



## Labeling Terms and Production Claims Influence Consumers' Palatability Perceptions of Ground Beef<sup>1</sup>

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**ABSTRACT:** The objective of this study was to evaluate consumers' palatability ratings of ground beef from the same source when provided information about the labeling prior to evaluation. Chubs ( $n = 15$ ) from the same production lot and day of 80% lean/20% fat ground beef were procured and fabricated into 151.2 g patties. Pairs of patties from each chub were randomly assigned to one consumer panel session and to 1 of 8 different labeling terms: all natural, animal raised without added antibiotics (WA), animal raised without added hormones (WH), fresh never frozen (FNF), grass-fed, locally sourced, premium quality, USDA organic (ORG), and a blank sample (NONE). Consumers ( $N = 105$ ) evaluated each sample on 0-to-100-point line scales for tenderness, juiciness, flavor liking, texture liking, overall liking, and purchasing intent and also evaluated each palatability trait as either acceptable or unacceptable. Prior to sample evaluation, the consumers were provided additional labeling information about the ground beef. Consumers found no differences ( $P > 0.05$ ) among the samples with the different labeling terms for tenderness, juiciness, texture liking, overall liking, tenderness acceptability, flavor acceptability, and texture acceptability for all the treatments evaluated. For flavor liking, there was a larger increase ( $P < 0.05$ ) in ratings for samples labeled as grass-fed in comparison with WA, WH, and premium quality-labeled samples. There was a large increase ( $P < 0.05$ ) in the consumer ratings for overall liking when product was labeled as all natural, WA, WH, FNF, locally sourced, premium quality, and ORG. Additionally, there was a larger decrease ( $P < 0.05$ ) in the percentage of samples rated as acceptable overall when labeled as WA in comparison with all other treatments. These results indicate that adding production claims that consumers are familiar with can improve their palatability perception.

**Key words:** branding, ground beef, labeling, palatability, consumer, sensory

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## Introduction

Purchasing food products at retail no longer involves simply finding the single commodity that is needed. Consumers are increasingly presented with multiple products that fall under numerous brands and labels. The brands and labels are the main form of communication that consumers receive from a product at the time of purchase (Nocella et al., 2010). Numerous cues can be found on the labels of meat items in the retail case and on menus in foodservice, which vary in being both intrinsic and extrinsic to the product. Consumers mainly evaluate a product based on

the extrinsic cues available to them to assess quality, however, the cues they use vary based on the type of meat they are purchasing (Mellveen and Buchanan, 2001; Aboah and Lees, 2020). The most recent National Meat Case Study found only 4% of packages to be unbranded in the retail case, which changed from the 2010 study, which found 27% of packages to be unbranded (Kelly, 2016), further highlighting the increased branding and labeling of products currently used to attract consumers at the retail case.

The impact of production practices on the palatability of food products has been extensively studied (Napolitano et al., 2010; Kumpulainen et al., 2018;

Bir et al., 2020; Wemette et al., 2021). Several terms, including “organic” and “locally sourced,” have a perceived “halo” effect on food palatability traits, despite the lack of additional quality, taste, or nutritional benefits (Abrams et al., 2010; Bacig and Young, 2019; Gassler et al., 2019). Previous work with meat products has evaluated the impact of some of these cues on consumer eating perceptions. Ron et al. (2019) demonstrated that consumers are influenced in their perception of beef steak palatability when production practice and labeling information is known about the product prior to sample evaluation. Similarly, Wilfong et al. (2016a; 2016b) found consumers to be influenced by brand, fat level, and primal source when they were informed of the products’ attributes prior to testing. However, consumers in these studies evaluated products that represented the various production and quality traits evaluated, leaving the authors to only speculate as to how the impact of inherent quality differences among treatments impacted their results.

Consumer interest in a product is stimulated by the ability of a product to tell a story through its various attributes (Fenger et al., 2015). Although the greatest element for determining consumers’ preference is still taste, brand packaging also has a strong effect on the consumers’ eating experience (Méndez et al., 2011). Consequently, a greater understanding of the impact of labeling and branding on telling the story to the consumer and their subsequent eating experience must be evaluated. Therefore, the objective of this study was to evaluate the effect of providing information via different labeling terms on consumers’ palatability ratings of ground beef of an identical source.

## Materials and Methods

The Institutional Review Board of Kansas State University approved the procedures outlined in this study as project number 7440.7 (February 2, 2021).

### Ground beef preparation

Due to the objective of this study assessing the impact of labeling and branding terms, the research team laid out an experimental design aimed at keeping the product quality the same and changing only the labeling terms provided to the consumers. Treatment allotment was designed so that each consumer would be sampling 9 different samples that corresponded to a different labeling term even though the product quality and intrinsic attributes were identical. A single sample for each consumer was assigned no information so

that a basis of having no labeling information associated with a product could be established.

The 80% lean/20% fat ground beef chubs (4.54 kg) were acquired from the same production lot and production day from a commercial food purveyor. Chubs were shipped to the Kansas State University Meat Laboratory, Manhattan, Kansas, and stored under refrigeration at 0°C to 4°C before patty formation.

Eleven days after the date of manufacture, ground beef chubs ( $n = 15$ ) were formed into 151.2 g patties (approximately 13 cm diameter, 1 cm thick) using a Hollymatic patty former (Super Model 54 Food Portioning Unit, Countryside, IL). To keep patties as similar to one another as possible, chubs were randomly assigned to one single panel session. Patties were randomly labeled in the order in which they were formed, and patties were kept as pairs. Two pairs of patties were designated for instrumental tenderness testing and texture profile analysis (TPA). The remaining patties were designated and labeled for consumer sensory testing as follows: all natural, animal raised without added antibiotics (WA), animal raised without added hormones (WH), fresh never frozen (FNF), grass-fed, locally sourced, premium quality, USDA organic (ORG), and a blank sample (NONE). After fabrication, patties were crust frozen for approximately 30 min and then packaged on a rollstock type packaging machine (Model Bulldog 42a300, UltraSource, Kansas City, MO). All samples were stored frozen until analysis at  $-20^{\circ}\text{C}$ .

Instrumental tenderness testing for shear force was performed according to the procedures set by the American Meat Science Association (AMSA) for ground beef patties utilizing a straight edge blade (AMSA, 2016). TPA was done utilizing the procedures described by Bourne (1978).

### Consumer sensory evaluation

Prior to cooking for each panel, patties were thawed for 20 to 24 h at 2°C to 4°C. Cooking was conducted on Cuisinart Griddler Deluxe (East Windsor, NJ) clam-shell style grills that were set at 177°C. The peak temperature of 71°C was targeted and recorded using a Doric 205 (Beckman Industries, Newbury Park, CA) thermocouple-type thermometer inserted into the geometric center of the patties while cooking. Using a cutting guide, patties were sliced into 6 equally sized triangular pieces once they were cooked, placed on plates, and immediately served to consumers who were predetermined.

Recruitment for consumer panelists ( $n = 105$ ) took place in the Manhattan, Kansas, and surrounding areas.

All consumers were compensated monetarily for completing a full panel session. Consumers were fed in a lecture-style classroom on Kansas State University under normal fluorescent lighting in panel sessions that lasted approximately 1 h. Five different panel sessions consisting of 21 unique consumers were held. Each panelist was given a cup of water, apple juice, and unsalted crackers to use as palate cleansers in between each sample, along with a napkin, plastic fork, and empty expectorant cup. Consumers were informed and given verbal instructions about the evaluation procedures, palate cleansing, and digital survey use prior to evaluating any samples.

The labeling information associated with each treatment was provided to consumers prior to their evaluation of each sample. Information was displayed on a screen in the front of the classroom and said aloud to consumers as samples were being served. The feed order for each session was predetermined and in a randomized order. When consumers were served the NONE sample, a blank screen appeared, and they were informed they were eating a sample of ground beef with no other information provided about the sample. Consumers were asked to consider the additional labeling information as they were consuming the ground beef and utilize it in their evaluation of each sample.

Digital surveys (Qualtrics XM, Provo, UT) were preloaded onto electronic tablets (Lenovo TB-8505F, Hong Kong, China) for consumers to complete during their evaluation of samples. First, consumers were asked to voluntarily give some demographic information about themselves, which included information about their gender, marital status, household size, ethnicity, income, level of education, weekly ground beef consumption, their preferred degree of doneness when consuming ground beef, and the palatability trait most important to them when consuming ground beef. Next, a series of purchasing motivator questions were asked that had the consumer rate the importance of each trait on 0-to-100-point line scales verbally anchored at either ends with 0 = extremely unimportant and 100 = extremely important. As consumers evaluated the 9 different samples, they were asked to rate the tenderness, juiciness, flavor liking, texture, and overall liking as well as give their likeliness to purchase each sample. Ratings were recorded on 0-to-100-point line scales that were anchored at each end and at the center: 0 = extremely dry, tough, dislike flavor/texture/overall extremely, and extremely unlikely; 50 = neither juicy nor dry, neither tough nor tender, neither like nor dislike, and neither likely nor unlikely; and 100 = extremely juicy, tender,

like flavor/texture/overall extremely, and extremely likely. Finally, each trait was rated as either acceptable or unacceptable by consumers.

### ***Change in rating determination***

The change in palatability ratings as an impact of labeling was calculated for each sample in order to assess the changes in consumers' perceptions of the samples when information was provided. Change in palatability scores was calculated by subtracting the consumer's rating for the NONE sample from the rating for the labeled sample and dividing by the rating for the NONE sample and is presented as a percentage.

### ***Statistical analysis***

The statistical analysis software of SAS (SAS Institute Inc., Cary, NC) utilizing the PROC GLIMMIX procedure was used for all statistical analysis. An  $\alpha$  value of 0.05 was considered significant for the comparison of treatments. A completely randomized design was utilized with a Kenward-Roger adjustment for all analyses. Panel session was considered as a random effect for all sensory evaluation data. Additionally, a binomial error distribution was used for the consumer acceptability data model.

## **Results**

### ***Demographic characteristics and purchasing motivators***

Information about the demographics of participants can be found in Table 1. The gender of the 105 participants was split almost evenly, with women making up the majority (51.4%) of consumers. Most participants in the study were married (60.6%), Caucasian (87.5%), from a 2-person household (43.3%), and a college graduate (35.6%). Moreover, the majority of participants were over 30 years old, with 21.1% of the participants being 50 to 59 years old. More than half of the participants made greater than \$50,000 annually, and 12.7% made more than \$100,000. Flavor (68.3%) was identified by the majority of participants as being the most important palatability trait when they consumed ground beef, followed by tenderness (15.3%), juiciness (13.5%), and texture (2.9%). Additionally, most participants preferred their ground beef cooked to medium-rare (28.9%), medium (21.1%), or medium-well (27.9%) degree of doneness. Furthermore, 77.2%

**Table 1.** Demographic characteristics of consumers ( $N = 105$ ) who participated in ground beef consumer sensory panels when given additional labeling information

| Characteristic  | Response                      | Percentage of consumers |
|---|-------------------------------|-------------------------|
| <b>Gender</b>   | Male                          | 48.6                    |
|   | Female                        | 51.4                    |
| <b>Household size</b>   | 1 person                      | 20.2                    |
|   | 2 people                      | 43.3                    |
|   | 3 people                      | 20.1                    |
|   | 4 people                      | 4.8                     |
|   | 5 people                      | 4.8                     |
|   | 6 people                      | 5.8                     |
|   | Greater than 6 people         | 1.0                     |
| <b>Marital status</b>   | Married                       | 60.6                    |
|   | Single                        | 39.4                    |
| <b>Age</b>  | Under 20                      | 6.7                     |
|   | 20–29                         | 28.9                    |
|   | 30–39                         | 14.4                    |
|   | 40–49                         | 13.5                    |
|   | 50–59                         | 21.1                    |
|   | Over 60                       | 15.4                    |
| <b>Ethnic origin</b>  | African American              | 2.9                     |
|   | Caucasian/White               | 87.5                    |
|   | Hispanic                      | 6.7                     |
|   | Mixed race                    | 2.9                     |
| <b>Income</b>   | Under \$25,000                | 12.8                    |
|   | \$25,000–\$34,999             | 10.8                    |
|   | \$35,000–\$49,999             | 17.6                    |
|   | \$50,000–\$74,999             | 15.7                    |
|   | \$75,000–\$99,999             | 13.7                    |
|   | \$100,000–\$149,999           | 16.7                    |
|   | \$150,000–\$199,999           | 8.8                     |
|   | Greater than \$199,999        | 3.9                     |
| <b>Education level</b>  | Non-high school graduate      | 2.9                     |
|   | High school graduate          | 19.2                    |
|   | Some college/technical school | 24.0                    |
|   | College graduate              | 35.6                    |
|   | Post-college graduate         | 18.3                    |
| <b>Most important palatability trait when consuming ground beef</b> | Tenderness                    | 15.3                    |
|   | Juiciness                     | 13.5                    |
|   | Flavor                        | 68.3                    |
|   | Texture                       | 2.9                     |
| <b>Preferred degree of doneness when consuming ground beef</b>      | Rare                          | 1.0                     |
|   | Medium rare                   | 28.9                    |
|   | Medium                        | 21.1                    |
|   | Medium well                   | 27.9                    |
|   | Well done                     | 16.3                    |
| <b>Weekly ground beef consumption</b>                               | Very well done                | 4.8                     |
|   | 1 to 3 times                  | 77.2                    |
|   | 4 to 6 times                  | 18.8                    |
|   | 7 to 9 times                  | 2.0                     |
|   | 10 or more times              | 2.0                     |

of participants consumed ground beef 1 to 3 times per week.

Consumers were asked to rate the importance of 18 different traits considered when they purchase ground beef at retail (Table 2). Consumers rated “price” and “appearance – lean to fat ratio” similar ( $P > 0.05$ ) in importance to “fat content” and “color,” but more ( $P < 0.05$ ) important than all other traits evaluated. Moreover, “animal welfare” was rated as more ( $P < 0.05$ ) important than “fresh never frozen,” “animal not administered antibiotics,” “locally raised,” “growth promotant use in the animal,” “animal fed a grass-based diet,” “natural or organic claims,” and “animal fed a grain-based diet.” “Animal not administered antibiotics” was similar ( $P > 0.05$ ) in importance to “growth promotant use in the animal.” Additionally, “animal fed a grain-based diet,” “animal fed a grass-based diet,” and “natural or organic claims” were rated similar ( $P > 0.05$ ) in importance by consumers. Furthermore, “preformed patty” was similar ( $P > 0.05$ ) in importance to “brand of product” but less ( $P < 0.05$ ) important when compared with all other traits.

**Table 2.** Ground beef purchasing motivators<sup>1</sup> of consumers ( $N = 105$ ) who participated in ground beef consumer sensory panels when given additional labeling information

| Trait                                      | Importance          |
|--|---------------------|
| <b>Appearance – lean to fat ratio</b>      | 73.5 <sup>a</sup>   |
| <b>Price</b>                               | 73.5 <sup>a</sup>   |
| <b>Fat content</b>                         | 70.4 <sup>ab</sup>  |
| <b>Color</b>                               | 65.8 <sup>abc</sup> |
| <b>Animal welfare</b>                      | 64.0 <sup>bc</sup>  |
| <b>Size, weight, and thickness</b>         | 58.0 <sup>dc</sup>  |
| <b>Nutrient content</b>                    | 57.8 <sup>cd</sup>  |
| <b>Primal source</b>                       | 52.8 <sup>de</sup>  |
| <b>Fresh never frozen</b>                  | 46.5 <sup>ef</sup>  |
| <b>Animal not administered antibiotics</b> | 45.6 <sup>ef</sup>  |
| <b>Locally raised</b>                      | 45.2 <sup>ef</sup>  |
| <b>Growth promotant use in the animal</b>  | 42.9 <sup>f</sup>   |
| <b>Animal fed a grass-based diet</b>       | 40.9 <sup>fg</sup>  |
| <b>Natural or organic claims</b>           | 40.0 <sup>fg</sup>  |
| <b>Animal fed a grain-based diet</b>       | 39.0 <sup>fg</sup>  |
| <b>Packaging type</b>                      | 38.5 <sup>fg</sup>  |
| <b>Brand of product</b>                    | 33.3 <sup>gh</sup>  |
| <b>Preformed patty</b>                     | 28.8 <sup>h</sup>   |
| <b>SE<sup>2</sup></b>                      | 2.9                 |
| <b>P value</b>                             | <0.01               |

<sup>a–h</sup>Least-squares means lacking a common superscript differ ( $P < 0.05$ ).

<sup>1</sup>Purchasing motivators: 0 = extremely unimportant, 100 = extremely important.

<sup>2</sup>SE = (largest) of the least-squares means.

## Sensory evaluation

The means of the consumer ratings for the palatability traits can be found in Table 3. Few differences were found among the treatments for the palatability traits evaluated by consumers. When evaluating flavor liking, consumers rated locally sourced labeled ground beef higher ( $P < 0.05$ ) for flavor than WA, premium quality labeled samples, and NONE but similar ( $P > 0.05$ ) to all other treatments. Moreover, WA was rated lower ( $P < 0.05$ ) for flavor liking than all natural, grass-fed, locally sourced, and ORG labeled ground beef but similar ( $P > 0.05$ ) to all other treatments. There were no differences ( $P > 0.05$ ) in the consumer ratings for tenderness, juiciness, texture liking, and overall liking among all the treatments. Consumers were also asked to give their likelihood to purchase each of the samples. The NONE sample with no information provided was rated lower ( $P < 0.05$ ) for purchasing intent than all natural, grass-fed, locally sourced, and ORG-labeled products. Furthermore, WH was similar ( $P > 0.05$ ) to all other treatments for consumers intent to purchase.

To account for the changes in consumer ratings when information was provided, the change in consumer palatability traits was calculated [(consumer trait score – NONE score)/NONE score] and reported in Figure 1. For tenderness, increases ( $P < 0.05$ ) in tenderness ratings for all natural (25.0%), grass-fed (23.4%), and locally sourced (20.7%) labeled ground beef were observed when information was provided. Similar increases ( $P < 0.05$ ) were also found for

juiciness, in which ratings for WH (24.5%), grass-fed (23.0%), locally sourced (20.7%), premium quality (20.9%), and ORG (24.0%) labeled products increased when information was given to consumers. Grass-fed labeled samples had a larger ( $P < 0.05$ ) increase in flavor liking ratings when information was provided in comparison with WA, WH, and premium quality-labeled samples but had a similar ( $P > 0.05$ ) change in ratings as all natural, FNF, locally sourced, and ORG-labeled samples. Increases ( $P < 0.05$ ) for texture liking were found when consumers were informed that a product was labeled as all natural (30.6%), WH (44.0%), grass-fed (36.1%), and locally sourced (33.8%). Again, an increase ( $P < 0.05$ ) in overall liking ratings were observed for all natural (30.1%), WA (28.6%), WH (29.8%), FNF (39.0%), locally sourced (34.9%), premium quality (28.9%), and ORG (30.0%) when consumers were informed of the labeling information. Purchasing intent ratings also increased ( $P < 0.05$ ) for all terms except for premium quality when additional labeling information was provided.

## Palatability trait acceptability

Consumers were asked to rate each palatability trait as either acceptable or unacceptable during their evaluation of each sample of ground beef (Table 4). There were no differences ( $P > 0.05$ ) among treatments in the percentage of samples rated as acceptable for tenderness, flavor, and texture, with more than 70% of the samples rated as acceptable for each trait. For

**Table 3.** Consumer ( $N = 105$ ) palatability ratings<sup>1</sup> for ground beef patties when given additional labeling information

| Term <sup>2</sup>                       | Tenderness | Juiciness | Flavor liking        | Texture liking | Overall liking | Purchasing intent    |
|---|------------|-----------|----------------------|----------------|----------------|----------------------|
| All natural                             | 72.2       | 70.1      | 66.7 <sup>ab</sup>   | 67.8           | 67.0           | 66.0 <sup>a</sup>    |
| Animal raised without added antibiotics | 65.1       | 62.5      | 59.4 <sup>d</sup>    | 64.3           | 60.9           | 55.4 <sup>d</sup>    |
| Animal raised without added hormones    | 67.6       | 68.9      | 64.3 <sup>abcd</sup> | 66.5           | 65.3           | 61.6 <sup>abcd</sup> |
| Fresh never frozen                      | 67.3       | 71.0      | 64.1 <sup>abcd</sup> | 64.2           | 67.3           | 63.4 <sup>abc</sup>  |
| Grass-fed                               | 72.1       | 71.0      | 66.5 <sup>ab</sup>   | 69.0           | 69.0           | 65.9 <sup>a</sup>    |
| Locally sourced                         | 69.6       | 70.8      | 68.0 <sup>a</sup>    | 67.0           | 68.3           | 65.7 <sup>ab</sup>   |
| Premium quality                         | 68.5       | 71.5      | 60.9 <sup>cd</sup>   | 64.1           | 63.8           | 59.3 <sup>bcd</sup>  |
| USDA Organic                            | 70.3       | 70.9      | 65.9 <sup>abc</sup>  | 68.5           | 69.4           | 65.9 <sup>a</sup>    |
| NONE <sup>3</sup>                       | 66.5       | 67.2      | 62.0 <sup>bcd</sup>  | 63.2           | 62.8           | 58.6 <sup>cd</sup>   |
| SE <sup>4</sup>                         | 2.5        | 2.7       | 2.6                  | 2.3            | 2.9            | 3.2                  |
| <b>P value</b>                          | 0.14       | 0.18      | 0.03                 | 0.12           | 0.08           | <0.01                |

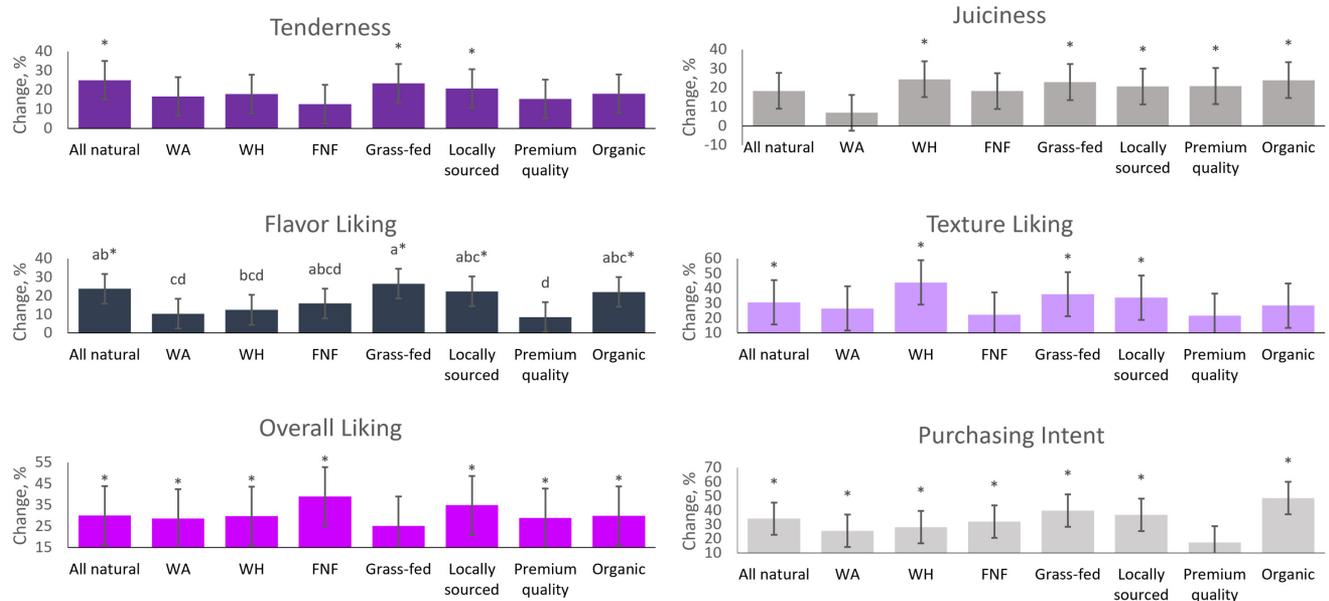
<sup>a-d</sup>Least-squares means within the same column lacking a common superscript differ ( $P < 0.05$ ).

<sup>1</sup>Sensory scores: 0 = not tender/juicy, dislike flavor/texture/overall extremely, or extremely unlikely to purchase; 50 = neither tender nor tough, juicy nor dry, neither like nor dislike flavor/texture/overall, or neither likely or unlikely; 100 = very tender/juicy, like flavor/texture/overall extremely, or extremely likely to purchase.

<sup>2</sup>Labeling terms and information provided to consumers prior to sample evaluation.

<sup>3</sup>NONE = no information was provided.

<sup>4</sup>SE = (largest) of the least-squares means.



**Figure 1.** Change in sensory scores due to labeling information disclosure prior to sample evaluation. FNF = fresh never frozen; WA = animal raised without added antibiotics; WH = animal raised without added hormones. <sup>abcd</sup>Least square means within the same trait lacking a common superscript differ ( $P < 0.05$ ). \*Mean differs from zero ( $P < 0.05$ ).

**Table 4.** Percentage of ground beef patties considered acceptable for tenderness, juiciness, flavor, texture, and overall liking by consumers ( $N = 105$ ) when given additional labeling information

| Term <sup>1</sup>                       | Tenderness acceptability | Juiciness acceptability | Flavor acceptability | Texture acceptability | Overall acceptability |
|---|--------------------------|-------------------------|----------------------|-----------------------|-----------------------|
| All natural                             | 96.0                     | 91.2 <sup>a</sup>       | 90.0                 | 93.9                  | 91.4 <sup>ab</sup>    |
| Animal raised without added antibiotics | 91.0                     | 80.1 <sup>b</sup>       | 78.9                 | 87.5                  | 74.5 <sup>c</sup>     |
| Animal raised without added hormones    | 90.0                     | 94.0 <sup>a</sup>       | 85.5                 | 90.3                  | 85.9 <sup>ab</sup>    |
| Fresh never frozen                      | 90.0                     | 91.3 <sup>a</sup>       | 84.6                 | 87.5                  | 90.5 <sup>ab</sup>    |
| Grass-fed                               | 96.0                     | 87.6 <sup>ab</sup>      | 88.2                 | 92.1                  | 89.6 <sup>ab</sup>    |
| Locally sourced                         | 95.2                     | 92.2 <sup>a</sup>       | 90.0                 | 92.1                  | 92.3 <sup>a</sup>     |
| Premium quality                         | 95.2                     | 93.1 <sup>a</sup>       | 86.4                 | 90.3                  | 91.4 <sup>ab</sup>    |
| USDA Organic                            | 93.5                     | 94.0 <sup>a</sup>       | 90.0                 | 94.8                  | 90.5 <sup>ab</sup>    |
| NONE <sup>2</sup>                       | 86.5                     | 88.6 <sup>ab</sup>      | 86.4                 | 83.8                  | 83.1 <sup>bc</sup>    |
| SE <sup>3</sup>                         | 3.9                      | 4.4                     | 4.9                  | 3.9                   | 5.0                   |
| <i>P</i> value                          | 0.08                     | 0.03                    | 0.33                 | 0.19                  | <0.01                 |

<sup>a-c</sup>Least-squares means within the same column lacking a common superscript differ ( $P < 0.05$ ).

<sup>1</sup>Labeling terms and information provided to consumers prior to sample evaluation.

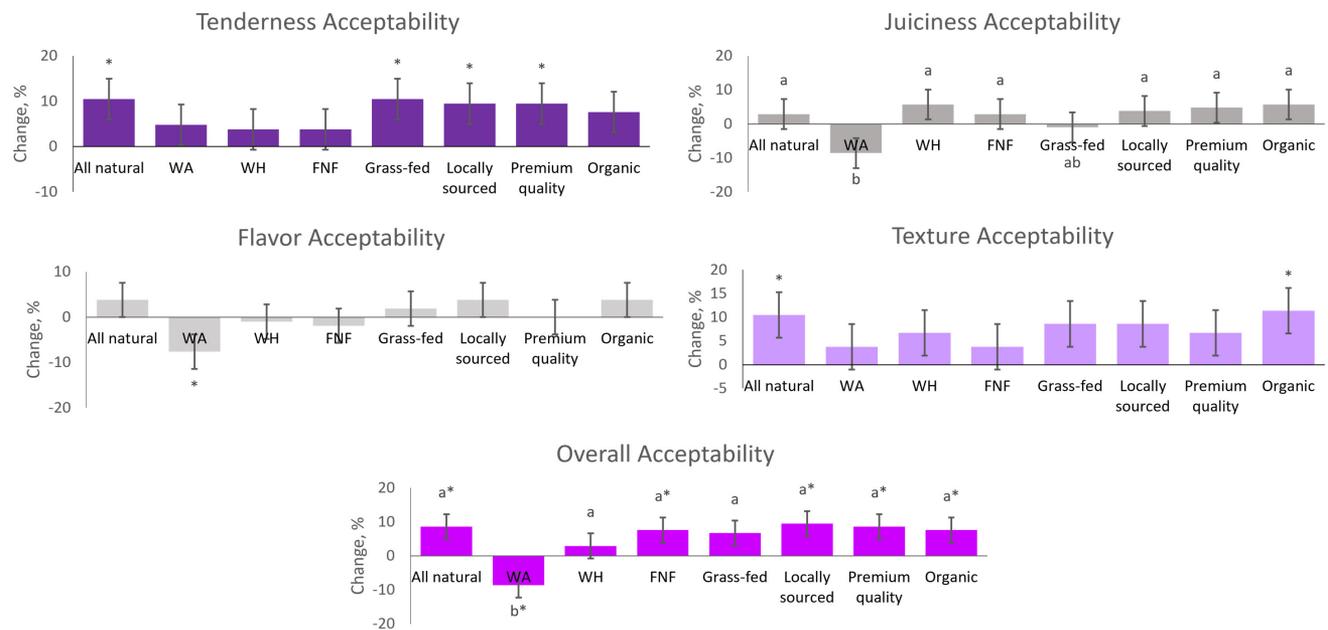
<sup>2</sup>NONE = no information was provided.

<sup>3</sup>SE = (largest) of the least-squares means.

juiciness acceptability, WA had a lower ( $P < 0.05$ ) percentage of samples rated as acceptable in comparison with all natural, WH, FNF, locally sourced, premium quality, and ORG-labeled products but was similar ( $P > 0.05$ ) to grass-fed and NONE. Furthermore, locally sourced labeled ground beef had a higher ( $P < 0.05$ ) percentage of samples rated as acceptable overall in comparison with NONE and WA but was

similar ( $P > 0.05$ ) to all other treatments. Also, WA had the lowest ( $P < 0.05$ ) percentage of samples rated as acceptable overall, being similar ( $P > 0.05$ ) only to NONE.

The change in acceptability ratings when information was provided versus the NONE sample was calculated and can be found in Figure 2. For tenderness, there was an increase ( $P < 0.05$ ) in the percentage of samples



**Figure 2.** Change in the percentage of samples rated as acceptable by consumers due to labeling information disclosure prior to sample evaluation. FNF = fresh never frozen; WA = animal raised without added antibiotics; WH = animal raised without added hormones. <sup>ab</sup>Least square means within the same trait lacking a common superscript differ ( $P < 0.05$ ). \*Mean differs from 0 ( $P < 0.05$ ).

rated as acceptable by consumers when ground beef was labeled as all natural (10.5%), grass-fed (10.5%), locally sourced (9.5%), and premium quality (9.5%). Conversely, there was a larger ( $P < 0.05$ ) decrease in the percentage of samples rated acceptable for juiciness when ground beef was labeled as WA in comparison with all other treatments. The same trend was observed for flavor acceptability, as labeling WA decreased ( $P < 0.05$ ) the percentage of samples rated as acceptable when the treatment information was disclosed. All natural and ORG labeling increased ( $P < 0.05$ ) the percentage of samples rated as acceptable for texture. Furthermore, the percentage of samples rated as acceptable overall increased ( $P < 0.05$ ) for all treatments when production information was disclosed, with the exception of WA, which decreased ( $P < 0.05$ ) in the percentage of samples rated as acceptable overall.

### Shear force and texture profile analysis

One sample from each chub of ground beef was utilized for shear force analysis and TPA to provide an objective measure of quality traits for the samples used in the study. An average shear force value of  $2.68 \pm 0.21$  kg of force was determined for the 15 chubs. For TPA, the averages  $\pm$  standard deviation were reported and are as follows: hardness =  $12.22 \pm 2.17$ ; cohesiveness =  $0.38 \pm 0.02$ ; gumminess =  $4.68 \pm 0.99$ ; springiness =  $72.58 \pm 3.25$ ; and chewiness =  $3.43 \pm 0.84$ .

## Discussion

Numerous intrinsic cues of a product are balanced with extrinsic cues related to labeling and branding strategies as consumers purchase food products at retail and foodservice (McIlveen and Buchanan, 2001). The main form of communication for meat products comes from cues found on the package and any additional marketing materials present at the time of purchase (Nocella et al., 2010). Increasing consumers' knowledge of a product is ultimately affected by the advertising of a brand or trait that is meant to stimulate interest in a product (Skipper et al., 1999). To increase consumer interest, a product needs to tell a story through the attributes that appeal to the more natural or authentic side (Fenger et al., 2015). In the current study, the utilization of terms that aid in telling the story of the product were selected based on ground beef labels currently found at retail. Furthermore, the most recent National Meat Case Study from 2015 reported only 4% of products are unbranded at the retail case, indicating the vast number of branding strategies used by companies (Kelly, 2016). The rise in popularity of branded products at retail has accordingly promoted an increase of information for consumers to evaluate.

Within the current study, labeling ground beef as locally sourced increased the consumers' ratings across the palatability traits evaluated. Undoubtedly, the global events of 2020 and 2021 have garnered much attention to locally sourced foodstuffs given challenges

within the supply chain and consumers eating more meals from home (Ijaz et al., 2021). The current study was conducted in the fall of 2020 at the height of the COVID-19 pandemic, in which shortages of staple food items were prevalent and many consumers turned to more local sources to find meat and produce items, undoubtedly impacting consumers' perceptions of this term. Previous research, although not involving meat specifically, found consumers of locally sourced food to view it as healthier, more nutritious, environmentally friendly, and more likely to be from an organic or natural origin (Bacig and Young, 2019). Numerous authors point to their being a perceived quality-enhancing "halo" around products that are locally sourced and thus increasing consumer liking of those products (Khachatryan et al., 2018; Kumpulainen et al., 2018; Bacig and Young, 2019). However, what is defined as local varies greatly by the region and the consumer (Martinez et al., 2010). Local is defined in some USDA programs as being a product that is less than 644 km from the origination of production; however, there is no official USDA designation for local (Tropp, 2015). For our study, the samples were only identified as being locally sourced with no further information given, leaving it to the consumer for interpretation of the meaning of "local." Furthermore, consumers in the current study identified "locally raised" as being similar in importance to several other animal production claims when asked to rank the importance of traits as they are purchasing ground beef at retail; however, locally sourced increased consumer ratings more so than other traits that were rated as higher in importance.

Labeling ground beef as from an animal raised without added antibiotics tended to have a negative perception and decreased the percentage of samples rated as acceptable for both flavor and overall. Within the literature, authors report varying reasons for consumers choosing to purchase products that are labeled as being antibiotic free (Bir et al., 2020; Wemette et al., 2021). Bir et al. (2020) found consumers willing to pay more for a USDA or industry-verified antibiotic-free product when purchasing cheese. Similarly, Wemette et al. (2021) found consumers had a conviction that animal antibiotic usage posed a risk to their health when they were purchasing milk from cattle raised with the usage of antibiotics. The Food Safety and Inspection Service (FSIS) arm of the USDA, which governs labeling, only has the authority to ensure labeling is truthful and accurate and does not have any authority over animal production claims (USDA-FSIS, 2019). Therefore, attaching a raised without added antibiotics claim can be done with minimal documentation and carries little

to no credence in some cases in which antibiotic usage is not permitted. Consumers in the present study were more concerned with animal welfare and antibiotic usage labeling than the other production claims evaluated in their initial assessment of the purchasing motivators. Yet, the traits they rated similar to or lower than the antibiotic usage trait had a larger perceived effect on the palatability traits evaluated when samples were assessed.

In the current study, labeling ground beef as grass-fed increased consumer palatability ratings for all traits except for overall liking. Previous studies evaluating grass-fed beef, when quality differences existed, have found many consumers to be varying in their opinion of the flavor and overall liking of grass-fed beef compared with conventionally raised beef (Najar-Villarreal et al., 2019; Ron et al., 2019). Ron et al. (2019) found increases in palatability ratings for grass-fed steaks in comparison with steaks from other production practices, including increases in overall liking due to the product being labeled as grass-fed. Najar-Villarreal et al. (2019) found differing results in a blinded study, with consumers having a greater dislike overall for grass-fed beef over conventional beef. Conversely, Ellison et al. (2017), when evaluating multiple production claims, found consumers to be less worried about grass-fed labeling compared with other production claims. FSIS governs the labeling of grass-fed products, which must be backed up by production records that maintain an animal must be fed only with grass or forage prior to slaughter (USDA-FSIS, 2019). Moreover, grass-fed beef products made up 44 million kg of beef sold at retail in 2020 out of the estimated annual total beef production of 12.4 billion kg, indicating the popularity of grass-fed products to US consumers (Beef Checkoff, 2021). Grass-fed beef tends to come with the perception of having health benefits that consumers are willing to pay a premium for (Umberger et al., 2009; Carabante et al., 2018). Within the current study, consumers also indicated an increased willingness to purchase grass-fed beef in comparison with the other treatments.

Often sorted into the same category as grass-fed by consumers are the labels of all natural and organic. In both cases, a clear definition for what a product must be for such labeling is well defined by the USDA-FSIS. For a product to be labeled as all natural, it cannot have any enhancements or processing beyond the natural state, except for grinding or separating of whole, intact products (USDA-FSIS, 2005). Conversely, to be labeled as USDA Organic, a product must be verified by a third-party auditor as following the organic

practices and regulations set forth by USDA in accordance with the Organic Foods Production Act of 1990 (USDA, 2021). In the current study, a similar effect for both all-natural and organic labeling was observed, with both having a large impact on consumer ratings. One possible explanation for this was reported by Abrams et al. (2010), who found many consumers consider many of the USDA organic standards in their perception of “all natural” and thus considered the all-natural label to be misleading. Two separate studies involving wine found consumers willing to pay a premium for natural and organically labeled wine (Galati et al., 2019; Gassler et al., 2019). Furthermore, Van Loo et al. (2010) found many consumers to view organic as being safer and healthier than a conventionally raised product. Dominick et al. (2018) found similar views from consumers evaluating all-natural labeling and reported a perceived healthy “halo” around all-natural labeling. Although separate in identity, consumers commonly confuse the meaning and perceptions behind natural and organic labeling, which may explain, in the case of our study, why consumers perceived the natural and organic-labeled product as being similar to one another.

Of the claims evaluated by consumers, premium quality is the only cue to not have a specification defined by FSIS (USDA-FSIS, 2020). In recent years, “premium quality” has been employed on package labels to attract consumer attention. Labels indicating a perceived quality level influence the consumer at the time of purchasing when multiple products of similar type are present (Meyerding et al., 2018). Therefore, attaching a statement such as “premium quality” is meant to attract a consumer looking for an item that has a higher quality cue attached. However, in the current study, consumers indicated they were less likely to purchase the premium quality product. Attaching the premium quality label to products allows for a large degree of interpretation by the consumer, and consumers who are not looking for an added level of quality might not receive a product marketed as such as well as those who are seeking an added level of quality. Thus, unlike many of the other labeling terms evaluated, our data indicate premium quality labeling may not be as impactful on consumers’ perceptions of eating quality.

FNF was 1 of 2 cues used that were intrinsic in nature to the product. In order to be labeled as fresh, a product must not have been exposed to temperatures below  $-2^{\circ}\text{C}$  and is not altered beyond the fresh state (USDA-FSIS, 2005). Labeling ground beef as FNF had an impact on the overall liking, purchasing intent,

and overall acceptability but otherwise was a term considered intermediate in impact. Limited research exists as to US-based consumers’ perception of frozen ground beef product, despite their being offerings of frozen ground beef patties commonly at retail. However, Chinese consumers who evaluated frozen versus fresh pork indicated they would discount frozen product for not being as fresh (Wang et al., 2018). In the US, the popularity of FNF branding has been largely used in foodservice chains but not as extensively in retail.

Studying the impact of branding and labeling on meat products and its subsequent effect on palatability has proven to be challenging and limited in quantity. Previous research evaluating the branding of beef products’ effects on palatability has been conducted on both steaks and ground beef (Wilfong et al., 2016a, 2016b; Ron et al., 2019). However, these studies were conducted in manners in which actual product differences existed, with the exception of Ron et al. (2019). Ron et al. (2019) did falsely inform consumers of the production practices utilized and found increases in consumer ratings of products of differing production claims despite there being no differences in product quality. Comparatively, within the current study, we also found increases in consumer ratings despite their being no differences in the ground beef being consumed. Overall liking and purchasing intent ratings were impacted the most due to labeling, indicating that the impact of labeling influences the overall perception of a product to a larger degree than the individual palatability traits. But in other studies, when evaluating chicken, Samant and Seo (2016) found consumers who had a higher label understanding had an increased perception of the tenderness, juiciness, and flavor of chicken breasts than those who had a low understanding of and trust in the labeling claims. Alternatively, Wilfong et al. (2016b) found an increase in ratings due to informing consumers of the production practice information (Certified Angus Beef) associated with the product being consumed. In that study, a “brand lift” was observed when attaching an additional brand and label to the products being evaluated (Wilfong et al., 2016b). However, the actual product quality differences in their study were present, and quantifying the amount of the increased ratings that were attributed directly to the brand disclosure itself is difficult. Our study did not disclose any brand names but did include terms that aided in telling the story of a product and consequently increasing the marketability of a product. A concern for all branding and marketing terms and the impact they have on consumer perception lies within the accuracy and truthfulness of the claims. Many of the evaluated claims in the current work are

regulated by USDA, whereas others are not. Consumers are often reliant upon truthfulness of claims in their assessment of product quality. It is thus paramount that marketing claims are accurate and not misleading to consumers in order to ensure consumer trust and regulatory compliance.

## Conclusions

Ultimately, labeling ground beef with various cues aids in telling the story of the product and creating product differentiation in the marketplace. Our study demonstrated that informing consumers of branding information creates a “brand lift,” despite there being no differences in product quality. Claims related to “local” and “grass-fed” were among the terms that had the greatest positive impact on palatability ratings. These results can help retailers and foodservice understand the impact that marketing terms have on beef palatability and can provide insight as to which terms will have the greatest impact on their consumers. Overall, adding production claims that the consumer is familiar with and values can lead to improved palatability perceptions.

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