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1999 U.S. Cold Temperature Evaluation

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PREFACE

Nationwide, average refrigerated and frozen product temperatures typically meet regulatory and product specifications. Does this mean that product designers should base their decisions on these averages? Should shelf life expectations be based on averages? Absolutely not. When you consider that 10,000 packages out of every million produced are exposed to the conditions of the 99th percentile, “worst case” data becomes more interesting and relevant than averages for design purposes. For this reason, studies designed to observe refrigeration need to be sufficiently large to identify those worst case conditions.

In 1989, several food manufacturers asked Audits International to implement a study which would gather information about “typical” and “worst case” temperatures at retail and in home refrigeration. That 1989 study has been the definitive source of information on this subject in the U.S. for the last decade.

We were asked to conduct this study again in 1999. Why? Since the last cold temperature study was conducted, thousands of new stores have opened, many supermarkets have purchased new refrigeration equipment and the U.S. Food Code has changed now advising that refrigerated products be held at or below 41°F rather than 45°F. In addition, there has been increased media and consumer attention to issues of safety and quality.

The 1989 project was designed to evaluate temperature abuses of dairy, fresh fish, delicatessen, lunch meat, fresh meat, frozen food, bulk ice cream, and novelty ice cream products. The 1999 study added the new pre-packaged deli case to the list. Approximately 1,000 participants from across the United States measured the temperatures of each of these refrigerated/frozen products at three times during their routine shopping excursion: upon removal from the retail display, at home after shopping, and 24 hours later.

The data has been tabulated by product, and includes: retail refrigeration temperature, temperature change from retail to home, home refrigeration temperatures, effect of ambient temperature and effect of time.

Audits International has attempted to report "real world" conditions and abuse data as well as overall observations which can be used by individual companies to develop internal programs/systems for specific product. The tables in this report are constructed to assist users in answering questions specific to their products or product categories.

Project Design

Participants

Field activities for this project were handled by the Audits International network of auditors. These individuals are dispersed across the U.S. with a focus towards metropolitan areas. Our field auditors have been specifically trained to provide technical retail product quality information as a routine part of their activities with Audits International. For this project A.I. auditors identified shoppers, supplied each shopper with needed materials, information and training. The project was designed to collect data from primary shoppers of over 1,000 households geographically dispersed across the country.

Materials

Each participant (shopper) was supplied with the following:

- a pre-calibrated thermometer
- both verbal and written project instructions
- forms for recording the required information

Upon completion, participants returned their survey to the Audits International auditor and were paid for performing the survey.

Participants Instructions

Specific participant instructions included (1) proper use of the thermometer, (2) specific products to be tested and (3) specific time and temperature information required.

Each participant collected product temperatures and specific time information during their primary food shopping excursion in the supermarket or grocery store at which they usually shop.

Specific instructions for returning home after shopping were not given. If consumers normally play golf/tennis, visit the barber/hair stylist or talk for extended periods of time in parking lots, they were not told to alter this behavior. It was our desire that consumers behave normally no matter how abusive this might be to their purchases.

Case Types & Products

Listed below are the refrigerated and frozen cases, the product category, and primary package size (if specified) evaluated during this study.

<u>Location</u>	<u>Case Type</u>	<u>Product</u>	<u>Primary Size</u>	
Backroom	Refrigerator	semi-solid	6 oz.	
	Freezer	whipped topping	8 oz.	
Retail	Dairy	liquid	1 quart	
	Dairy	semi-solid	6 oz.	
	Lunch meat	pre-packaged lunch meat	6 oz.	
	Fresh meat	ground beef	none specified	
	Fresh fish	fish fillet	none specified	
	Deli counter	sliced meat	none specified	
	Pre-packaged deli	potato salad or equivalent	none specified	
	Frozen food	frozen whipped topping	8 oz.	
	Frozen food	frozen entrée	12 oz.	
	Ice cream	ice cream	1/2 gallon	
	Frozen novelty	novelty	1 box	
	Home	Refrigerator	semi-solid	6 oz.
		Freezer	ice cream	1/2 gallon

Field Data Collected

The temperature data reported in this document represents product temperatures collected using pre-calibrated probe thermometers. Actual product temperatures were taken for all cases evaluated with the exception of the frozen entrée and frozen novelty. When evaluating the frozen entrée case, shoppers were instructed to place the probe thermometer between two packages of product, until the temperature stabilized. Temperature for the frozen novelty was obtained by pushing the thermometer probe into the novelty box, yielding the internal package air temperature.

Backroom Temperatures - Upon arriving at the retail market, participants requested back storeroom samples. If these samples were made available, temperatures were recorded and the participant returned to the front of the store to start their normal shopping pattern. *(442 backroom freezer and 515 backroom refrigerator evaluations were completed)*

Display Case Temperatures and Time - When reaching a desired display case within their normal shopping pattern, participants removed the product to be purchased and inserted the thermometer directly into product. Participants left the thermometer in the product until the temperature stabilized and then recorded the product temperature and time of day on their form.

Transit Temperature - Before leaving the store, participants were instructed to place their thermometer in a shopping bag containing only shelf stable product. Upon returning home, participants recorded the temperature their groceries reached during transit.

Ambient Temperature - Upon arriving home, participants were asked to record the outside temperature using their probe thermometer. This ambient temperature data has been presented in a format designed to permit an evaluation of the impact of ambient temperature on home product temperatures.

Home Temperature (Zero Hour) and Time - Immediately before placing products in the home refrigerator or freezer, the temperature of each product was determined and the time recorded. The change in temperature from the retail case to home is considered to be short term high temperature abuse resulting from shopping, excessive ambient temperatures and delays between removal of product from its display and re-refrigeration at home.

Home (24 hour) Refrigerator and Freezer Temperatures - After 24 hours in home refrigerators temperatures of the semi-solid refrigerated dairy product and the frozen whipped topping were collected and recorded.

Additional Data Collected

Participants answered questionnaires addressing mode of travel to and from the store, where in their cars groceries were placed, if they lived in an area considered city, suburban or rural, and whether the store they shopped at was in an area considered city, suburban or rural. In addition, they recorded how often they typically shopped for groceries and if they handled groceries differently because of the high summer temperatures.

Basic demographic data was also requested from of the participants, including: marital and financial status, number and age of children, and number of people in household.

Questions and Answers

The data included in this report can be approached in many ways depending upon the specific needs of the user. However, Audits International has made some observations which we feel will be of interest to the majority of the studies sponsors. These observations follow in a Q&A format.

What percent of retail refrigerated products is currently being held above 41°, 45°, 50°F? (page 6)

Overall, about one in two refrigerated product temperatures were over 41°F, one in four were over 45°F, and one in seventeen were over 50°F.

Are all retail refrigeration areas equal? If not, which offer the best product protection? (page 6)

Although there is some difference from one case type to the next, all types had product above 41°F. The frequency of cases holding product above 41°F ranged from 27% (fresh meat) to 71% (deli counter).

Are current shelf-life determinations based upon sound information? (page 6, individual product pages)

Almost half of the refrigerated supermarket cases held products above 41°F. which is the temperature recommended by each of the FDA Model Food Codes issued in the 1990s. Additionally, the worst 10% of product temperatures for each refrigerated case averaged at least 45°F and were above 50°F for pre-packaged lunch meat and deli counter meat. We believe that company decisions related to product design and shelf-life should incorporate the expectation that a significant percentage of product will spend time at temperatures in excess of 45-50°F.

To what extent do product temperatures change as a result of shopping? (page 8)

Temperatures rise approximately 8-10°F during the typical summer shopping excursion however, the worst 5% of shopping condition (long time/high transportation temperatures) result in product temperatures which increase on the order of 15-20°F. The greatest temperature change observed was 58°F. This worst (0.1%) case of shopping abuse occurred in Phoenix, an 84 minute transportation time at a temperature of 103°F.

How long does shopping really require? (page 10)

The average shopping trip in this study took approximately one hour. Approximately 3% of shoppers required more than 2 hours to place refrigerated product under home refrigeration.

Are new products possible today which would have been less than safe in 1989? (page 12)

Although mean product temperatures for all cases improved, the average temperature observed for the worst 5 –10% of products does not appear to have changed appreciably since 1989. The answer to this question is product and company specific.

What are the worst percentiles for each food product category? (individual product pages)

The 90th, 95th, and 99th percentiles have been listed on each of the individual product pages. It is recommended that products be designed to withstand the worst case situations rather than average handling conditions. Whether worst case is considered to be the poorest 10%, 5% or 1% is a decision which should be made on a company by company basis. However, it should be kept in mind that the difference in temperature between mean and the 99th percentile is frequently greater than 15°F.

Are there any issues due to supermarket or household location? (Appendix A4-A7)

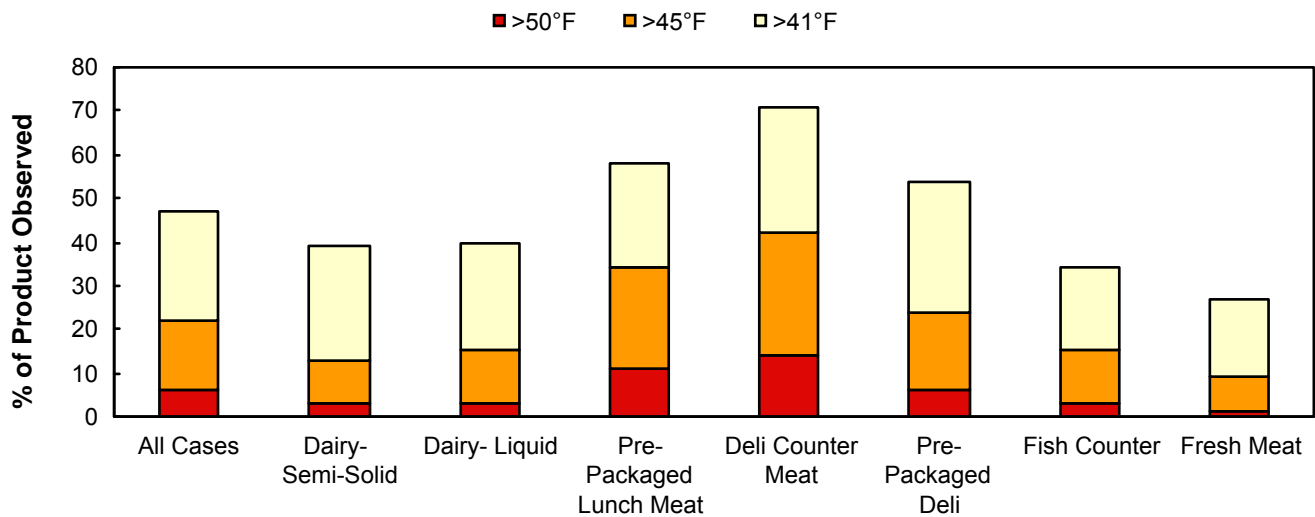
This study did not identify any effect on product temperature due to the supermarkets or households being in an urban, suburban, or rural location.

In this section Audits International has given general answers to these questions in an attempt to summarize the data generated during this evaluation. Sponsors should always evaluate the data first hand rather than making any decisions based on this Questions and Answers section.

Retail Refrigerator Product Temperatures

Location of Temperatures	All Cases	Dairy		Pre-Packaged	Deli	Pre-Packaged	Fish	Fresh
		Semi-Solid	Liquid	Lunch Meat	Counter Meat	Deli	Counter	Meat
Mean (°F)	41.7	40.7	40.9	43.6	44.8	42.3	40.0	39.2
Standard Deviation	5.88	4.99	5.05	6.14	5.91	5.54	6.05	5.06
Minimum (°F)	14	22	20	24	24	20	14	19
Maximum (°F)	70	68	60	66	64	66	70	58
Percent above 41°F	47	39	40	60	71	54	34	27
Percent above 45°F	22	13	15	34	42	24	15	9
Percent above 50°F	6	3	3	11	14	6	3	1
Product Temperature Frequency Distribution (%)								
≤26°F	0.6	0.4	0.6	0.3	0.2	0.4	1	1
27 - 29	0.5	0.5	0.2	0.2	0.2	0.3	0.7	1
30 - 32	5	4	4	3	2	4	9	9
33 - 35	5	6	6	3	2	4	8	8
36 - 38	15	17	17	10	6	13	21	22
39 - 41	27	33	32	23	19	25	26	33
42 - 44	21	24	20	22	23	26	16	16
45 - 47	10	7	9	12	16	10	8	5
48 - 50	10	6	8	15	18	12	7	5
51 - 53	3	2	1	4	6	3	2	0.8
54 - 56	2	0.8	0.7	3	4	1	0.4	0.4
57 - 59	0.8	0.3	0.3	2	2	0.9	0.5	0.2
60 - 62	0.8	0.4	0.6	1	2	0.5	0.5	0
63 - 65	0.1	0	0	0.2	0.1	0.1	0.2	0
≥66°F	0.1	0.1	0	0.1	0	0.1	0.4	0

Percent of Product Observed Over 41°F, 45°F, and 50°F

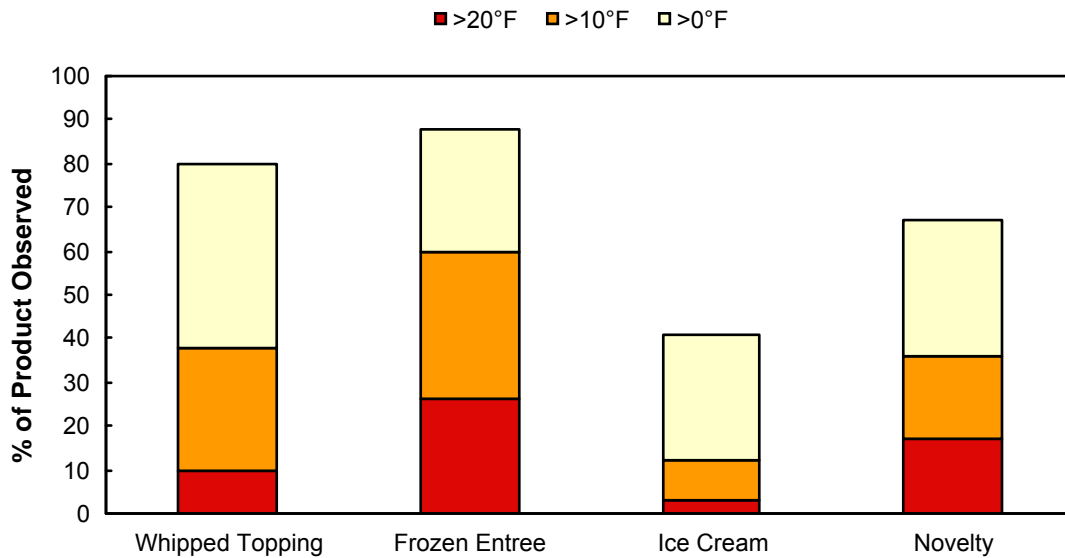


Retail Freezer Product and Air Temperatures[†]

Location of Temperatures	Whipped Topping	Frozen Entrée	Ice Cream	Frozen Novelty
Mean (°F)	9.9	15.0	1.1	8.7
Standard Deviation	10.07	11.47	8.96	12.53
Minimum (°F)	-25	-18	-28	-20
Maximum (°F)	50	50	36	44
Percent above 0°F	80	88	41	67
Percent above 10°F	39	60	12	36
Percent above 20°F	10	26	3	17
Product Temperature Frequency Distribution (%)				
≤-15°F	0.3	0.2	2	1
-14 to -10	0.6	1	8	3
-9 to -5	3	0.8	14	6
-4 to 0	16	10	34	23
1 - 5	17	9	17	17
6 - 10	24	19	12	14
11 - 15	13	10	5	7
16 - 20	16	23	5	11
21 - 25	3	11	0.8	5
26 - 30	4	6	2	5
31 - 35	1	3	0.2	3
36 - 40	1	5	0.2	3
≥41°F	1	2	0	1

[†] Whipped topping and ice cream represent product temperatures. When evaluating the frozen entrée case, shoppers were instructed to place the probe thermometer between two packages of product, until the temperature stabilized. Temperature for the frozen novelty was obtained by pushing the thermometer probe into the novelty box, yielding the internal package air temperature.

Percent of Product Observed Above 0°F, 10°F, and 20°F



Retail Backroom Refrigerator and Freezer Summary

Number of Samples	Backroom Refrigerator 515	Backroom Freezer 442
Mean Product Temperature (°F)	37.9	8.6
Standard Deviation	5.29	11.30
Minimum (°F)	11	-32
Maximum (°F)	60	45
Percent above 0°F	-	72
Percent above 32°F	-	4
Percent above 41°F	17	1
Percent above 45°F	4	-
Percent above 50°F	1	-

Product Temperature Frequency Distribution (%)

Backroom Refrigerator

Product Temperature	Frequency (%)
≤26°F	3
27 - 29	1
30 - 32	9
33 - 35	10
36 - 38	33
39 - 41	28
42 - 44	11
45 - 47	2
48 - 50	3
51 - 53	0.8
54 - 56	0.2
57 - 59	0.2
60 - 62	0.2
63 - 65	0
≥66°F	0

Backroom Freezer

Product Temperature	Frequency (%)
≤-15°F	0.7
-14 to -10	3
-9 to -5	4
-4 to 0	20
1 - 5	14
6 - 10	23
11 - 15	11
16 - 20	12
21 - 25	3
26 - 30	4
31 - 35	2
36 - 40	2
≥41°F	1

What Happens to Product Temperature During Transportation?

	All Refrigerated Products	All Frozen Products
Mean Time Out of Refrigeration (h:mm)	1:05	0:51
Mean Change in Product Temperature from Store to Home Based on Time Out of Refrigeration (°F)		
0 - 15 minutes	8.1	6.8
16 - 30	6.1	8.3
31 - 45	7.2	9.7
46 - 60	8.1	10.1
61 - 75	9.1	12.3
76 - 90	10.0	12.0
91 - 105	11.2	14.8
106 - 120	11.0	14.0
>2 hours	12.2	13.2
Mean Change in Product Temperature from Store to Home (°F)		
Overall Change	8.8	10.4
Urban Home	8.4	10.0
Suburban Home	9.1	10.5
Rural Home	8.8	10.5
Δ if Outside Air Temperature <70°F	8.0	10.3
Δ if Outside Air Temperature Between 70- 89°F	8.7	10.2
Δ if Outside Air Temperature ≥90°F	9.7	10.7
Product Temperature at Home[†]		
Mean (°F)	50.5	16.9
Standard Deviation	7.04	12.19
Minimum (°F)	20	-20
Maximum (°F)	98	68
Percent above 32°F	-	10
Percent above 41°F	92	5
Percent above 45°F	76	3
Percent above 50°F	45	1
Percent above 60°F	6	0.1

[†] Product temperatures taken upon arrival home before placing products in home refrigeration.

Home Refrigerator and Freezer Product Temperatures[†]

Number of Samples	Home Refrigerator 939	Home Freezer 940
Mean Product Temperature (°F)	39.2	3.4
Standard Deviation	4.78	8.21
Minimum (°F)	21	-20
Maximum (°F)	70	48
Percent above 0°F	-	56
Percent above 32°F	-	0.7
Percent above 41°F	27	0.1
Percent above 45°F	8	-
Percent above 50°F	2	-

[†] Product temperatures taken 24 hours after being placed in home refrigerator and freezer.

Product Temperature Frequency Distribution (%)

Home Refrigerator

Product Temperature	Frequency (%)
≤26°F	0.2
27 - 29	2
30 - 32	7
33 - 35	10
36 - 38	25
39 - 41	29
42 - 44	18
45 - 47	5
48 - 50	3
51 - 53	0.4
54 - 56	0.5
57 - 59	0.4
60 - 62	0.1
63 - 65	0
≥66°F	0.1

Home Freezer

Product Temperature	Frequency (%)
≤-15°F	1
-14 to -10	3
-9 to -5	6
-4 to 0	33
1 - 5	25
6 - 10	19
11 - 15	5
16 - 20	4
21 - 25	1
26 - 30	1
31 - 35	0.4
36 - 40	0.5
≥41°F	0.1

Time Out of Refrigeration and Outside Temperature Information

Time Out of Refrigeration[†]

Product Category	Mean (h:mm)	Standard Deviation (h:mm)	Range (h:mm)
	<i>(n =)</i>		
Refrigerated			
Dairy- Semi-solid	939	1:06	0:25
Dairy- Liquid	943	1:04	0:25
Pre-packaged lunch meat	961	1:09	0:27
Deli counter meat	895	1:06	0:28
Pre-packaged deli	909	1:05	0:27
Fish counter	825	1:05	0:27
Fresh meat	943	1:04	0:26
Frozen			
Whipped topping	941	0:56	0:24
Ice cream	935	0:48	0:23
Frozen novelty	895	0:48	0:20

[†] Time between removal of product from store display until placement in home refrigeration.

* The maximum time out of refrigeration for the frozen novelty is significantly lower than the other products due to the unavailability of that product in one store that accounts for the high maximum time of all other products.

Outside Ambient Temperature

Temperature (°F)	Number of Temperatures 971	Frequency (%)
<55°F	10	1
55 - 59	16	2
60 - 64	52	5
65 - 69	68	7
70 - 74	118	12
75 - 79	120	12
80 - 84	192	20
85 - 89	141	15
90 - 94	135	14
95 - 99	75	8
100 - 104	38	4
≥105°F	6	0.6

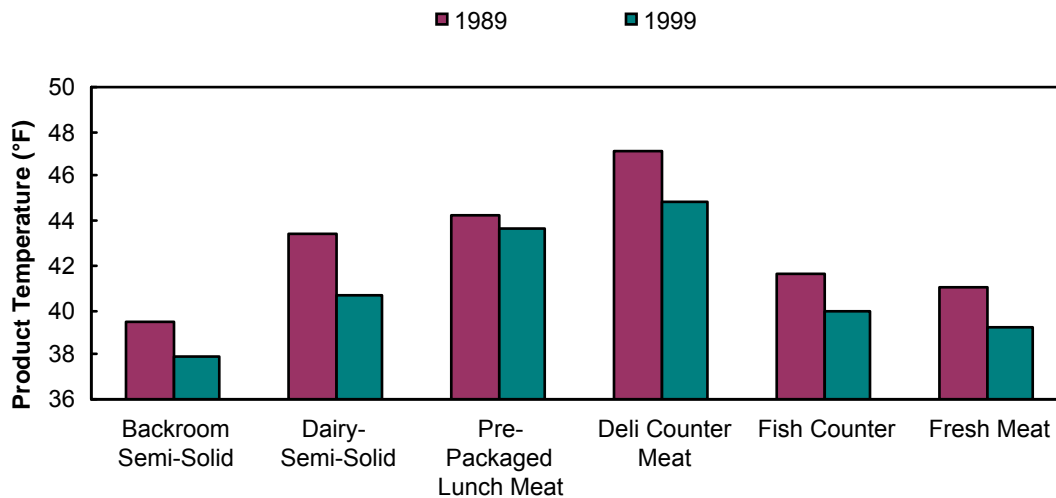
Comparison to Previous Study

Refrigerated Product[†]

	1989 Retail Display	1999 Retail Display
Backroom Refrigerator- Semi-Solid		
Mean Product Temperature (°F)	39.5	37.9
90th Percentile (°F)	48	43
Dairy Product- Semi-Solid		
Mean Product Temperature (°F)	43.4	40.7
90th Percentile (°F)	51	47
Pre-Packaged Lunch Meat		
Mean Product Temperature (°F)	44.3	43.6
90th Percentile (°F)	51	52
Deli Counter Meat		
Mean Product Temperature (°F)	47.1	44.8
90th Percentile (°F)	57	52
Fish Counter		
Mean Product Temperature (°F)	41.6	40.0
90th Percentile (°F)	50	48
Fresh Meat		
Mean Product Temperature (°F)	41.0	39.2
90th Percentile (°F)	48	45

[†] The liquid dairy product and the pre-packaged deli product were not part of the 1989 study.

Product Temperature Comparison from Previous Study (°F)

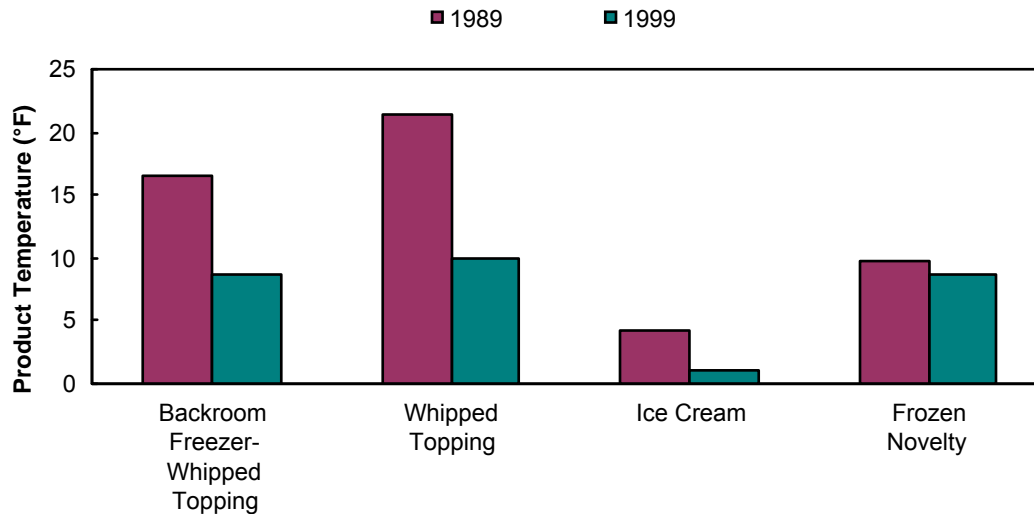


Comparison to Previous Study

Frozen Product

	1989 Retail Display	1999 Retail Display
Backroom Freezer- Whipped Topping		
Mean Product Temperature (°F)	16.6	8.6
90th Percentile (°F)	34	22
Whipped Topping		
Mean Product Temperature (°F)	21.3	9.9
90th Percentile (°F)	36	21
Ice Cream		
Mean Product Temperature (°F)	4.2	1.1
90th Percentile (°F)	14	13
Frozen Novelty		
Mean Product Temperature (°F)	9.7	8.7
90th Percentile (°F)	24	28

Product Temperature Comparison from Previous Study (°F)

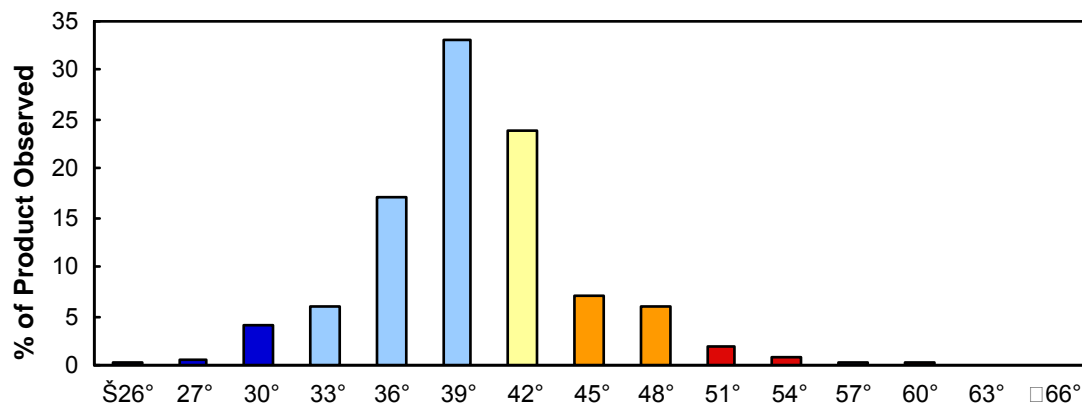


Dairy Product - Semi-Solid

Location of Temperature	Backroom Refrigerator	Retail Display	Home 0 Hour	Home 24 Hour
Number of Samples [†]	515	972	970	939
All Dairy - Semi-Solid				
Mean Product Temperature (°F)	37.9	40.7	51.0	39.2
Standard Deviation	5.29	4.99	6.38	4.78
Minimum (°F)	11	22	30	21
Maximum (°F)	60	68	90	70
Percent above 41°F	17	39	94	27
Percent above 45°F	4	13	79	8
Percent above 50°F	1	3	49	2
90th Percentile (°F)	43	47	60	44
95th Percentile (°F)	45	50	60	47
99th Percentile (°F)	51	56	66	54
Product Temperature Frequency Distribution (%)				
≤26°F	3	0.4	0	0.2
27 - 29	1	0.5	0	2
30 - 32	9	4	0.1	7
33 - 35	10	6	0.4	10
36 - 38	33	17	0.8	25
39 - 41	28	33	4	29
42 - 44	11	24	10	18
45 - 47	2	7	12	5
48 - 50	3	6	23	3
51 - 53	0.8	2	14	0.4
54 - 56	0.2	0.8	16	0.5
57 - 59	0.2	0.3	9	0.4
60 - 62	0.2	0.4	8	0.1
63 - 65	0	0	1	0
≥66°F	0	0.1	1	0.1

[†] The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution (°F)



Change in Semi-Solid Product Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature (°F)		Mean Unpacking Home Temperature (°F)	
			(Std. Dev.)	(Std. Dev.)	(Std. Dev.)
Overall		10.4	(6.08)	51.1	(6.38)
Time Out of Refrigeration					
0 - 15 minutes	0.3	6.0	(3.46)	47.0	(1.00)
16 - 30	5	5.6	(4.41)	46.0	(5.82)
31 - 45	15	7.9	(4.86)	48.5	(5.26)
46 - 60	26	9.3	(4.89)	50.2	(5.52)
61 - 75	25	11.2	(6.05)	51.5	(6.16)
76 - 90	14	12.5	(6.97)	53.2	(7.02)
91 - 105	9	12.3	(6.02)	52.7	(5.94)
106 - 120	4	13.5	(7.42)	56.4	(7.05)
>2 hours	2	15.0	(6.21)	55.7	(6.65)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (<i>n</i> =)	(143)		(545)		(245)	
All Dairy - Semi-Solid						
Mean Home Temperature (°F) [†]	48.8		50.9		52.7	
Standard Deviation	4.86		6.30		6.80	
Mean Change in Temperature (°F)	8.9		10.2		11.6	
Standard Deviation	5.01		6.04		6.43	
Transportation Temperature^{††}						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration[*]	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>
0 - 15 minutes	0	-	0.4	8.0	0.4	2.0
16 - 30	3	6.0	6	5.3	4	6.1
31 - 45	15	7.4	14	8.1	17	8.0
46 - 60	25	6.7	27	9.8	24	9.5
61 - 75	27	8.6	24	10.9	26	13.4
76 - 90	16	11.5	13	12.1	16	14.0
91 - 105	11	12.3	10	11.4	7	14.8
106 - 120	3	10.8	4	12.9	3	17.1
>2 hours	1	15.0	3	13.5	2	18.7

[†] Product temperatures taken upon arrival home before placing products in home refrigerator.

^{††} The temperature of the area in which groceries were transported.

^{*} Time between removal of product from store display until placement in home refrigerator.

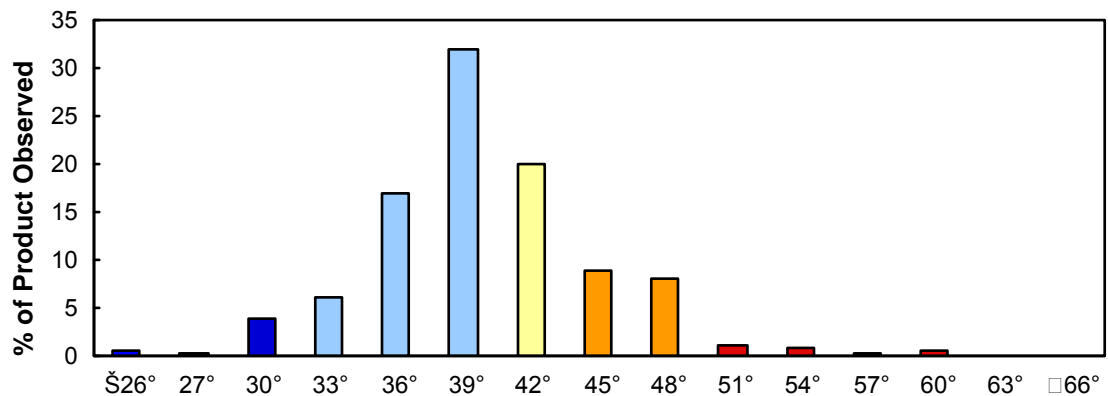
Dairy Product - Liquid

Location of Temperature	Retail Display	Home 0 Hour	Home 24 Hour*
Number of Samples†	975	971	939
All Dairy - Liquid			
Mean Product Temperature (°F)	40.9	50.4	39.2
Standard Deviation	5.05	6.48	4.78
Minimum (°F)	20	24	21
Maximum (°F)	60	94	70
Percent above 41°F	40	94	27
Percent above 45°F	15	78	8
Percent above 50°F	3	44	2
90th Percentile (°F)	48	58	44
95th Percentile (°F)	50	60	47
99th Percentile (°F)	57	68	54
Product Temperature Frequency Distribution (%)			
≤26°F	0.6	0.1	0.2
27 - 29	0.2	0.1	2
30 - 32	4	0.2	7
33 - 35	6	0.3	10
36 - 38	17	1	25
39 - 41	32	4	29
42 - 44	20	11	18
45 - 47	9	13	5
48 - 50	8	25	3
51 - 53	1	15	0.4
54 - 56	0.7	12	0.5
57 - 59	0.3	8	0.4
60 - 62	0.6	6	0.1
63 - 65	0	1	0
≥66°F	0	1	0.1

* For the home refrigerator temperature, the semi-solid dairy product was used.

† The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution (°F)



Change in Liquid Product Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature (°F)		Mean Unpacking Home Temperature (°F)	
		(Std. Dev.)		(Std. Dev.)	
Overall		9.6	(5.60)	50.5	(6.46)
Time Out of Refrigeration					
0 - 15 minutes	0.4	4.0	(4.55)	46.8	(8.88)
16 - 30	6	6.2	(4.19)	47.3	(4.95)
31 - 45	17	8.2	(4.93)	48.6	(5.76)
46 - 60	25	9.2	(4.63)	50.2	(5.92)
61 - 75	23	9.2	(4.85)	50.6	(5.27)
76 - 90	16	11.0	(6.77)	51.8	(7.29)
91 - 105	7	11.4	(5.87)	52.0	(8.33)
106 - 120	3	14.1	(7.58)	54.5	(8.68)
>2 hours	3	13.8	(7.06)	55.4	(6.64)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (n =)	(143)		(548)		(246)	
All Dairy - Liquid						
Mean Home Temperature (°F) [†]	48.0		50.4		51.7	
Standard Deviation	4.81		6.63		6.61	
Mean Change in Temperature (°F)	8.3		9.4		10.4	
Standard Deviation	4.67		5.47		6.29	
Transportation Temperature^{††}						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration[*]	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>
0 - 15 minutes	0	-	0.2	4.0	1	4.0
16 - 30	4	4.8	6	6.4	7	6.3
31 - 45	15	6.5	16	8.4	19	8.8
46 - 60	28	8.0	25	9.2	24	9.9
61 - 75	24	8.0	24	9.0	20	10.7
76 - 90	17	9.8	16	10.6	16	12.8
91 - 105	8	10.4	8	10.8	6	13.8
106 - 120	1	12.0	4	13.8	2	15.8
>2 hours	3	14.3	2	13.3	3	14.5

[†] Product temperatures taken upon arrival home before placing products in home refrigerator.

^{††} The temperature of the area in which groceries were transported.

^{*} Time between removal of product from store display until placement in home refrigerator.

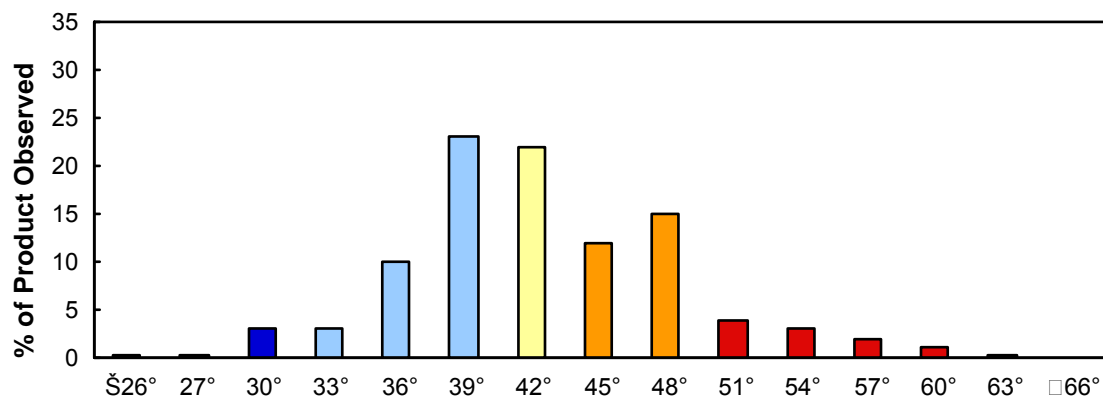
Pre-Packaged Lunch Meat Product

Location of Temperature	Retail Display	Home 0 Hour	Home 24 Hour*
Number of Samples†	973	970	939
All Pre-Packaged Lunch Meat			
Mean Product Temperature (°F)	43.6	52.4	39.2
Standard Deviation	6.14	6.56	4.78
Minimum (°F)	24	30	21
Maximum (°F)	66	94	70
Percent above 41°F	60	95	27
Percent above 45°F	34	86	8
Percent above 50°F	11	58	2
90th Percentile (°F)	52	60	44
95th Percentile (°F)	55	62	47
99th Percentile (°F)	60	70	54
Product Temperature Frequency Distribution (%)			
≤26°F	0.3	0	0.2
27 - 29	0.2	0	2
30 - 32	3	0.5	7
33 - 35	3	0	10
36 - 38	10	0.8	25
39 - 41	23	4	29
42 - 44	22	5	18
45 - 47	12	10	5
48 - 50	15	21	3
51 - 53	4	14	0.4
54 - 56	3	18	0.5
57 - 59	2	12	0.4
60 - 62	1	10	0.1
63 - 65	0.2	3	0
≥66°F	0.1	2	0.1

* For the home refrigerator temperature, the semi-solid dairy product was used.

† The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution (°F)



Change in Pre-Packaged Lunch Meat Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature (°F)		Mean Unpacking Home Temperature (°F)	
			(Std. Dev.)		(Std. Dev.)
Overall		8.8	(6.03)	52.4	(6.57)
Time Out of Refrigeration					
0 - 15 minutes	0.2	2.5	(2.12)	54.5	(6.36)
16 - 30	4	6.8	(5.73)	50.6	(6.69)
31 - 45	14	7.3	(5.71)	50.8	(6.77)
46 - 60	23	7.6	(4.69)	51.3	(5.72)
61 - 75	25	9.4	(5.79)	53.3	(5.86)
76 - 90	16	9.5	(6.65)	52.8	(6.79)
91 - 105	9	10.6	(7.15)	54.3	(7.55)
106 - 120	5	10.0	(5.82)	53.5	(6.89)
>2 hours	4	11.6	(7.46)	54.6	(8.48)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (n =)	(144)		(561)		(250)	
All Pre-Packaged Lunch Meat						
Mean Home Temperature (°F) [†]	50.6		52.2		53.9	
Standard Deviation	5.19		6.60		6.91	
Mean Change in Temperature (°F)	7.8		8.6		9.7	
Standard Deviation	4.97		5.85		6.78	
Transportation Temperature^{††}						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration[*]	% Shoppers	ΔTemp (°F)	% Shoppers	ΔTemp (°F)	% Shoppers	ΔTemp (°F)
0 - 15 minutes	0	-	0.2	4.0	0.4	1.0
16 - 30	3	4.3	4	6.8	6	7.5
31 - 45	13	7.7	14	6.7	14	8.5
46 - 60	29	6.5	22	8.0	21	7.6
61 - 75	24	8.2	24	9.4	28	10.0
76 - 90	15	8.6	16	8.6	16	11.8
91 - 105	7	10.0	11	10.0	8	12.6
106 - 120	6	10.1	5	9.6	4	11.0
>2 hours	3	7.8	5	11.7	2	13.7

[†] Product temperatures taken upon arrival home before placing products in home refrigerator.

^{††} The temperature of the area in which groceries were transported.

^{*} Time between removal of product from store display until placement in home refrigerator.

Change in Pre-Packaged Lunch Meat by Size

Due to Outside Temperature

	Overall	Outside Temperature		
		<70°F	70 - 89°F	>89°F
All Pre-Packaged Lunch Meat	<i>(n = 970)[†]</i>	<i>(n = 144)</i>	<i>(n = 566)</i>	<i>(n = 252)</i>
Mean Home Temperature (°F)	52.4	50.6	52.2	53.9
Standard Deviation	6.56	5.19	6.60	6.91
Mean Change in Temperature (°F)	8.8	7.8	8.6	9.7
Standard Deviation	6.01	4.97	5.85	6.78
Size				
≤6 oz.:	<i>(n = 69)</i>	<i>(n = 12)</i>	<i>(n = 38)</i>	<i>(n = 18)</i>
Mean Home Temperature (°F)	54.5	53.8	54.5	54.5
Standard Deviation	6.71	3.85	7.49	6.24
Mean Change in Temperature (°F)	10.8	11.8	10.6	10.7
Standard Deviation	5.88	5.95	5.23	7.01
8 oz.:	<i>(n = 653)</i>	<i>(n = 91)</i>	<i>(n = 379)</i>	<i>(n = 179)</i>
Mean Home Temperature (°F)	52.5	50.4	52.5	53.6
Standard Deviation	6.42	5.34	6.42	6.72
Mean Change in Temperature (°F)	8.9	7.3	9.1	9.4
Standard Deviation	5.99	5.01	6.00	6.34
≥12 oz.:	<i>(n = 26)</i>	<i>(n = 7)</i>	<i>(n = 15)</i>	<i>(n = 4)</i>
Mean Home Temperature (°F)	49.0	47.4	48.9	52.0
Standard Deviation	5.54	2.72	6.15	5.61
Mean Change in Temperature (°F)	7.1	6.3	7.6	6.8
Standard Deviation	3.85	2.60	4.57	1.92

[†] This sample size represents all home temperature data for the pre-packaged lunch meat product. All other sample sizes indicated on the page represent usable data points meeting the required criteria.

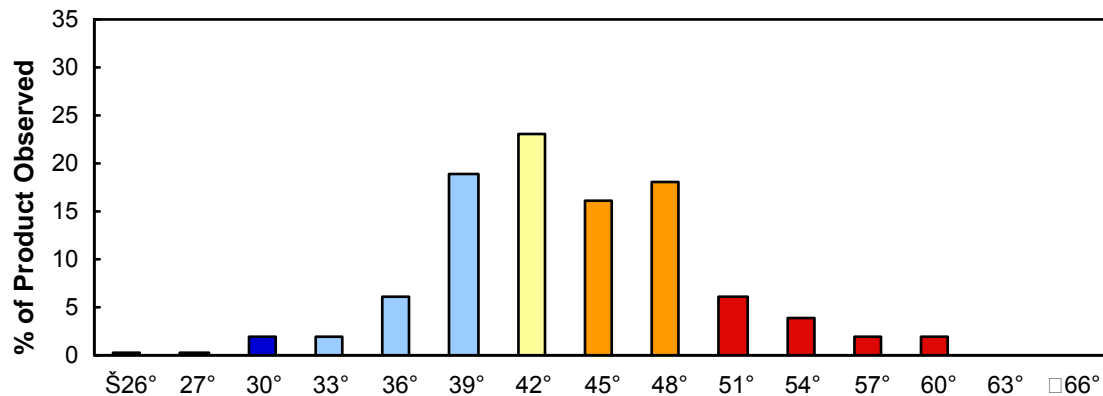
Deli Counter Meat Product

Location of Temperature	Retail Display	Home 0 Hour	Home 24 Hour*
Number of Samples†	925	922	939
All Deli Counter Meat			
Mean Product Temperature (°F)	44.8	53.8	39.2
Standard Deviation	5.91	7.16	4.78
Minimum (°F)	24	25	21
Maximum (°F)	64	98	70
Percent above 41°F	71	97	27
Percent above 45°F	42	88	8
Percent above 50°F	14	64	2
90th Percentile (°F)	52	62	44
95th Percentile (°F)	56	65	47
99th Percentile (°F)	60	70	54
Product Temperature Frequency Distribution (%)			
≤26°F	0.2	0.1	0.2
27 - 29	0.2	0	2
30 - 32	2	0.1	7
33 - 35	2	0.1	10
36 - 38	6	0.7	25
39 - 41	19	2	29
42 - 44	23	5	18
45 - 47	16	9	5
48 - 50	18	18	3
51 - 53	6	13	0.4
54 - 56	4	14	0.5
57 - 59	2	13	0.4
60 - 62	2	15	0.1
63 - 65	0.1	5	0
≥66°F	0	5	0.1

* For the home refrigerator temperature, the semi-solid dairy product was used.

† The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution (°F)



Change in Deli Counter Meat Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature (°F)		Mean Unpacking Home Temperature (°F)	
			(Std. Dev.)	(Std. Dev.)	(Std. Dev.)
Overall		9.0	(6.43)	53.9	(7.16)
Time Out of Refrigeration					
0 - 15 minutes	0.2	9.5	(0.71)	52.0	(0.00)
16 - 30	6	7.0	(4.75)	51.4	(6.65)
31 - 45	18	8.2	(5.83)	52.6	(7.03)
46 - 60	23	8.0	(5.66)	53.3	(6.58)
61 - 75	22	9.1	(6.30)	53.8	(6.57)
76 - 90	14	10.0	(6.13)	54.9	(7.03)
91 - 105	11	11.3	(8.67)	56.5	(8.63)
106 - 120	3	11.6	(6.43)	56.4	(7.16)
>2 hours	4	10.7	(7.61)	56.9	(8.16)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (n =)	<i>(135)</i>		<i>(523)</i>		<i>(231)</i>	
All Deli Counter Meat						
Mean Home Temperature (°F)†	51.9		53.4		56.0	
Standard Deviation	5.94		6.96		7.68	
Mean Change in Temperature (°F)	7.9		8.6		10.4	
Standard Deviation	5.27		6.29		6.93	
Transportation Temperature††						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration*	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>
0 - 15 minutes	0	-	0.2	10.0	0.4	9.0
16 - 30	5	4.7	7	7.9	6	5.7
31 - 45	16	6.9	19	8.0	17	9.1
46 - 60	22	8.1	21	7.1	27	9.3
61 - 75	22	6.8	21	8.9	23	11.0
76 - 90	14	9.0	15	9.3	13	12.5
91 - 105	15	9.7	10	10.5	10	14.2
106 - 120	3	12.8	3	10.4	2	14.2
>2 hours	3	9.3	5	10.9	2	11.0

† Product temperatures taken upon arrival home before placing products in home refrigerator.

†† The temperature of the area in which groceries were transported.

* Time between removal of product from store display until placement in home refrigerator.

Change in Deli Counter Meat Temperatures by Size

Due to Outside Temperature

	Overall	Outside Temperature		
		<70°F	70 - 89°F	>89°F
All Deli Counter Meat	<i>(n = 922)[†]</i>	<i>(n = 138)</i>	<i>(n = 539)</i>	<i>(n = 238)</i>
Mean Home Temperature (°F)	53.8	51.9	53.4	56.0
Standard Deviation	7.16	5.94	6.96	7.68
Mean Change in Temperature (°F)	9.0	7.9	8.6	10.4
Standard Deviation	6.38	5.27	6.29	6.93
Size				
≤8 oz.:	<i>(n = 644)</i>	<i>(n = 100)</i>	<i>(n = 371)</i>	<i>(n = 170)</i>
Mean Home Temperature (°F)	54.7	52.9	54.2	56.7
Standard Deviation	6.95	5.67	7.10	6.86
Mean Change in Temperature (°F)	9.2	8.3	9.0	10.3
Standard Deviation	6.48	5.46	6.65	6.50
9-16 oz.:	<i>(n = 154)</i>	<i>(n = 24)</i>	<i>(n = 91)</i>	<i>(n = 37)</i>
Mean Home Temperature (°F)	51.8	49.5	52.3	52.5
Standard Deviation	6.70	5.94	6.38	7.46
Mean Change in Temperature (°F)	8.1	7.0	7.8	9.5
Standard Deviation	5.56	4.84	5.41	6.15
>16 oz.:	<i>(n = 18)</i>	<i>(n = 0)</i>	<i>(n = 14)</i>	<i>(n = 4)</i>
Mean Home Temperature (°F)	54.3		51.5	64.0
Standard Deviation	11.85		5.45	20.15
Mean Change in Temperature (°F)	11.3		9.2	18.5
Standard Deviation	11.23		4.75	20.52

[†] This sample size represents all home temperature data for the deli counter meat product. All other sample sizes indicated on the page represent usable data points meeting the required criteria.

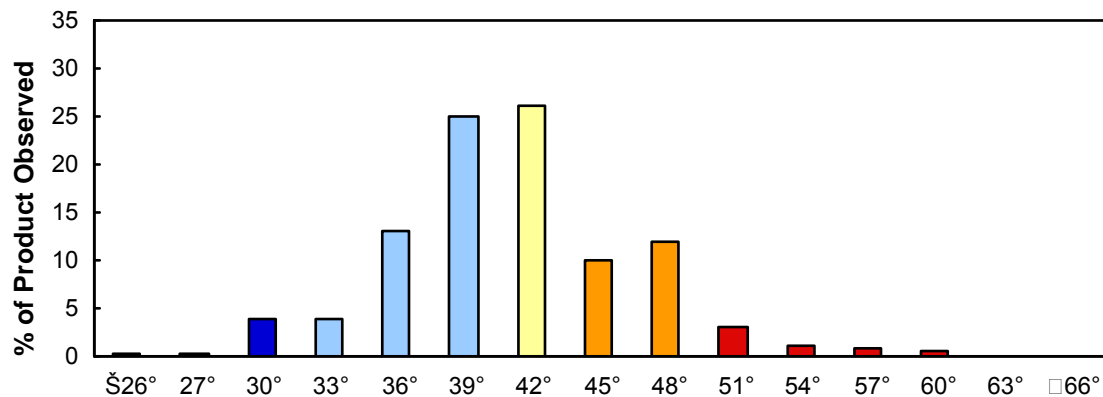
Pre-Packaged Deli Product

Location of Temperature	Retail Display	Home 0 Hour	Home 24 Hour*
Number of Samples†	940	936	939
All Pre-Packaged Deli			
Mean Product Temperature (°F)	42.3	50.2	39.2
Standard Deviation	5.54	6.35	4.78
Minimum (°F)	20	30	21
Maximum (°F)	66	84	70
Percent above 41°F	54	93	27
Percent above 45°F	24	77	8
Percent above 50°F	6	45	2
90th Percentile (°F)	50	58	44
95th Percentile (°F)	52	60	47
99th Percentile (°F)	59	67	54
Product Temperature Frequency Distribution (%)			
≤26°F	0.4	0	0.2
27 - 29	0.3	0	2
30 - 32	4	0.4	7
33 - 35	4	0.2	10
36 - 38	13	2	25
39 - 41	25	4	29
42 - 44	26	13	18
45 - 47	10	12	5
48 - 50	12	24	3
51 - 53	3	16	0.4
54 - 56	1	12	0.5
57 - 59	0.9	8	0.4
60 - 62	0.5	6	0.1
63 - 65	0.1	1	0
≥66°F	0.1	1	0.1

* For the home refrigerator temperature, the semi-solid dairy product was used.

† The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution (°F)



Change in Pre-Packaged Deli Product Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature (°F)		Mean Unpacking Home Temperature (°F)	
			(Std. Dev.)		(Std. Dev.)
Overall		8.0	(5.40)	50.3	(6.35)
Time Out of Refrigeration					
0 - 15 minutes	0.9	12.4	(13.36)	55.4	(12.48)
16 - 30	7	5.8	(4.61)	47.8	(6.03)
31 - 45	16	5.8	(4.21)	48.2	(5.59)
46 - 60	25	7.7	(5.02)	50.1	(6.16)
61 - 75	21	7.9	(5.01)	50.0	(6.27)
76 - 90	15	9.0	(5.55)	51.9	(6.18)
91 - 105	8	10.4	(5.78)	51.9	(6.52)
106 - 120	4	10.0	(5.08)	52.3	(5.60)
>2 hours	3	10.9	(6.71)	53.2	(6.71)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (n =)	(135)		(538)		(230)	
All Pre-Packaged Deli						
Mean Home Temperature (°F)†	49.0		50.2		50.9	
Standard Deviation	5.43		6.43		6.60	
Mean Change in Temperature (°F)	7.8		7.9		8.0	
Standard Deviation	4.61		5.42		5.76	
Transportation Temperature††						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration*	% Shoppers	ΔTemp (°F)	% Shoppers	ΔTemp (°F)	% Shoppers	ΔTemp (°F)
0 - 15 minutes	0.7	8.0	0.7	8.8	1	18.7
16 - 30	5	4.1	7	5.9	8	6.1
31 - 45	11	5.5	17	5.1	18	7.4
46 - 60	25	6.5	24	8.3	26	7.1
61 - 75	23	7.6	20	8.0	23	8.1
76 - 90	18	9.0	17	9.0	10	8.8
91 - 105	9	12.3	7	9.7	10	10.5
106 - 120	4	7.3	4	10.6	2	10.5
>2 hours	4	14.0	4	11.0	2	7.4

† Product temperatures taken upon arrival home before placing products in home refrigerator.

†† The temperature of the area in which groceries were transported.

* Time between removal of product from store display until placement in home refrigerator.

Change in Pre-Packaged Deli Product Temperature by Size

Due to Outside Temperature

	Overall	Outside Temperature		
		<70°F	70 - 89°F	>89°F
All Pre-Packaged Deli	<i>(n = 936)[†]</i>	<i>(n = 138)</i>	<i>(n = 554)</i>	<i>(n = 237)</i>
Mean Home Temperature (°F)	50.2	49.0	50.2	50.9
Standard Deviation	6.36	5.43	6.43	6.60
Mean Change in Temperature (°F)	7.9	7.8	7.9	8.0
Standard Deviation	5.43	4.61	5.42	5.76
Size				
≤8 oz.:	<i>(n = 263)</i>	<i>(n = 45)</i>	<i>(n = 157)</i>	<i>(n = 59)</i>
Mean Home Temperature (°F)	51.8	51.5	51.2	53.4
Standard Deviation	6.36	5.25	6.13	7.33
Mean Change in Temperature (°F)	9.0	8.8	8.6	10.0
Standard Deviation	5.74	4.36	5.59	6.78
9-16 oz.:	<i>(n = 479)</i>	<i>(n = 64)</i>	<i>(n = 285)</i>	<i>(n = 129)</i>
Mean Home Temperature (°F)	49.8	47.9	50.2	49.9
Standard Deviation	6.16	5.15	6.37	5.99
Mean Change in Temperature (°F)	7.7	7.6	7.9	7.4
Standard Deviation	5.28	4.34	5.46	5.26
>16 oz.:	<i>(n = 71)</i>	<i>(n = 10)</i>	<i>(n = 41)</i>	<i>(n = 19)</i>
Mean Home Temperature (°F)	48.9	47.8	49.1	49.1
Standard Deviation	6.09	2.99	6.91	5.47
Mean Change in Temperature (°F)	7.0	6.8	7.1	6.7
Standard Deviation	3.98	3.34	3.84	4.62

[†] This sample size represents all home temperature data for the pre-packaged deli product. All other sample sizes indicated on the page represent usable data points meeting the required criteria.

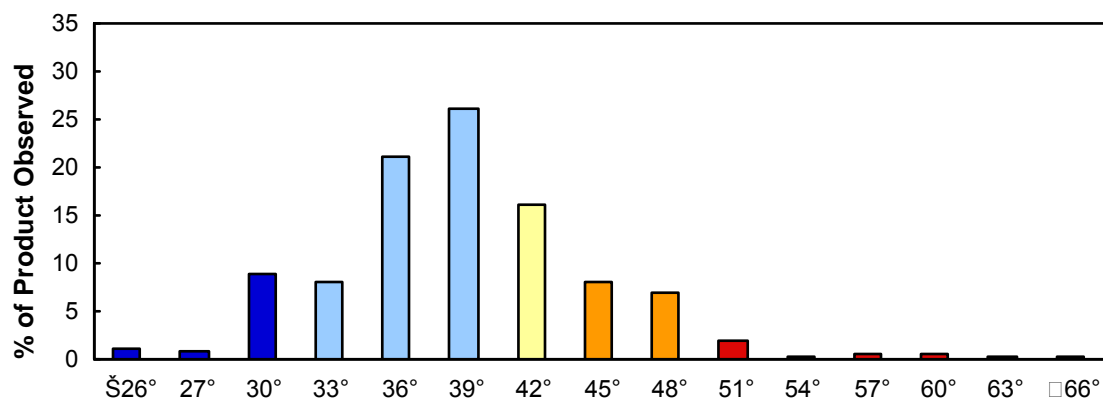
Fish Counter Product

Location of Temperature	Retail Display	Home 0 Hour	Home 24 Hour*
Number of Samples†	851	848	939
All Fish			
Mean Product Temperature (°F)	40.0	49.8	39.2
Standard Deviation	6.05	7.76	4.78
Minimum (°F)	14	20	21
Maximum (°F)	70	80	70
Percent above 41°F	34	89	27
Percent above 45°F	15	71	8
Percent above 50°F	3	40	2
90th Percentile (°F)	48	60	44
95th Percentile (°F)	50	62	47
99th Percentile (°F)	60	70	54
Product Temperature Frequency Distribution (°F)			
≤26°F	1	0.2	0.2
27 - 29	0.7	0.2	2
30 - 32	9	1	7
33 - 35	8	1	10
36 - 38	21	2	25
39 - 41	26	7	29
42 - 44	16	13	18
45 - 47	8	13	5
48 - 50	7	22	3
51 - 53	2	11	0.4
54 - 56	0.4	9	0.5
57 - 59	0.5	8	0.4
60 - 62	0.5	7	0.1
63 - 65	0.2	2	0
≥66°F	0.4	3	0.1

* For the home refrigerator temperature, the semi-solid dairy product was used.

† The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution



Change in Fish Product Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature (°F)		Mean Unpacking Home Temperature (°F)	
			(Std. Dev.)		(Std. Dev.)
Overall		9.9	(6.66)	49.9	(7.76)
Time Out of Refrigeration					
0 - 15 minutes	0.5	7.8	(14.20)	50.3	(11.79)
16 - 30	6	7.0	(5.60)	47.2	(6.85)
31 - 45	17	8.3	(6.36)	48.7	(7.38)
46 - 60	24	8.9	(6.26)	48.9	(7.71)
61 - 75	22	10.5	(6.15)	49.9	(7.71)
76 - 90	16	10.5	(6.78)	50.9	(7.46)
91 - 105	8	12.4	(6.58)	52.2	(7.14)
106 - 120	3	13.3	(6.10)	54.4	(7.23)
>2 hours	3	14.3	(9.35)	53.5	(10.86)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (n =)	(121)		(477)		(221)	
All Fish						
Mean Home Temperature (°F) [†]	48.6		49.9		50.4	
Standard Deviation	6.52		7.89		7.97	
Mean Change in Temperature (°F)	9.1		9.7		10.5	
Standard Deviation	6.22		6.64		6.67	
Transportation Temperature^{††}						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration[*]	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>
0 - 15 minutes	0.8	0.0	0.4	14.5	0.5	2.0
16 - 30	5	8.0	6	6.0	5	8.9
31 - 45	16	6.8	17	7.4	20	10.4
46 - 60	21	6.0	23	9.4	26	9.5
61 - 75	20	10.9	22	10.5	24	10.3
76 - 90	17	9.6	17	10.6	13	11.1
91 - 105	14	10.7	7	12.4	8	13.2
106 - 120	5	14.2	4	13.0	1	13.3
>2 hours	2	29.5	4	11.7	1	20.7

[†] Product temperatures taken upon arrival home before placing products in home refrigerator.

^{††} The temperature of the area in which groceries were transported.

^{*} Time between removal of product from store display until placement in home refrigerator.

Change in Fish Product Temperature by Size

Due to Outside Temperature

	Overall	Outside Temperature		
		<70°F	70 - 89°F	>89°F
All Fish	<i>(n = 848)[†]</i>	<i>(n = 124)</i>	<i>(n = 489)</i>	<i>(n = 228)</i>
Mean Home Temperature (°F)	49.8	48.6	49.9	50.4
Standard Deviation	7.76	6.52	7.89	7.97
Mean Change in Temperature (°F)	9.8	9.1	9.7	10.5
Standard Deviation	6.62	6.22	6.64	6.67
Size				
≤8 oz.:	<i>(n = 407)</i>	<i>(n = 65)</i>	<i>(n = 236)</i>	<i>(n = 102)</i>
Mean Home Temperature (°F)	51.7	49.7	52.5	51.4
Standard Deviation	7.82	6.97	8.04	7.53
Mean Change in Temperature (°F)	11.1	10.3	11.4	11.1
Standard Deviation	6.90	6.67	7.15	6.38
9-16 oz.:	<i>(n = 230)</i>	<i>(n = 39)</i>	<i>(n = 131)</i>	<i>(n = 59)</i>
Mean Home Temperature (°F)	47.9	47.8	47.5	48.9
Standard Deviation	6.99	6.12	6.13	8.99
Mean Change in Temperature (°F)	9.1	8.1	8.6	10.7
Standard Deviation	5.95	5.99	4.99	7.38
>16 oz.:	<i>(n = 57)</i>	<i>(n = 3)</i>	<i>(n = 32)</i>	<i>(n = 22)</i>
Mean Home Temperature (°F)	45.4	42.0	44.6	47.0
Standard Deviation	7.56	2.94	8.31	6.43
Mean Change in Temperature (°F)	7.5	9.0	7.0	8.0
Standard Deviation	6.71	5.10	6.98	6.42

[†] This sample size represents all home temperature data for the fish product. All other sample sizes indicated on the page represent usable data points meeting the required criteria.

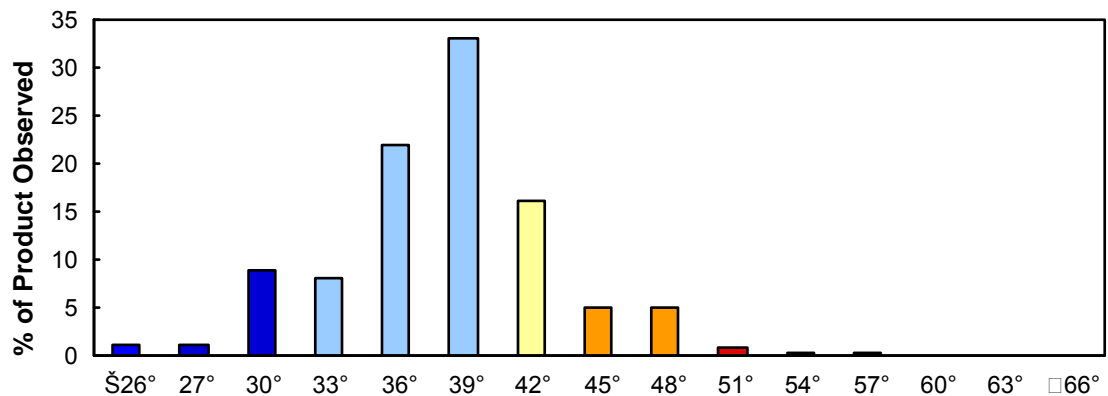
Fresh Meat Product

Location of Temperature	Retail Display	Home 0 Hour	Home 24 Hour*
Number of Samples†	975	971	939
All Fresh Meat			
Mean Product Temperature (°F)	39.2	45.9	39.2
Standard Deviation	5.06	5.89	4.78
Minimum (°F)	19	25	21
Maximum (°F)	58	70	70
Percent above 41°F	27	80	27
Percent above 45°F	9	51	8
Percent above 50°F	1	17	2
90th Percentile (°F)	45	52	44
95th Percentile (°F)	48	56	47
99th Percentile (°F)	52	60	54
Product Temperature Frequency Distribution (%)			
≤26°F	1	0.3	0.2
27 - 29	1	0.2	2
30 - 32	9	2	7
33 - 35	8	2	10
36 - 38	22	3	25
39 - 41	33	13	29
42 - 44	16	22	18
45 - 47	5	18	5
48 - 50	5	23	3
51 - 53	0.8	7	0.4
54 - 56	0.4	5	0.5
57 - 59	0.2	2	0.4
60 - 62	0	2	0.1
63 - 65	0	0.3	0
≥66°F	0	0.2	0.1

* For the home refrigerator temperature, the semi-solid dairy product was used.

† The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution (°F)



Change in Fresh Meat Product Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature (°F) (Std. Dev.)		Mean Unpacking Home Temperature (°F) (Std. Dev.)	
Overall		6.7	(5.08)	45.9	(5.89)
Time Out of Refrigeration					
0 - 15 minutes	0.5	7.2	(5.40)	49.2	(5.72)
16 - 30	5	5.4	(6.44)	44.1	(6.95)
31 - 45	18	5.3	(3.80)	44.1	(5.37)
46 - 60	25	6.5	(4.67)	45.8	(5.72)
61 - 75	22	6.5	(4.39)	45.9	(5.47)
76 - 90	16	7.9	(5.93)	47.0	(6.24)
91 - 105	7	8.8	(5.77)	47.3	(5.65)
106 - 120	3	8.0	(4.28)	46.8	(5.90)
>2 hours	2	10.2	(7.54)	49.4	(6.77)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (n =)	(142)		(550)		(245)	
All Fresh Meat						
Mean Home Temperature (°F) [†]	44.8		45.7		47.1	
Standard Deviation	5.35		5.82		6.08	
Mean Change in Temperature (°F)	6.2		6.7		7.2	
Standard Deviation	4.74		5.13		5.18	
Transportation Temperature^{††}						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration[*]	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>
0 - 15 minutes	1	4.0	0.4	9.0	0.4	10.0
16 - 30	2	0.0	6	5.1	5	7.7
31 - 45	16	4.9	18	5.0	18	5.9
46 - 60	27	4.8	22	6.7	31	7.0
61 - 75	22	5.3	23	6.5	22	7.4
76 - 90	13	8.9	18	7.7	15	7.7
91 - 105	15	9.5	6	7.8	5	10.3
106 - 120	2	7.3	4	8.5	2	6.8
>2 hours	1	14.5	3	9.2	1	13.0

[†] Product temperatures taken upon arrival home before placing products in home refrigerator.

^{††} The temperature of the area in which groceries were transported.

^{*} Time between removal of product from store display until placement in home refrigerator.

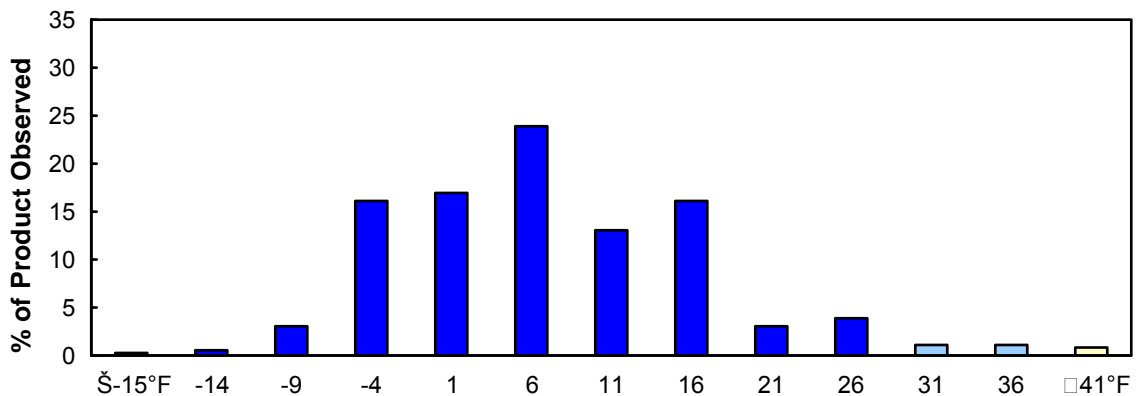
Frozen Foods - Whipped Topping Product

Location of Temperature	Backroom Freezer	Retail Display	Home 0 Hour	Home 24 Hour*
Number of Samples[†]	442	973	971	940
All Whipped Topping				
Mean Product Temperature (°F)	8.6	9.9	20.1	3.4
Standard Deviation	11.30	10.07	10.27	8.21
Minimum (°F)	-32	-25	-10	-20
Maximum (°F)	45	50	60	48
90th Percentile (°F)	22	21	34	12
95th Percentile (°F)	30	29	41	20
99th Percentile (°F)	43	41	52	32
Product Temperature Frequency Distribution (%)				
≤-15°F	0.7	0.3	0	1
-14 to -10	3	0.6	0.1	3
-9 to -5	4	3	0	6
-4 to 0	20	16	0.3	33
1 - 5	14	17	4	25
6 - 10	23	24	11	19
11 - 15	11	13	18	5
16 - 20	12	16	31	4
21 - 25	3	3	14	1
26 - 30	4	4	9	1
31 - 35	2	1	3	0.4
36 - 40	2	1	4	0.5
≥41°F	1	1	5	0.1

* The product used for the home freezer temperature was one half gallon of ice cream.

† The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution (°F)



Change in Whipped Topping Product Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature (°F)		Mean Unpacking Home Temperature (°F)	
			(Std. Dev.)	(Std. Dev.)	
Overall		10.2	(8.24)	19.9	(10.09)
Time Out of Refrigeration					
0 - 15 minutes	0.6	4.0	(3.58)	19.0	(15.63)
16 - 30	11	8.2	(7.74)	19.3	(11.83)
31 - 45	24	9.1	(6.98)	17.7	(8.88)
46 - 60	29	9.4	(8.50)	19.5	(9.26)
61 - 75	18	11.9	(8.54)	20.5	(10.30)
76 - 90	11	11.0	(8.07)	21.8	(10.79)
91 - 105	5	15.5	(9.16)	24.6	(10.64)
106 - 120	2	12.5	(8.06)	22.1	(10.89)
>2 hours	2	15.1	(8.72)	23.3	(9.82)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (n =)	<i>(143)</i>		<i>(548)</i>		<i>(244)</i>	
All Whipped Topping						
Mean Home Temperature (°F) [†]	18.8		20.1		20.6	
Standard Deviation	9.94		10.22		10.59	
Mean Change in Temperature (°F)	10.4		10.1		10.3	
Standard Deviation	7.69		8.43		8.04	
Transportation Temperature^{††}						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration[*]	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>
0 - 15 minutes	0	-	0.7	5.5	0.8	1.0
16 - 30	6	13.0	11	7.6	15	8.3
31 - 45	22	8.3	24	8.9	23	10.1
46 - 60	30	8.4	28	9.3	28	10.1
61 - 75	20	12.1	18	12.0	16	11.0
76 - 90	13	9.6	10	11.4	9	11.8
91 - 105	6	18.9	6	15.0	4	13.9
106 - 120	1	10.5	1	11.7	3	12.3
>2 hours	1	20.0	2	14.5	0.8	20.5

[†] Product temperatures taken upon arrival home before placing products in home refrigerator.

^{††} The temperature of the area in which groceries were transported.

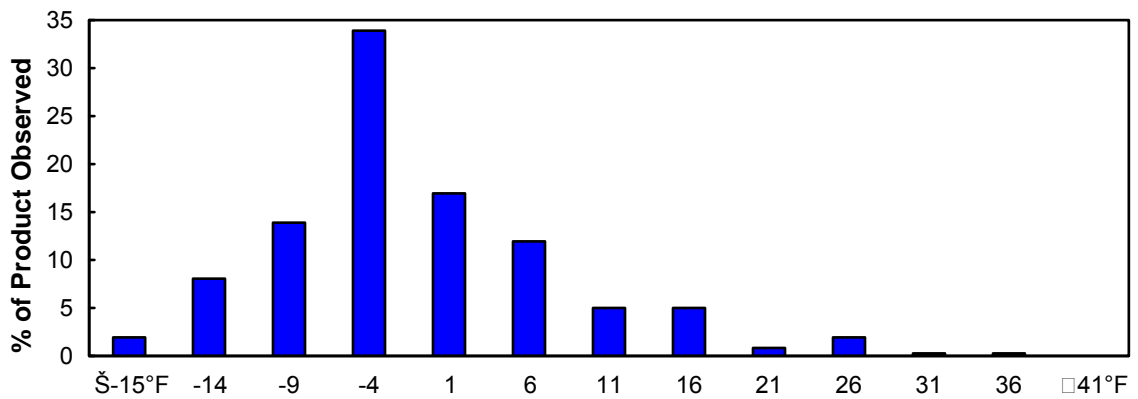
^{*} Time between removal of product from store display until placement in home refrigerator.

Ice Cream Product

Location of Temperature	Retail Display	Home 0 Hour	Home 24 Hour
Number of Samples[†]	966	963	940
All Ice Cream			
Mean Product Temperature (°F)	1.1	9.2	3.4
Standard Deviation	8.96	9.49	8.21
Minimum (°F)	-28	-20	-20
Maximum (°F)	36	60	48
90th Percentile (°F)	13	21	12
95th Percentile (°F)	19	28	20
99th Percentile (°F)	30	40	32
Percent <-15°F	2	0.1	1
Percent between -15°F and -5°F	23	3	10
Percent >-5°F	75	97	89
Product Temperature Frequency Distribution (%)			
≤-15°F	2	0.1	1
-14 to -10	8	0.7	3
-9 to -5	14	2	6
-4 to 0	34	14	33
1 - 5	17	22	25
6 - 10	12	29	19
11 - 15	5	13	5
16 - 20	5	8	4
21 - 25	0.8	4	1
26 - 30	2	3	1
31 - 35	0.2	0.9	0.4
36 - 40	0.2	1	0.5
≥41°F	0	0.7	0.1

[†] The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution



Change in Ice Cream Product Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature		Mean Unpacking Home Temperature	
		(°F)	(Std. Dev.)	(°F)	(Std. Dev.)
Overall		8.0	(6.92)	8.9	(9.26)
Time to Shop (Minutes)					
0 - 15	3	6.0	(4.78)	7.4	(12.05)
16 - 30	17	6.3	(6.66)	6.9	(8.84)
31 - 45	31	7.5	(6.91)	8.5	(8.89)
46 - 60	26	7.6	(6.55)	9.0	(9.41)
61 - 75	13	10.1	(7.49)	10.0	(8.81)
76 - 90	6	9.9	(5.35)	12.3	(9.96)
91 - 105	3	11.8	(9.64)	12.3	(9.44)
106 - 120	2	13.3	(4.82)	10.9	(7.26)
>2 hours	0.5	10.4	(6.80)	13.0	(14.80)

Due to Time Out of Refrigeration

Outside Temperature	<70°F		70 - 89°F		>89°F	
Number of Shoppers (n =)	(142)		(548)		(240)	
All Ice Cream						
Mean Home Temperature (°F) [†]	8.4		9.2		9.5	
Standard Deviation	8.88		9.61		9.56	
Mean Change in Temperature (°F)	8.0		7.8		8.7	
Standard Deviation	6.83		6.90		7.32	
Transportation Temperature^{††}						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration[*]	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>
0 - 15 minutes	1	10.5	2	5.6	4	5.7
16 - 30	13	4.7	16	6.1	22	7.5
31 - 45	31	7.9	32	6.9	30	8.9
46 - 60	25	6.6	26	7.9	27	7.4
61 - 75	16	11.3	13	9.0	12	11.4
76 - 90	8	8.6	6	9.7	3	13.0
91 - 105	4	12.4	3	12.5	1	11.0
106 - 120	2	13.3	2	13.1	1	13.7
>2 hours	0	-	0.7	12.3	0.4	3.0

[†] Product temperatures taken upon arrival home before placing products in home refrigerator.

^{††} The temperature of the area in which groceries were transported.

^{*} Time between removal of product from store display until placement in home refrigerator.

Frozen Novelty Product

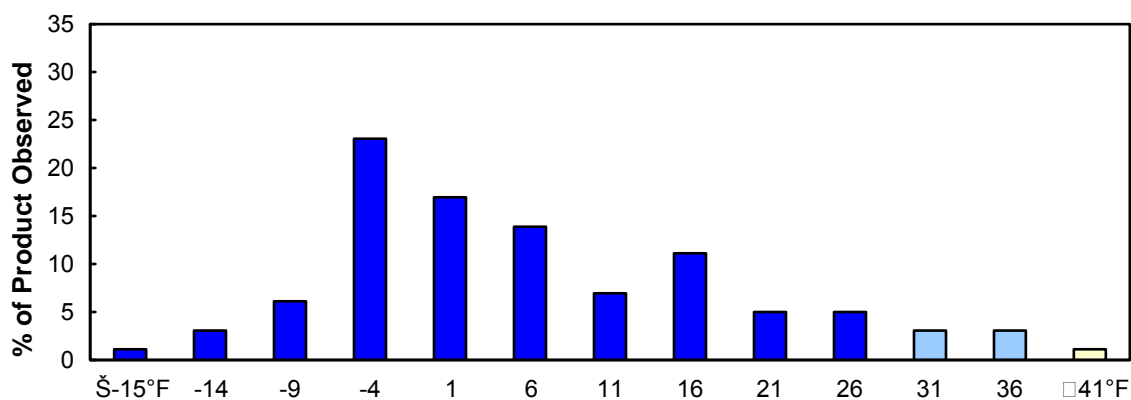
Location of Temperature	Retail Display	Home 0 Hour	Home 24 Hour*
Number of Samples†	922	919	940
All Frozen Novelty			
Mean Product Temperature (°F)	8.7	21.9	3.4
Standard Deviation	12.53	12.57	8.21
Minimum (°F)	-20	-10	-20
Maximum (°F)	44	68	48
90th Percentile (°F)	28	40	12
95th Percentile (°F)	33	48	20
99th Percentile (°F)	42	60	32
Product Temperature Frequency Distribution (%)			
≤-15°F	1	0	1
-14 to -10	3	0.1	3
-9 to -5	6	0.5	6
-4 to 0	23	0.9	33
1 - 5	17	4	25
6 - 10	14	12	19
11 - 15	7	14	5
16 - 20	11	27	4
21 - 25	5	11	1
26 - 30	5	10	1
31 - 35	3	4	0.4
36 - 40	3	7	0.5
≥41°F	1	9	0.1

Note: The frozen novelty is an internal package air temperature.

* The product used for the home freezer temperature was one half gallon of ice cream.

† The sample sizes represent the number of usable data points meeting the required criteria.

Retail Product Temperature Frequency Distribution (°F)



Change in Frozen Novelty Product Temperature

Due to Time Out of Refrigeration

	% of Shoppers	Mean Change in Product Temperature		Mean Unpacking Home Temperature	
		(°F)	(Std. Dev.)	(°F)	(Std. Dev.)
Overall		13.3	(9.03)	21.8	(12.56)
Time Out of Refrigeration					
0 - 15 minutes	2	7.1	(6.49)	15.9	(12.10)
16 - 30	19	10.6	(8.52)	19.3	(12.74)
31 - 45	31	13.0	(8.94)	20.8	(12.45)
46 - 60	26	14.0	(8.81)	22.0	(11.84)
61 - 75	15	15.1	(8.93)	25.3	(13.25)
76 - 90	5	16.3	(10.22)	25.5	(12.28)
91 - 105	1	16.8	(10.34)	26.4	(11.01)
106 - 120	2	15.9	(9.32)	25.5	(10.12)
>2 hours	0.4	15.3	(10.69)	26.0	(10.58)

Due to Time Out of Refrigeration and Outside Temperature

Outside Temperature	<70 °F		70 - 89 °F		>89 °F	
Number of Shoppers (n =)	(136)		(524)		(229)	
All Frozen Novelty						
Mean Home Temperature (°F) [†]	20.4		22.6		21.3	
Standard Deviation	11.08		12.88		12.67	
Mean Change in Temperature (°F)	13.0		13.2		13.4	
Standard Deviation	8.16		9.44		8.56	
Transportation Temperature^{††}						
Mean (°F)	66.7		76.2		82.4	
Range (°F)	39 - 100		42 - 114		45 - 105	
Time Out of Refrigeration[*]	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>	<i>% Shoppers</i>	<i>ΔTemp (°F)</i>
0 - 15 minutes	2	9.7	2	7.6	2	4.3
16 - 30	16	10.6	18	10.8	24	11.0
31 - 45	32	11.2	30	12.4	30	14.7
46 - 60	24	15.3	27	14.2	25	13.1
61 - 75	14	12.1	15	15.7	15	15.1
76 - 90	9	17.9	5	15.8	2	18.0
91 - 105	1	15.0	2	17.3	0	-
106 - 120	1	17.0	2	14.2	2	20.0
>2 hours	0.7	20.0	0.6	13.7	0	-

[†] Product temperatures taken upon arrival home before placing products in home refrigerator.

^{††} The temperature of the area in which groceries were transported.

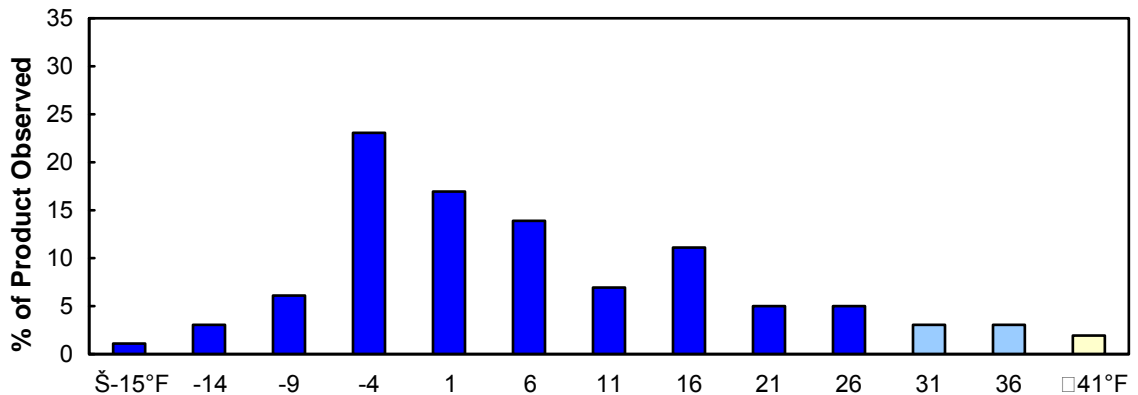
^{*} Time between removal of product from store display until placement in home refrigerator.

Frozen Entrée Product†

Location of Temperature	Retail Display
Number of Samples	922
All Frozen Entrée	
Mean Air Temperature (°F)	15.0
Standard Deviation	11.47
Minimum (°F)	-18
Maximum (°F)	50
90th Percentile (°F)	30
95th Percentile (°F)	38
99th Percentile (°F)	44
Air Temperature Frequency Distribution (%)	
≤-15°F	0.2
-14 to -10	1
-9 to -5	0.8
-4 to 0	10
1 - 5	9
6 - 10	19
11 - 15	10
16 - 20	23
21 - 25	11
26 - 30	6
31 - 35	3
36 - 40	5
≥41°F	2

† Air temperature of the frozen entrée was taken by placing a thermometer between two packages of product in the freezer case.

Retail Air Temperature Frequency Distribution (°F)



Grocery Handling Habits

	Number of Households	Frequency (%)
Frequency of Shopping Trips <i>(n = 949)</i>		
One trip per month	15	2
One trip every two weeks	103	11
One trip per week	361	38
Two to three trips per week	420	44
Four to five trips per week	47	5
Greater than five trips per week	3	0.3
Method of Transportation Home <i>(n = 976)</i>		
Automobile	968	99
Walk	7	0.7
Bicycle	1	0.1
Location of Groceries During Transportation <i>(n = 974)</i>		
Back seat	391	40
Trunk	335	34
Front seat	133	14
Rear of van	61	6
Rear of sport utility vehicle	25	3
Bed of pick-up truck	12	1
Rear of station wagon	10	1
Carried in arms	7	0.7
Do You Handle Groceries Differently in Summer? <i>(n = 947)</i>		
No	634	67
Yes	313	33
Participant Living Area <i>(n = 966)</i>		
Suburban	502	52
Urban	305	32
Rural	159	16
Store Area		
Suburban	521	54
Urban	377	39
Rural	68	7

Vehicle Grocery Location and Product Temperature Summary

Average Transportation Temperature and Change in Product Temperature Due to Grocery Location

Location of Groceries	Front Seat		Back Seat		Rear of SUV, minivan or station wagon		Trunk	
Number of Samples	127		377		93		325	
Transportation Temperature								
Mean (°F)	74.9		76.0		76.8		77.4	
Standard Deviation	10.34		10.11		9.03		10.14	
Minimum (°F)	49		42		52		39	
Maximum (°F)	105		105		102		114	
Product Category								
<i>Refrigerated</i>	<i>Mean Δ Temp (°F) †</i>	<i>Mean Temp at Home (°F) ††</i>	<i>Mean Δ Temp (°F)</i>	<i>Mean Temp at Home (°F)</i>	<i>Mean Δ Temp (°F)</i>	<i>Mean Temp at Home (°F)</i>	<i>Mean Δ Temp (°F)</i>	<i>Mean Temp at Home (°F)</i>
Dairy - Semi-solid	9.2	50.0	10.0	50.2	11.9	52.8	10.8	51.1
Dairy - Liquid	8.7	49.4	9.4	49.8	10.3	52.3	9.7	50.1
Pre-packaged lunch meat	7.9	50.5	8.7	51.7	9.2	53.5	9.0	52.5
Deli counter meat	7.4	49.9	8.1	49.4	9.7	53.6	9.4	52.5
Pre-packaged deli	7.1	47.6	7.4	47.7	8.2	49.7	7.9	48.4
Fish counter	7.0	40.7	8.2	42.1	8.6	42.9	9.8	46.3
Fresh meat	6.5	45.9	6.4	45.3	7.6	47.2	7.1	45.9
<i>Frozen</i>								
Whipped topping	9.1	19.1	9.6	19.2	11.4	19.9	11.0	20.8
Ice cream	7.1	9.0	7.5	9.0	7.6	9.0	8.6	8.9
Frozen novelty	12.3	19.9	12.1	20.6	13.9	22.1	12.4	21.3

† The change in product temperature is the difference between removal of product from store display until placement in home refrigeration.

†† Product temperatures taken upon arrival home before placing products in home refrigeration.

Transportation Temperature and Product Temperature Summary

Change in Product Temperature Due to Transportation Temperature

Transportation Temperature	< 60°F		60 - 69°F		70 - 79°F		80 - 89°F		90 - 99°F		≥ 100°F	
Number of Samples	34		148		391		265		85		21	
Product Category	Mean (°F)		Mean (°F)		Mean (°F)		Mean (°F)		Mean (°F)		Mean (°F)	
	Δ Temp [†]	Temp at Home ^{††}	Δ Temp	Temp at Home	Δ Temp	Temp at Home	Δ Temp	Temp at Home	Δ Temp	Temp at Home	Δ Temp	Temp at Home
<i>Refrigerated</i>												
Dairy - Semi-solid	5.3	46.4	9.5	45.8	10.7	50.8	10.3	51.1	11.3	52.9	14.8	56.6
Dairy - Liquid	5.6	45.7	9.2	49.0	9.4	49.7	9.4	50.6	11.0	52.6	13.4	55.7
Pre-packaged lunch meat	5.3	48.3	7.2	50.2	8.9	52.0	8.8	52.2	11.2	54.5	13.0	57.6
Deli counter meat	6.2	45.7	8.2	50.1	8.3	50.4	8.3	51.2	11.3	54.2	14.6	59.3
Pre-packaged deli	4.7	41.7	7.6	47.7	7.7	48.6	7.2	47.9	9.0	49.4	12.0	53.1
Fish counter	5.0	37.6	7.9	41.5	8.5	42.4	9.1	45.8	10.5	46.3	10.4	48.4
Fresh meat	4.0	41.2	7.1	45.9	6.8	45.5	6.3	45.6	8.6	48.3	8.2	47.5
<i>Frozen</i>												
Whipped topping	7.2	15.2	11.1	19.3	10.0	19.9	9.9	19.4	12.1	23.8	10.1	19.1
Ice cream	7.5	9.6	7.5	7.8	7.7	8.6	7.7	9.5	9.1	10.8	10.8	8.5
Frozen novelty	9.3	17.9	12.9	20.0	12.5	21.4	11.8	20.4	13.5	23.0	13.2	16.1

[†] The change in product temperature is the difference between removal of product from store display until placement in home refrigeration.

^{††} Product temperatures taken upon arrival home before placing products in home refrigeration.

Participant Home Location and Product Temperature Summary

Change in Product Temperature Due to Shoppers Area

Location of Shoppers Home	Urban		Suburban		Rural	
Number of Samples	305		502		159	
Shopping Trip Length						
Mean (h:mm)	0:58		1:00		1:09	
Standard Deviation	0:17		0:18		0:30	
Minimum (h:mm)	0:14		0:23		0:28	
Maximum (h:mm)	2:02		2:32		5:43	
Product Category						
<i>Refrigerated</i>	<i>Mean Δ Temp (°F)[†]</i>	<i>Mean Temp at Home (°F)^{††}</i>	<i>Mean Δ Temp (°F)</i>	<i>Mean Temp at Home (°F)</i>	<i>Mean Δ Temp (°F)</i>	<i>Mean Temp at Home (°F)</i>
Dairy - Semi-solid	9.5	50.5	10.4	50.5	10.6	50.9
Dairy - Liquid	8.9	50.3	9.6	49.8	9.5	50.0
Pre-packaged lunch meat	8.1	51.9	9.1	51.9	8.7	52.2
Deli counter meat	8.0	50.3	8.6	51.6	8.6	48.8
Pre-packaged deli	7.1	47.0	7.9	48.7	7.4	47.8
Fish counter	8.3	43.1	9.0	44.5	7.2	38.4
Fresh meat	6.3	45.4	6.9	45.8	6.2	45.1
<i>Frozen</i>						
Whipped topping	10.2	20.4	10.1	19.7	9.9	19.6
Ice cream	7.5	9.0	8.0	8.9	7.8	9.4
Frozen novelty	11.7	20.5	12.8	21.0	11.9	19.3

[†] The change in product temperature is the difference between removal of product from store display until placement in home refrigeration.

^{††} Product temperatures taken upon arrival home before placing products in home refrigeration.

Store Location and Product Temperature Summary

Retail Product Temperature Due to Area of Store

Location of Store	Urban	Suburban	Rural
Number of Stores	376	522	68
Product Category <i>Refrigerated</i>			
Dairy - Semi-solid, backroom	<i>(n = 210)</i>	<i>(n = 263)</i>	<i>(n = 35)</i>
Mean (°F)	37.9	38.0	36.5
Standard Deviation	4.78	5.51	5.42
Range (°F)	11 - 51	15 - 60	25 - 51
% > 45°F	4	5	3
Dairy - Semi-solid, display	<i>(n = 373)</i>	<i>(n = 519)</i>	<i>(n = 68)</i>
Mean (°F)	41.3	40.3	40.2
Standard Deviation	4.70	5.30	4.83
Range (°F)	29 - 61	22 - 70	28 - 53
% > 45°F	14	12	10
Dairy - Liquid	<i>(n = 376)</i>	<i>(n = 519)</i>	<i>(n = 68)</i>
Mean (°F)	41.6	40.6	40.0
Standard Deviation	5.12	5.15	5.29
Range (°F)	20 - 60	22 - 74	20 - 50
% > 45°F	17	14	15
Pre-packaged lunch meat	<i>(n = 372)</i>	<i>(n = 520)</i>	<i>(n = 68)</i>
Mean (°F)	44.4	43.1	43.1
Standard Deviation	6.16	6.03	6.48
Range (°F)	24 - 66	27 - 63	24 - 62
% > 45°F	37	33	24
Deli counter meat	<i>(n = 351)</i>	<i>(n = 501)</i>	<i>(n = 62)</i>
Mean (°F)	44.8	45.0	43.6
Standard Deviation	5.76	6.02	6.02
Range (°F)	24 - 64	27 - 62	25 - 60
% > 45°F	42	43	34
Pre-packaged deli	<i>(n = 355)</i>	<i>(n = 510)</i>	<i>(n = 63)</i>
Mean (°F)	42.6	42.1	42.4
Standard Deviation	5.65	5.29	6.92
Range (°F)	22 - 66	20 - 60	26 - 60
% > 45°F	26	23	29
Fish counter	<i>(n = 335)</i>	<i>(n = 461)</i>	<i>(n = 44)</i>
Mean (°F)	39.5	40.2	40.6
Standard Deviation	6.22	5.94	5.94
Range (°F)	14 - 69	26 - 70	30 - 55
% > 45°F	13	17	18

Store Location and Product Temperature Summary (cont'd)

Retail Product Temperature Due to Area of Store

Location of Store	Urban	Suburban	Rural
Number of Stores	376	522	68
Product Category <i>Refrigerated (cont'd)</i>			
Fresh meat	<i>(n = 374)</i>	<i>(n = 521)</i>	<i>(n = 68)</i>
Mean (°F)	39.4	39.0	39.0
Standard Deviation	5.14	4.88	6.03
Range (°F)	19 - 58	22 - 54	20 - 58
% > 45°F	10	8	10
<i>Frozen</i>			
Whipped topping, backroom	<i>(n = 192)</i>	<i>(n = 209)</i>	<i>(n = 35)</i>
Mean (°F)	9.2	8.5	4.7
Standard Deviation	12.23	10.20	11.96
Range (°F)	-32 - 45	-10 - 43	-18 - 40
Whipped topping, display	<i>(n = 373)</i>	<i>(n = 521)</i>	<i>(n = 67)</i>
Mean (°F)	10.4	9.3	11.1
Standard Deviation	10.36	9.97	9.85
Range (°F)	-25 - 43	-22 - 50	-8 - 45
Ice cream	<i>(n = 372)</i>	<i>(n = 517)</i>	<i>(n = 66)</i>
Mean (°F)	1.4	0.8	3.1
Standard Deviation	8.74	9.15	10.16
Range (°F)	-20 - 31	-28 - 36	-14 - 36
Frozen novelty	<i>(n = 355)</i>	<i>(n = 493)</i>	<i>(n = 63)</i>
Mean (°F)	9.4	8.3	9.7
Standard Deviation	12.62	12.68	12.50
Range (°F)	-18 - 44	-20 - 44	-18 - 42
Frozen entree	<i>(n = 353)</i>	<i>(n = 502)</i>	<i>(n = 59)</i>
Mean (°F)	15.2	14.9	14.9
Standard Deviation	11.46	11.19	14.06
Range (°F)	-10 - 50	-18 - 50	-10 - 41

95th Percentile Product Temperature Change by Household Location

Worst 5% Mean Change in Product Temperature by Shoppers Area

Location of Shoppers Home	Urban	Suburban	Rural
Product Category	Δ Temperature (°F) 95th Percentile	Δ Temperature (°F) 95th Percentile	Δ Temperature (°F) 95th Percentile
<i>Refrigerated</i>			
Dairy - Semi-solid	19	20	22
Dairy - Liquid	18	20	19
Pre-packaged lunch meat	18	19	19
Deli counter meat	18	20	20
Pre-packaged deli	18	18	18
Fish counter	20	22	19
Fresh meat	14	16	18
<i>Frozen</i>			
Whipped topping	24	26	25
Ice cream	19	20	20
Frozen novelty	28	30	31

Note: The change in product temperature is the difference between removal of product from store display until placement in home refrigeration.

Demographic Household Information

	Number of Households 964	Frequency (%)
Total Persons in Household		
Mean	3.1	
Standard Deviation	1.40	
Frequency Distribution of Total Persons in Household		
1 member	99	10
2 members	302	31
3 members	179	19
4 members	239	25
5 members	108	11
6 members	26	3
7 members	6	0.6
8 members	1	0.1
9 members	1	0.1
10 members	3	0.3
Total Children in Household		
Mean	1.1	
Standard Deviation	1.20	
Households with Children	536	56
Households without Children	428	44
Frequency Distribution of Total Children in Household		
0 children	429	44
1 child	183	19
2 children	222	23
3 children	99	10
4 children	23	2
5 children	8	0.8
6 children	1	0.1
Marital Status		
	<i>(n = 958)</i>	
Married	698	73
Single	260	27

Education and Income Demographics

	Number of Households	Frequency (%)
Highest Level of Education Completed	<i>(n = 955)</i>	
Grades 1-8	6	0.6
High School	298	31
College Degree	651	68
Household Annual Income (\$)	<i>(n = 931)</i>	
<15,000	50	5
15,000 - 29,999	114	12
30,000 - 44,999	190	20
45,000 - 59,999	170	18
60,000 - 74,999	162	17
≥75,000	245	26

Comparison to Previous Study

Backroom Store Refrigeration

Year	1989 Backroom Refrigeration	1999 Backroom Refrigeration
Product	3 oz. Semi-Solid	6 oz. Semi-Solid
Number of Samples	402	515
All Backroom Refrigeration		
Mean Product Temperature (°F)	39.5	37.9
Standard Deviation	7.8	5.29
Minimum (°F)	-2	11
Maximum (°F)	60	60
Percent above 45°F	16	4
Percent above 50°F	4	1
90th Percentile (°F)	48	43
95th Percentile (°F)	50	45
99th Percentile (°F)	54	51

Backroom Store Frozen Foods

Year	1989 Backroom Frozen Foods	1999 Backroom Frozen Foods
Product	8 oz. Whipped Topping	8 oz. Whipped Topping
Number of Samples	413	442
All Backroom Frozen Foods		
Mean Product Temperature (°F)	16.6	8.6
Standard Deviation	13.5	11.30
Minimum (°F)	-40	-32
Maximum (°F)	62	45
90th Percentile (°F)	34	22
95th Percentile (°F)	40	30
99th Percentile (°F)	50	43

Comparison to Previous Study

Home Refrigeration

Year	1989 Home Refrigeration	1999 Home Refrigeration
Product	3 oz. Semi-Solid	6 oz. Semi-Solid
Number of Samples	942	939
All Home Refrigeration		
Mean Product Temperature (°F)	42.8	39.2
Standard Deviation	6.1	4.78
Minimum (°F)	4	21
Maximum (°F)	66	70
Percent above 45°F	27	8
Percent above 50°F	8	2
90th Percentile (°F)	50	44
95th Percentile (°F)	53	47
99th Percentile (°F)	60	54

Home Frozen

Year	1989 Home Frozen Foods	1999 Home Frozen Foods
Product	8 oz. Whipped Topping	8 oz. Whipped Topping
Number of Samples	943	940
All Home Frozen Foods		
Mean Product Temperature (°F)	8.4	3.4
Standard Deviation	7.1	8.21
Minimum (°F)	-24	-20
Maximum (°F)	34	48
90th Percentile (°F)	18	12
95th Percentile (°F)	20	20
99th Percentile (°F)	32	32

Comparison to Previous Study

Dairy Product

Year	1989 Retail Display	1999 Retail Display	1999 Retail Display
Product	3 oz. Semi-Solid	6 oz. Semi-Solid	1 Quart Liquid
Number of Samples	961	972	975
All Dairy			
Mean Product Temperature (°F)	43.4	40.7	40.9
Standard Deviation	6.3	4.99	5.05
Minimum (°F)	4	22	20
Maximum (°F)	66	68	60
Percent above 45°F	31	13	15
Percent above 50°F	11	3	3
Mean Unpacking Home Temperature (°F)	52.7	51.1	50.5
Standard Deviation	6.6	6.38	6.46
90th Percentile (°F)	51	47	48
95th Percentile (°F)	55	50	50
99th Percentile (°F)	60	56	57

Pre-Packaged Lunch Meat Product

Year	1989 Retail Display	1999 Retail Display
Product	Hot Dog or Meat Product	Packaged Lunch Meat
Number of Samples	963	973
All Pre-Packaged Lunch Meat		
Mean Product Temperature (°F)	44.3	43.6
Standard Deviation	5.9	6.14
Minimum (°F)	20	24
Maximum (°F)	65	66
Percent above 45°F	36	34
Percent above 50°F	11	11
Mean Unpacking Home Temperature (°F)	52.2	52.4
Standard Deviation	6.5	6.57
90th Percentile (°F)	51	52
95th Percentile (°F)	56	55
99th Percentile (°F)	60	60

Comparison to Previous Study

Deli Counter Meat Product

Year	1989 Retail Display	1999 Retail Display
Product	Any Deli Meat	Any Deli Meat
Number of Samples	926	925
All Deli Counter Meat		
Mean Product Temperature (°F)	47.1	44.8
Standard Deviation	6.9	5.91
Minimum (°F)	14	24
Maximum (°F)	71	64
Percent above 45°F	56	42
Percent above 50°F	26	14
Mean Unpacking Home Temperature (°F)	54.0	53.9
Standard Deviation	6.8	7.16
90th Percentile (°F)	57	52
95th Percentile (°F)	60	56
99th Percentile (°F)	64	60

Fish Counter Product

Year	1989 Retail Display	1999 Retail Display
Product	Fish Fillet	Fish Fillet
Number of Samples	851	851
All Fish		
Mean Product Temperature (°F)	41.6	40.0
Standard Deviation	6.9	6.05
Minimum (°F)	0	14
Maximum (°F)	69	70
Percent above 45°F	23	15
Percent above 50°F	7	3
Mean Unpacking Home Temperature (°F)	49.9	49.9
Standard Deviation	7.5	7.76
90th Percentile (°F)	50	48
95th Percentile (°F)	52	50
99th Percentile (°F)	61	60

Comparison to Previous Study

Fresh Meat Product

Year	1989 Retail Display	1999 Retail Display
Product	Ground Beef or Any Meat 1" Thick	Ground Beef or Any Meat 1" Thick
Number of Samples	961	975
All Fresh Meat		
Mean Product Temperature (°F)	41.0	39.2
Standard Deviation	5.7	5.06
Minimum (°F)	15	19
Maximum (°F)	64	58
Percent above 45°F	18	9
Percent above 50°F	4	1
Mean Unpacking Home Temperature (°F)	46.7	45.9
Standard Deviation	6.3	5.89
90th Percentile (°F)	48	45
95th Percentile (°F)	50	48
99th Percentile (°F)	58	52

Comparison to Previous Study

Whipped Topping Product

Year	1989 Retail Display	1999 Retail Display
Product	8 oz. Whipped Topping	8 oz. Whipped Topping
Number of Samples	954	973
All Whipped Topping		
Mean Product Temperature (°F)	21.3	9.9
Standard Deviation	10.9	10.07
Minimum (°F)	-14	-25
Maximum (°F)	59	50
Mean Unpacking Home Temperature (°F)	30.9	19.9
Standard Deviation	12.1	10.09
90th Percentile (°F)	36	21
95th Percentile (°F)	40	29
99th Percentile (°F)	46	41

Ice Cream Product

Year	1989 Retail Display	1999 Retail Display
Product	Half Gallon or Quart Ice Cream	Half Gallon Ice Cream
Number of Samples	962	966
All Ice Cream		
Mean Product Temperature (°F)	4.2	1.1
Standard Deviation	8.6	8.96
Minimum (°F)	-40	-28
Maximum (°F)	45	36
Mean Unpacking Home Temperature (°F)	13.1	8.9
Standard Deviation	8.4	9.26
90th Percentile (°F)	14	13
95th Percentile (°F)	20	19
99th Percentile (°F)	32	30

Comparison to Previous Study

Frozen Novelty Product

Year	1989 Retail Display	1999 Retail Display
Product	Any Kind of Ice Cream Filled Bar	Novelty
Number of Samples	961	922
All Frozen Novelty		
Mean Product Temperature (°F)	9.7	8.7
Standard Deviation	10.8	12.53
Minimum (°F)	-26	-20
Maximum (°F)	50	44
Mean Unpacking Home Temperature (°F)	20.2	21.8
Standard Deviation	9.7	12.56
90th Percentile (°F)	24	28
95th Percentile (°F)	30	33
99th Percentile (°F)	40	42