



A Study of Consumer Handling Behaviors during Transport from Retail to Residence Utilizing an Electronic Questionnaire

Derek A. Griffing, Lisa A. Kriese-Anderson, M. Kim Mullenix, Luxin Wang, and Christy L. Bratcher*

Department of Animal Science, Auburn University, Auburn, Alabama, 36849, USA

*Corresponding author. Email: cbratcher@auburn.edu (C. L. Bratcher)

Abstract: A critical problem in the field of meat science is the lack of understanding of consumer handling practices during transport from retail to residence. The objective of this study was to investigate consumer behaviors regarding fresh beef product handling, specifically during the period of transport from retail to residence, utilizing an electronic questionnaire. A 13-item questionnaire utilizing the Qualtrics survey platform was distributed across the United States through web-based platforms. A 43 d response period generated 1,554 responses with 1,484 completed questionnaires yielding a 95.5% completion rate. The survey revealed 46.9% of respondents shop between 17:00 h and 20:59 h. Exactly 42.5% of respondents checkout between 11 and 20 min after fresh beef product selection and placement in cart. Upon check-out, 79.6% of respondents return home from the grocery store in 20 min or less. Fresh beef products are most commonly placed in either the rear seat/floor of the vehicle or the trunk/cargo space for transport. Of the 25.8% of respondents who ran errands with a fresh beef product left in the vehicle, 60.6% admitted to leaving the fresh beef product in the vehicle between 6 and 20 min. Approximately, 55.7% do not use an insulated container to transport fresh beef products. For respondents who did use an insulated container, a bag is most commonly used for temperature abuse protection during vehicular transport. The questionnaire revealed age, gender, ethnicity, and level of attained education influenced handling behavior in retail and during transport to residence ($P < 0.05$). Results indicate the need for continued dissemination of proper handling behaviors as well as scientific data to support the suggestions.

Keywords: consumer behavior, consumer survey, fresh meat handling, palatability, temperature

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Introduction

Unlike the controlled and highly regulated systematic steps in the production and handling of the fresh red meat product prior to purchase, a consumer's handling behavior cannot be regulated by an outside authority after the product has left the retail setting. The consumer cold chain is viewed as a time of temperature protection in combination with food safety, not palatability assurance (Yu et al., 2017; Balzan et al., 2014; Montanari, 2008; Raspor, 2008). Additionally, consumers do not understand the importance and meaning of the sequence of events that is the cold chain (Ovca and Jevsnik, 2009). Limited studies have assessed consumer handling behaviors during vehicular transport from retail food loca-

tions to residence. The majority of consumers will return home in 20 min or less; however, consumers will run additional errands with temperature dependent foods left in the vehicle; specifically, the trunk (Godwin and Coppings, 2005). Furthermore, Godwin and Coppings (2005) determined coolers are only used 7% of the time during transport. Although recommendations can be found, the subjective suggestions are vague and can be difficult for consumers to understand. General suggestions found in extension literature include the suggestion to purchase meat products before the sell by date to provide safe and nutritious food for consumers; select and pick-up refrigerated and frozen foods immediately prior to checkout since refrigerated foods should be cold, and frozen foods should be solid with no evidence

of thawing; drive straight home with perishables placed inside the vehicle and kept on ice; and keep meat out of the danger zone; specifically between the temperatures of 4.4°C and 60°C (American Meat Institute, 2018; USDA, 2018). Given the volatility of meat quality stability due to reactions with the extrinsic environment, a greater understanding of consumer handling behavior in retail locations and during transport to residence is needed to provide educators, industry, and ultimately consumers with greater knowledge of proper handling behaviors and consequent accountability. Collaboration between consumers and industry stakeholders is of great importance (Aschemann-Witzel et al., 2017). Ultimately, this awareness could lead to reduced food waste and prolonged sustainability in the meat industry. Therefore, the current study sought to investigate consumer behaviors regarding fresh beef product handling, specifically during the period of transport from retail to residence, utilizing an electronic questionnaire.

Materials and Methods

Survey instrument

An electronic questionnaire was prepared at Auburn University over a 5 month period from January to May, 2016, prior to distribution on August 3, 2016, utilizing the Qualtrics electronic survey platform (Qualtrics Experience Management Platform, Qualtrics, North America). The preliminary questionnaire development began with item creation and construct determination. The final electronic questionnaire produced items ($n = 9$) utilizing a selection item scale for nominal measurement with the constructs of time, product placement, and temperature protection. Respondent demographic questions ($n = 4$) addressed age, gender, ethnicity, and education.

Data collection and participants

The protocol entitled “The Consumer Cold Chain: Evaluation of Consumer Handling Behaviors on Fresh Red meat Products During Vehicular Transport from Retail to Residence and the Implications on Palatability and Food Safety” (Protocol # 16–245 EX 1607) was approved by the Institutional Research Board as “Exempt” under federal regulation 45 CFR 46.101(b)(2) on July 20, 2016. Participants received an information letter prior to response. The target population of the study was fresh beef consumers 19 yr of age or older since the project research objective was to evaluate the transport of fresh beef products and the subsequent impact on palatabil-

ity. Convenient sampling of survey participants was accomplished utilizing a social media platform (Facebook, Menlo Park, CA). An electronic link directed participants to the Qualtrics electronic questionnaire. No incentives were provided to participants for survey recruitment or completion. A 43 d response period (August 3, 2016 to September 15, 2016) was allotted for the study. A total of 1,554 responses were generated.

Analysis

Prior to analysis, the data was transposed to a spreadsheet file (Model Microsoft Excel; Microsoft, Redmond, WA), and evaluated for respondent error and incompleteness. A completion rate of 100% was required for responses to be included in the study and subject to data assessment. Responses ($n = 1,484$; given a completion rate of 100%) were analyzed using IBM SPSS Software v. 22 (International Business Machines Corp., Armonk, NY). Frequency and chi-square analyses were performed on the respondent data.

Results and Discussion

Respondent demographics

The demographic profile of consumers that responded to the questions regarding handling behaviors is shown in Table 1. Age levels ranged from 19 to 24 yr of age to 64 yr of age or older. In this study, 66.2% of consumer respondents were between 25 and 54 yr of age (Table 1). Furthermore, 76.7% of consumer respondents were female; and 23.3% of consumer respondents were male (Table 1). In this study, 95.5% of consumer respondents identified as Caucasian. Nonetheless, respondents identifying with Hispanic or Latino (1.8%), African American (0.3%), Native American or American Indian (0.9%), and Asian or Pacific Islander (0.5%) were included in the consumer study (Table 1). Education levels varied from non-high school graduate to attained college graduate degree. In this study, 75.9% of all consumer respondents had at least an associate's degree from a higher education establishment (Table 1).

Comparisons of demographic information were made to data collected by the United States Census Bureau. Demographic information gathered in the current study was comparable to demographics of age. Moreover, roughly three-fourths of United States' citizens identify as Caucasian and recent consumer-based literature by Corbin et al. (2015) showed similar ethnic demographics. The average level of education for consumers in the cur-

Table 1. Demographic profile of respondents in survey of consumer behavior during transport of fresh beef products¹

| Demographic characteristic | Number of consumers (N = 1,484) | Percentage, % |
|------------------------------|------------------------------------|------------------|
| Age | | |
| 19 to 24 years old | 189 | 12.7 |
| 25 to 34 years old | 406 | 27.4 |
| 35 to 44 years old | 303 | 20.4 |
| 45 to 54 years old | 273 | 18.4 |
| 55 to 64 years old | 211 | 14.2 |
| 64 or older years old | 102 | 6.9 |
| Gender | | |
| Male | 346 | 23.3 |
| Female | 1,138 | 76.7 |
| Ethnicity | | |
| Caucasian | 1417 | 95.5 |
| Hispanic or Latino | 27 | 1.8 |
| African American | 5 | 0.3 |
| Native American | 14 | 0.9 |
| Asian or Pacific Islander | 7 | 0.5 |
| Other | 14 | 0.9 |
| Attained Education | | |
| Less than high school degree | 3 | 0.2 |
| High school degree | 73 | 4.9 |
| Some college but no degree | 248 | 16.7 |
| Technical certificate | 34 | 2.3 |
| Associate degree | 110 | 7.4 |
| Bachelor degree | 537 | 36.2 |
| Graduate degree | 479 | 32.3 |

¹Results from electronic questionnaire distributed by web-based platforms.

rent study was greater than the average for consumers in the United States. Furthermore, this study had a greater percentage of female respondents when compared to the gender population of the United States, which is validated in the research stating that women are more likely to participate in surveys than men (Curtin et al., 2000; Moore and Tarnai, 2002; Singer et al., 2000).

Time

In this study, 78.0% of consumers indicated grocery shopping between the hours of 12:00 h and 20:59 h with the largest percentage of consumers (46.9%) shopping in the evening between the hours of 17:00 h and 20:59 h (Table 2). Exactly 83.2% of respondents said that they checked out in 20 min or less after fresh beef product selection and placement in cart with the greatest percentage of consumers (42.5%) checking out between 11 and 20 minutes (Table 3). Moreover, 2.3% of consumers admitted taking up to 60 min to check out after fresh beef product placement in cart

Table 2. Time of day grocery shopping occurs in survey of consumer behavior during transport of fresh beef products¹

| Time period | Number of consumers | Percentage |
|-----------------------------------|---------------------|------------|
| Morning (5:00 a.m. to 11:59 a.m.) | 298 | 20.1 |
| Afternoon (Noon to 4:59 p.m.) | 462 | 31.1 |
| Evening (5:00 p.m. to 8:59 p.m.) | 696 | 46.9 |
| Night (9:00 p.m. to 4:59 a.m.) | 28 | 1.9 |
| Total | 1,484 | 100.0 |

¹Results from electronic questionnaire distributed by web-based platforms.

(Table 3). Greater than three-fourths of consumer respondents returned to residence in 20 min or less on leaving the grocery store (Table 4). This finding is in agreement with work by Godwin and Coppings (2005) that revealed 82.0% of food shoppers return home in 20 min or less. This could be due to the relative abundance of retail food locations found in municipal environments across the United States. Importantly, the current study found it can take up to 120 min for consumers to return to residence. Approximately, 74.2% of consumer respondents claimed to 'never' run an errand with a fresh beef product left sitting in the vehicle (Table 5). The results from the present study disagree with Godwin and Coppings (2005) which concluded that 92.0% of consumers will go run other errands with

Table 3. Time upon fresh beef product placement in cart until checkout in survey of consumer behavior during transport of fresh beef products¹

| Time period | Number of consumers | Percentage |
|-------------------|---------------------|------------|
| 5 minutes or less | 133 | 9.0 |
| 6 to 10 minutes | 471 | 31.7 |
| 11 to 20 minutes | 630 | 42.5 |
| 21 to 30 minutes | 216 | 14.6 |
| 31 to 60 minutes | 34 | 2.3 |
| Total | 1,484 | 100.0 |

¹Results from electronic questionnaire distributed by web-based platforms.

Table 4. Time required returning to residence from the grocery store in survey of consumer behavior during transport of fresh beef products¹

| Time period | Number of consumers | Percentage |
|--------------------|---------------------|------------|
| 10 minutes or less | 697 | 47.0 |
| 11 to 20 minutes | 484 | 32.6 |
| 21 to 30 minutes | 211 | 14.2 |
| 31 to 59 minutes | 76 | 5.1 |
| 60 to 120 minutes | 16 | 1.1 |
| Total | 1,484 | 100.0 |

¹Results from electronic questionnaire distributed by web-based platforms.

food products left in the vehicle. Moreover, the current study found that while completing an errand, fresh beef products will most often be left in the unoccupied vehicle for a time period between 6 and 10 min (Table 6). Exactly 27.7% of consumer respondents admitted to leaving fresh beef products in an unoccupied vehicle for up to 20 min; whereas, 20.1% of respondents claimed to return to the vehicle in 5 min or less (Table 6). Godwin and Coppings (2005) reasoned that persons living farther from available retail food locations would consolidate their travel and visit more than one store even though this further increases the time during which the temperature of cold foods could increase.

Placement

Approximately 87.7% of consumer respondents indicated fresh beef products are most habitually placed in either the trunk or cargo space of the vehicle or the rear seat or floor, 45.4% versus 42.3%, respectively (Table 7). Furthermore, 11.5% of consumer respondents routinely placed fresh beef products in the front seat or floor of the vehicle (Table 7). Lastly, nearly 1% of consumer respondents admitted to placing fresh beef products in the bed of the pickup truck (Table 7). These results are in agreement with work by Godwin and

Coppings (2005), which stated 52% of consumers place purchased foods in the trunk or back of pickup.

Temperature protection

Approximately 55.7% of consumer respondents never use an insulated container to transport fresh beef products for temperature protection (Table 8). Only 8.2% of respondents always use an insulated container for temperature protection during transport (Table 8). In 2005, Godwin and Coppings found 7% of consumers routinely use a cooler; a mere 1.2% respective increase in 12 yr. In this study, 36.2% of respondents either frequently or occasionally used an insulated product during the vehicular transport of fresh beef products (Table 8). Exactly 72.8% of respondents, who practice temperature protection at least occasionally, revealed a cooler bag is most commonly used as the designated insulated product type (Table 9). Moreover, for consumers who use a cooler, the respective sizes of 14.8 quarts to 40.0 quarts were most readily used for temperature dependent fresh beef product protection, 22.4% accordingly.

Demographic influence on handling behaviors

The effects of demographic influence on fresh red meat handling behaviors during vehicular transport from retail to residence is displayed in Table 10. The

Table 5. Frequency of consumers running errands with fresh beef products left in vehicle in survey of consumer behavior during transport of fresh beef products¹

| Frequency | Number of consumers | Percentage |
|--------------|---------------------|------------|
| Always | 5 | 0.3 |
| Frequently | 19 | 1.3 |
| Occasionally | 359 | 24.2 |
| Never | 1,101 | 74.2 |
| Total | 1,484 | 100.0 |

¹Results from electronic questionnaire distributed by web-based platforms.

Table 6. Time fresh beef product is left in vehicle while completing an errand in survey of consumer behavior during transport of fresh beef products^{1,2}

| Time period | Number of consumers | Percentage |
|-------------------------|---------------------|------------|
| 5 minutes or less | 77 | 20.1 |
| 6 to 10 minutes | 126 | 32.9 |
| 11 to 20 minutes | 106 | 27.7 |
| 21 to 30 minutes | 56 | 14.6 |
| 31 to 60 minutes | 16 | 4.2 |
| Greater than 60 minutes | 2 | 0.5 |
| Total | 383 | 100.0 |

¹Excludes respondents who selected ‘Never’ in Table 5.

²Results from electronic questionnaire distributed by web-based platforms.

Table 7. Purchased fresh beef product placement in vehicle during transport in survey of consumer behavior during transport of fresh beef products¹

| Location | Number of consumers | Percentage |
|----------------------------------|---------------------|------------|
| Front (including seat and floor) | 170 | 11.5 |
| Rear (including seat and floor) | 627 | 42.3 |
| Trunk or Cargo Space | 674 | 45.4 |
| Bed of Pickup Truck | 13 | 0.8 |
| Total | 1,484 | 100.0 |

¹Results from electronic questionnaire distributed by web-based platforms.

Table 8. Use of an insulated container to transport fresh beef products in survey of consumer behavior during transport of fresh beef products¹

| Frequency | Number of consumers | Percentage |
|--------------|---------------------|------------|
| Always | 121 | 8.2 |
| Frequently | 190 | 12.8 |
| Occasionally | 347 | 23.4 |
| Never | 826 | 55.7 |
| Total | 1,484 | 100.0 |

¹Results from electronic questionnaire distributed by web-based platforms.

Table 9. Type of insulated container used to transport fresh beef products in vehicle in survey of consumer behavior during transport of fresh beef products^{1,2}

| Type | Number of consumers | Percentage |
|-----------------------------------|---------------------|------------|
| Insulated Bag | 479 | 72.8 |
| Personal Size (14.8 quart) Cooler | 67 | 10.2 |
| Medium (40 quart) Cooler | 80 | 12.2 |
| Large (70 quart) Cooler | 28 | 4.3 |
| Extra Large (100 quart) Cooler | 4 | 0.6 |
| Total | 658 | 100.0 |

¹Excludes respondents who selected 'Never' in Table 8.

²Results from electronic questionnaire distributed by web-based platforms.

Table 10. Demographic influence on fresh red meat handling behaviors during vehicular transport in survey of consumer behavior during transport of fresh beef products^{1,2}

| Demographic | Handling behavior | | |
|-------------|------------------------------------------------|----------------------|---------------------------|
| | Time prior to checkout and return to residence | Placement in vehicle | Insulated container usage |
| Age | * | * | * |
| Sex | * | * | * |
| Ethnicity | * | - | - |
| Education | * | - | - |

* $P < 0.05$.

¹Based on 1,484 responses.

²Results from electronic questionnaire distributed by web-based platforms.

questionnaire revealed age influenced the time of day grocery shopping occurred, time between fresh beef product selection and checkout, transport time from grocer to residence, fresh beef product placement in vehicle during transport, occurrence of running errands with a fresh beef products left sitting in vehicle, and the use and type of an insulated container to prevent temperature abuse ($P < 0.05$). A greater percentage of consumer respondents between 19 and 54 yr of age shop in the evening when compared to respondents 55 yr of age or older. Additionally, after fresh beef product selection and placement in cart or basket, respondents 65 yr of age or older check-out more rapidly when compared to all other age ranges present in this study. The largest percentage of respondents returning to residence in the least amount of time, 5 min or less, were between 19 and 24 yr of age, 56.1%, respectively. Alternatively, a greater percentage of individuals between 25 and 44 yr of age took up to 30 min to return to residence. Next, a greater percentage of consumer respondents between 19 and 24 yr of age place fresh beef products in the front or back seat and floor locations, whereas a greater percentage of respondents 25 yr of age or older place fresh beef prod-

ucts in the trunk or cargo space of the vehicle. Although the majority of all respondents, regardless of years of age, do not run other errands with fresh beef products in the vehicle; the greatest percentage consumers that identify as being between 25 and 44 yr of age. This could be due to time availability and household dynamics including careers and offspring. Lastly, the greatest percentage of respondents to use an insulated container for temperature abuse protection were 55 yr of age or older. Notably, nearly three-quarters of respondents identify to be between 19 and 24 yr of age never use an insulated container to protect fresh beef products from temperature abuse, nearly 20% greater than any other age group. The greatest percentage of all age groups used an insulated bag; however, if a cooler was used, consumer respondents between 25 and 64 yr of age used greater capacity sized coolers when compared to those between 19 to 24 yr of age. This could be due to the volume of purchased food product as whole due to household dynamics.

Gender influenced the time of day grocery shopping occurred, time between fresh product selection and checkout, fresh beef product placement in vehicle during transport, and the use and type of an insulated container to prevent temperature abuse ($P < 0.05$). This study revealed female consumers shop at all times of the day, take longer to check out given the fresh beef product has been placed in the cart or basket, are more likely to place the fresh beef product in the trunk or cargo space of the vehicle during transport, and are more likely to use an insulated container for temperature protection, and the choice of the container is an insulated bag. In contrast, male consumers favor shopping in the evening, check-out more rapidly, place the fresh beef product in the back floor or seat of the vehicle during transport, and are less likely to use an insulated container to prevent temperature abuse; but if they were going to use something to protect the temperature of a product, it would be a cooler.

Ethnicity influenced the time between fresh beef product selection and checkout out in addition to the occurrence and period of time running errands with a fresh beef product left sitting in the vehicle ($P < 0.05$). The study found consumer respondents identifying as Native American or American Indian ethnicity had the lowest duration of time between selection and checkout followed by both Caucasian and Hispanic/Latino ethnicities, 6 to 10 min versus 11 to 20 min, respectively. Furthermore, the greatest percentage of consumer respondents identifying as African American or Asian/Pacific Islander ethnicities indicated a 21 to 30 min time period from selection to checkout. Compared to all other ethnicities in this study, 75% of Caucasian consumer respondents immediately return to residence immedi-

ately after food shopping. Whereas, approximately 60% of African American respondents and 57.1% of Asian or Pacific Islander respondents would at least occasionally run other errands with fresh red meat products left sitting in the vehicle. Additionally, in this study, the greatest percentage of Caucasian or African American consumer respondents took between 6 and 10 min to complete the errand; while Asian or Pacific Islander consumer respondents took between 11 and 20 min.

The level of attained education influenced transport time from grocer to residence ($P < 0.05$). The greatest percentage of respondents with attained higher education degrees reported less time required from a retail food location to residence when compared to respondents with an attained high school degree or equivalent or less than a high school degree, 20 min versus up to 60 min, respectively. Retail food centers can be devoid in non-metropolitan areas leading to increased transport times for these consumers due to economic reasons since metropolitan areas produce a higher median household income and have substantially lower poverty rates (\$58,260 vs. \$44,212 and 14.3 vs. 17.2% poverty rate, respectively; USDA-ERS, 2017).

Conclusions

Consumers do not protect fresh beef products from temperature abuse during vehicular transport from retail to residence as frequently as they should. In 12 years, the habitual use of an insulated container to protect temperature dependent foods has increased from 7.0 to 8.2%, a respective increase of only 1.2%. Regardless of increased consumer awareness to food from farm to plate, the study revealed there is still 91.8% chance fresh red meat could be transported without temperature protection. This is concerning as this period of time is a small portion of the consumer cold chain. Additionally, the present study found consumers will continue shopping in a retail food location up to an hour with a fresh beef product left sitting in the cart or basket. Upon checkout, most consumers will place a fresh beef product in the rear seat and floor or trunk or cargo space of the vehicle. Furthermore, 25.8% of consumers will run additional errands with fresh beef products left sitting in the vehicle for greater than 60 min. An insulated bag is most commonly used for temperature abuse protection. Notably, the questionnaire revealed age, gender, ethnicity, and attained education directly influenced fresh beef handling behavior in a retail food location and during vehicular transport to residence ($P < 0.05$). Therefore, the results indicate the

continued need for impactful consumer outreach and direct research of handling behaviors for meat.

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