	Upper
Ice bath 2-in Uncovered†	56°F	48°F	64°F	38°F	31°F	46°F
Ice bath 3-in Uncovered†	58°F	49°F	65°F	36°F	29°F	44°F
Freezer 2-in Uncovered	65°F	57°F	73°F	25°F	18°F	33°F
Ice bath 2-in Single	71°F	63°F	79°F	33°F	26°F	41°F

Table 1. Estimated 3-way treatment means and intervals for the best combined cooling treatments. Ice bath cooled, uncovered pans with 2 and 3-in chili depths met Food Code 2013 standards. †Estimated temperature upper limit for the treatment below 70°F at 2h, and 41°F at 6h.

Implications

- Many cooling methods commonly used in child nutrition programs do not meet Food Code 2013 cooling standards.
- None of the cooling methods with covered pans met standards.