AUDITS INTERNATIONAL/FDA

1999 U.S. Food Temperature Evaluation
Design and Summary Pages

Table of Contents

1999 U.S. Cold Temperature Evaluation Design and Study Summary

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 major 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. This project was designed to include the primary shoppers of over 1,000 households geographically dispersed across the country. Wherever possible auditors selected participants who shopped at different supermarkets, represented a broad range of income categories and were believed able to provide accurate and honest information.

Materials

Each participant was supplied with the following:

- a pre-calibrated thermometer
- verbal and written project instructions
- forms for recording the required information
- an expense advance for shopping

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

Participants Instructions

Specific participant instructions were kept to a minimum and covered (1) proper use of the thermometer, (2) specific products to be tested, (3) fees and (4) 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 where 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. The fact that they were participating in the program may have resulted in a more hasty than usual return home after shopping. This haste was probably countered by a slightly longer than usual amount of time spent in the market doing their normal shopping while collecting the required data.

Case Types & Products

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

Location	Case Type	Product	Primary Size
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 (air temperature)	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. In the frozen entrée case, a calibrated probe thermometer was placed between two packages of product to determine the 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 the shopping pattern, participants removed the product to be purchased, inserted the thermometer and recorded the time of day. Participants left the thermometer in the product until the temperature stabilized and then recorded the temperature on their paper form. Throughout this report, temperatures are of the specific product unless otherwise specified.

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 inordinate delays between removal of product from its display and re-refrigeration at home.

Home (24 hour) Temperatures - After 24 hours in home refrigerators, only one refrigerated product (Dairy Semi-Solid) was temped because all refrigerated products are stored in the same case at the consumers home. Only one frozen product was temped for the same reason.

Additional Data Collected

Participants answered questionnaires about how they got to and from the store, where the groceries were placed on the way home, 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.

The participants were also asked to record the final cooking temperature and name/main ingredient of any entrée they prepared during the week of the study. Upon completion of cooking and removal from heat, participants immediately recorded the finished cooking temperature with a calibrated probe thermometer.

Demographic data that was requested of the participants included: marital status, number of children and ages, number of people in household, highest level of education, and annual income.

Cooking Temperature Data

The participants were asked to record the final cooking temperature and name/main ingredient of any entrée they prepared during the week of the study. Upon completion of cooking and removal from heat, participants immediately recorded the finished cooking temperature with a calibrated probe thermometer. Seven percent of participants were interviewed upon completion of the study in order to gather data on actual performance. A brief summary of these results is as follows:

Where was the final cooking temperature taken?

Cooking Dish - 86% Serving Plate - 7% Dinner Plate - 7%

How long was it from the finished cooking decision until the temperature was taken?

Immediate - 56% 1 to 2 minutes - 37% 3 to 5 minutes - 5% >5 minutes - 2%

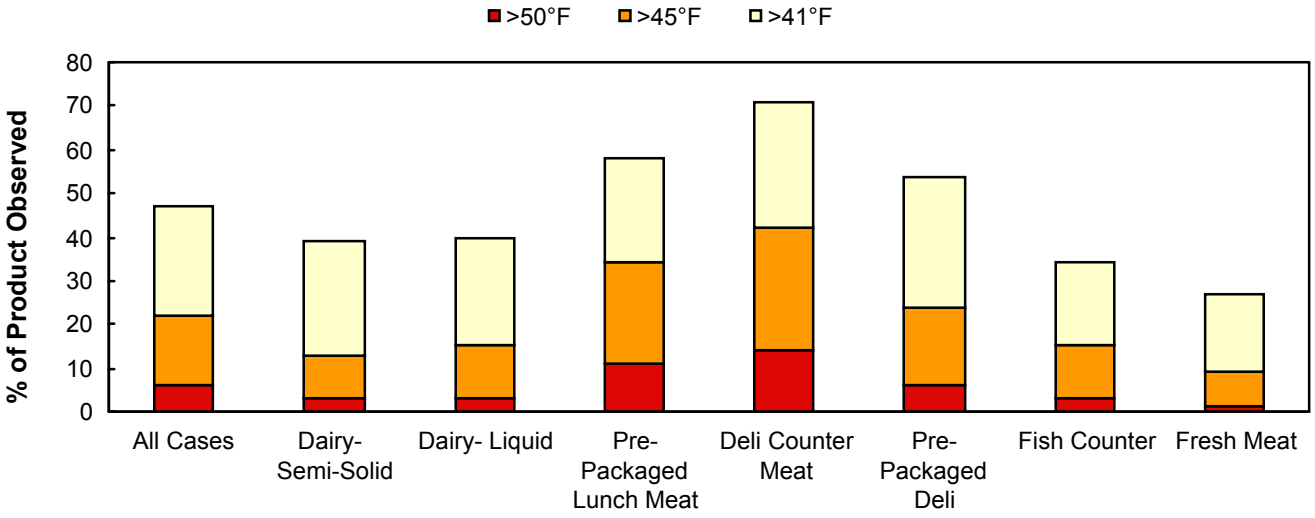
Data Validation

Respondent data were scrutinized on a case by case basis upon their return to Audits International. Questionable data suggesting severe undercooking were reviewed with the field participant. The temperature data for fewer than 10 entrees were deleted from the database. Deletion from the database occurred only when follow-up suggested broken equipment or inappropriate methodology as the cause of the low temperature.

Retail Refrigerator Product Temperatures

Location of Temperatures	All Cases	Dairy		Pre-Packaged Lunch Meat	Deli Counter Meat	Pre-Packaged Deli	Fish Counter	Fresh Meat
		Semi-Solid	Liquid					
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 (%)								
≤32°F	6	5	5	4	2	5	10	11
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

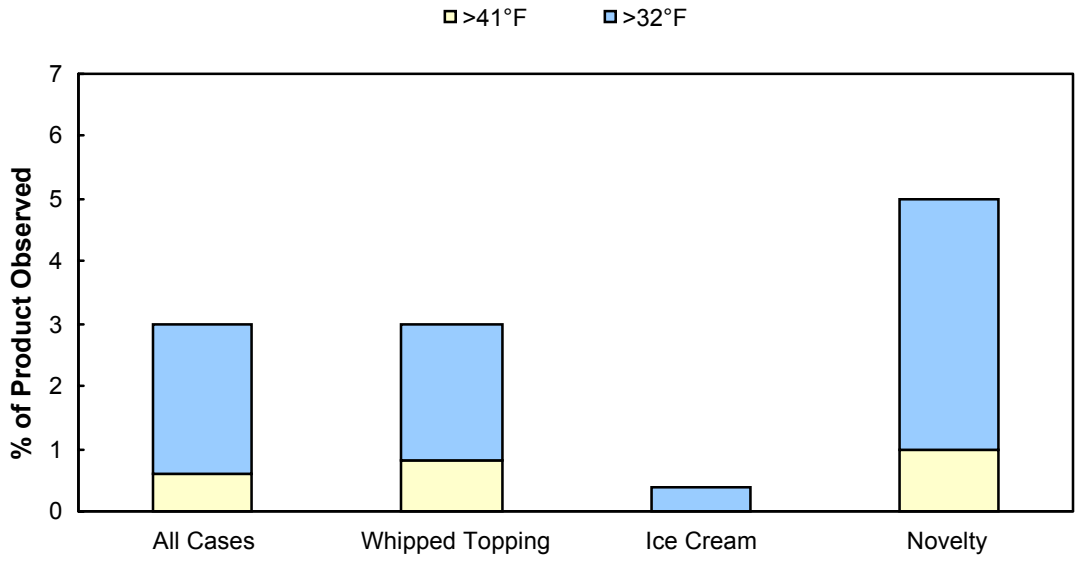
Percent of Product Observed Over 41°F, 45°F, and 50°F



Retail Freezer Product Temperatures

Location of Temperatures	All Cases	Whipped Topping	Ice Cream	Frozen Novelty
Mean (°F)	6.6	9.9	1.1	8.7
Standard Deviation	11.34	10.07	8.96	12.53
Minimum (°F)	-28	-25	-28	-20
Maximum (°F)	50	50	36	44
Product Temperature Frequency Distribution (%)				
≤-15°F	1	0.3	2	1
-14 to -10	4	0.6	8	3
-9 to -5	8	3	14	6
-4 to 0	25	16	34	23
1 - 5	17	17	17	17
6 - 10	17	24	12	14
11 - 15	8	13	5	7
16 - 20	11	16	5	11
21 - 25	3	3	0.8	5
26 - 30	4	4	2	5
31 - 35	1	1	0.2	3
36 - 40	2	1	0.2	3
≥41°F	0.7	1	0	1

Percent of Product Observed Over 32°F and 41°F



Retail Backroom Refrigerator and Freezer Summary

	Backroom Refrigerator	Backroom Freezer
Number of Samples	**515**	**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 (%)
≤32°F	13
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 Change in Product Temperature from Store to Home Based on Time Out of Refrigeration (°F)		
Mean Time Out of Refrigeration (h:mm)	1:05	0:51
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†

	Home Refrigerator	Home Freezer
Number of Samples	**939**	**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 (%)
≤32°F	9
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 Summary

Time Out of Refrigeration†

Product Category	(n =)	Mean (h:mm)	Standard Deviation (h:mm)	Range (h:mm)
Refrigerated				
Dairy- Semi-solid	*939*	1:05	0:25	0:13 - 6:00
Dairy- Liquid	*943*	1:04	0:25	0:11 - 5:45
Pre-packaged lunch meat	*961*	1:09	0:27	0:12 - 5:21
Deli counter meat	*895*	1:06	0:28	0:15 - 5:45
Pre-packaged deli	*909*	1:05	0:27	0:10 - 5:27
Fish counter	*825*	1:05	0:27	0:11 - 6:00
Fresh meat	*943*	1:04	0:26	0:13 - 6:20
Frozen				
Whipped topping	*941*	0:57	0:25	0:10 - 5:45
Ice cream	*935*	0:48	0:22	0:10 - 5:05
Frozen novelty	*895*	0:48	0:20	0:08 - 2:26*

† 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

Home Cooking Temperature Summary

Product	Ground Beef	Beef, Pork, Lamb	Poultry	Fish	Starch Dairy Protein	Vege-tables	Pre-Cooked Foods	Left-Overs
Number of Samples	**594**	**584**	**570**	**201**	**738**	**95**	**288**	**317**
Mean (°F)	155.9	154.7	158.6	151.3	152.6	153.5	148.2	144.4
Standard Deviation	20.4	20.94	20.58	18.7	23.8	22.8	24.7	23.9
Minimum (°F)	100	100	100	104	92	100	96	80
Maximum (°F)	208	220	240	196	220	190	206	200
% Under Specification†	43	33	55	38	35	25	34	78
Cooking Temperature Frequency Distribution (%)								
<100°F	0	0	0	0	1.5	0	1.7	2.2
100 - 109	1.7	1.2	0.7	1.5	2.7	3.2	2.8	4.7
110 - 119	2.9	3.8	3.3	3.5	5.8	6.3	8.7	10.1
120 - 129	6.2	8.2	4.6	6	8.0	6.3	12.8	10.1
130 - 139	8.8	8.9	8.8	13.9	9.5	9.5	7.6	11.7
140 - 149	16	15.1	11.2	20.9	11.1	13.7	18.1	16.4
150 - 159	13.6	13.2	14.6	13.4	15.0	15.8	9.4	12.6
160 - 169	21.4	19.2	20.5	22.4	16.1	11.6	11.1	15.8
170 - 179	13.5	14.9	18.8	9	12.5	14.7	14.9	6.6
180 - 189	13.5	13.0	13.9	8.5	15.4	17.9	10.1	8.2
190 - 199	2	1.2	2.8	1	1.5	1.1	1.4	0.6
≥200°F	0.5	0.7	0.9	0	0.8	0	1.4	0.9

† Cooked product temperature specifications are as follows: Ground Beef ≥155°F, Beef/Pork/Lamb ≥145°F, Poultry ≥165°F, Fish and Seafood ≥145°F, Starch/Dairy/other Protein ≥145°F, Vegetables ≥140°F, Commercially Pre-Cooked Foods ≥140°F, and Reheated Leftovers ≥165°F.

Note: Product temperatures were taken immediately upon removal from heat.

Distribution of Products Cooked Under and In Specification