Consumer Sensory Evaluation of Ground Beef and Plant-Based Ground Beef Alternatives Used in a Taco Application

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Abstract

The objective of this study was to evaluate consumer preferences for palatability traits and consumer acceptability of three plant-based protein alternatives and ground beef in a taco application. Three commercially available plant-based ground beef alternative (GBA) treatments (n = 20 production lots/treatment) were selected based upon industry availability. The GBAs were considered the most popular in the marketing sectors of foodservice (FGBA), retail (RGBA), and traditional (TGBA). One ground beef (80% lean/20% fat; 1.0-lb chubs) treatment was selected for use. After individual lots were cooked with taco seasoning, approximately 0.16-lb portions were served to panelists on a flour tortilla with the opportunity to add cheese, lettuce, and tomatoes to the samples. Consumers (n = 120) rated samples on a 100-point line scale for juiciness, tenderness, texture, flavor liking, beef-like flavor intensity, overall liking, and willingness to purchase. Additionally, consumers evaluated the sensory traits as acceptable or unacceptable. Furthermore, panelists identified a price of purchase for all samples as if purchasing a comparable product at a foodservice outlet. The GB treatment was preferred by consumers in nearly all categories. Consumer ratings for juiciness, texture, overall flavor liking, beef-like flavor intensity, and overall liking showed GB was higher ($P < 0.05$) compared to all three GBAs. However, GB, FGBA, and RGBA tenderness ratings were similar ($P > 0.05$), but all three rated higher ($P < 0.05$) than the TGBA. Moreover, GB, FGBA, and RGBA tenderness and juiciness were similar ($P > 0.05$) for the percentage of samples rated as acceptable by consumers, but all three had a higher ($P < 0.05$) percentage of samples rated acceptable than the TGBA. The GB treatment had a higher ($P < 0.05$) percentage of samples rated acceptable for texture, overall flavor liking, beef-like flavor intensity, and overall liking than all GBAs. Moreover, consumers rated GB higher ($P < 0.05$) for purchase intent than all GBAs and indicated they would be willing to pay a price nearly 50% higher ($P < 0.05$) for the GB than all the GBAs. Overall, GB was preferred by consumers when consumed as a crumbled product and GB should be marketed as a distinct eating experience at foodservice and retail when plant-based GBAs are available in similar crumbled products.

Introduction

The evolution of American consumer diet habits and growing concerns of environmental impacts from animal agricultural production is associated with the growth

of plant-based proteins market (Church, 2022). Plant-based protein processors have marketed traditionally toward vegetarian markets. They now have expanded the marketing plan to meat consumers who are environmentally conscious and incorporating modern diets that minimize meat consumption (Anonymous, 2021). Despite growing market popularity, there has been a gap of consumer research for consumption preferences among plant-based proteins and ground beef in practical usages, such as tacos and hamburgers (Anonymous, 2021). A recent consumer study conducted at Kansas State University directly compared ground beef and ground beef plant-based alternatives. Results showed consumers had a strong preference for ground beef (Davis et al., 2021). However, rarely do consumers consume ground beef or ground beef alternative products without the addition of toppings. Thus, the objective of this study was to evaluate consumer preferences for palatability traits and consumer acceptability of three plant-based protein alternatives and ground beef in a taco application.

Experimental Procedures

Three commercially available plant-based ground beef alternatives (GBA) treatments (n = 20 production lots/treatment) were selected based upon industry prevalence. The GBAs were identified as the most popular in the marketing sectors of foodservice (FGBA), retail (RGBA) and traditional (TGBA). One ground beef (80% lean/20% fat; 1-lb chubs) treatment (n = 20 production lots/treatment) was selected for use. All lots were purchased from multiple supermarkets in the Manhattan, KS, area over a four-month period. All samples were stored frozen at the Kansas State University Meat Laboratory in Manhattan, KS, for four months or less prior to consumer testing. Samples were thawed at 38°F for 24 hours prior to consumer panel analysis for identification and repackaging. Individual lots for GB and RGBA were unpackaged, hand mixed for 15 seconds, and immediately repackaged into 1-lb samples using a commercial rollstock packing machine (Model Bulldog 42a 300, Ultrasource, Kansas City, MO). The FGBA and TGBA treatments followed the same packaging procedure; however, two packages per production lot were combined from the same production lot to reach the 1-lb sample size.

Individual lots were crumbled in an Oster 12-in electric skillet (Boca Raton, FL) to a surface temperature of 180°F. Following cooking, a taco seasoning was added to the cooked treatments and allowed to simmer for 3 minutes following the manufacturer's instructions. Approximately 0.16-lb portions were served to panelists on a flour tortilla with the opportunity to add cheese, lettuce, and tomatoes to samples.

Consumer sensory panels (n = 20) were conducted at the Kansas State Meat Science Sensory Lab. Consumers (n = 120) rated samples on a 100-point continuous line scale for juiciness, tenderness, texture, flavor liking, beef-like flavor intensity, overall liking, and willingness to purchase. Line scales were anchored with descriptive terms at end and mid-points: 0 = extremely dry, tough, extremely dislike overall flavor/beef flavor/ texture/overall, and extremely unlikely to purchase; 50 = neither juicy nor dry, tough nor tender, neither like or dislike overall flavor/beef flavor/texture/overall, or neither likely or unlikely to purchase; and 100 = extremely juicy, tender, extremely like overall flavor/beef flavor/texture/overall, and extremely likely to purchase. Additionally, consumers evaluated the palatability traits as acceptable or unacceptable. Furthermore, panelists designated a price of purchase for all samples as if purchasing a comparable product at a foodservice outlet.

Results and Discussion

The GB treatment was preferred by consumers in nearly all categories (Table 1). Consumer ratings for juiciness, texture, overall flavor liking, beef-like flavor intensity, and overall liking showed GB was higher ($P < 0.05$) compared to all three GBAs. However, GB, FGBA, and RGBA tenderness ratings were similar ($P > 0.05$), but all three rated higher ($P < 0.05$) than the TGBA. Moreover, GB, FGBA, and RGBA tenderness and juiciness were rated similar ($P > 0.05$) for the percentage of samples rated as acceptable by consumers (Table 2), but all three had a higher ($P < 0.05$) percentage of samples rated acceptable than the TGBA. The GB treatment had a higher ($P < 0.05$) percentage of samples rated acceptable for texture, overall flavor liking, beef-like flavor intensity, and overall liking than all GBAs. Moreover, consumers rated GB higher ($P < 0.05$) for purchase intent and indicated they would be willing to pay a price nearly 50% higher ($P < 0.05$) for the GB than all the GBAs.

Implications

This research indicates consumers preferred ground beef to ground beef alternatives when used as a crumbled ingredient in tacos. Therefore, ground beef should be marketed as a distinct eating experience to consumers at foodservice and retail when plant-based ground beef alternatives are available in similar crumbled products.

References

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Table 1. Least squares means for consumer (n = 120) panel ratings for tacos made with ground beef and plant-based ground beef alternatives (GBA)[1]

Trait[2]	Ground beef	Foodservice GBA	Retail GBA	Traditional GBA	SEM[3]	P-value
Taco panels[4]						
Juiciness	74.3[a]	60.8[b]	66.6[b]	45.4[c]	2.4	< 0.01
Tenderness	68.6[a]	67.1[a]	65.4[a]	58.8[b]	2.2	< 0.01
Texture	70.9[a]	55.1[b]	53.7[b]	43.1[c]	2.9	< 0.01
Overall flavor	68.7[a]	51.3[b]	49.0[b]	36.0[c]	3.2	< 0.01
Beef flavor	68.3[a]	50.4[b]	46.4[b]	35.0[c]	3.1	< 0.01
Overall liking	69.7[a]	51.7[b]	47.4[b]	34.5[c]	3.3	< 0.01
Purchase intent[5]	63.7[a]	42.6[b]	39.6[b]	27.3[c]	3.4	< 0.01
Purchase price[6]	2.8[a]	1.9[b]	1.6[bc]	1.3[c]	0.2	< 0.01

[abc]Least squares means in the same row without a common superscript differ ($P < 0.05$).
[1]Foodservice GBA = plant-based ground beef alternative most commonly sold in foodservice establishments (restaurants).
Retail GBA = plant-based ground beef alternative most commonly sold in retail markets (grocery stores, supermarkets).
Traditional GBA = plant-based ground beef alternative most indicative of a traditional soy-based product.
[2]Sensory scores: 0 = extremely dry/tough, dislike texture/overall flavor/beef flavor/overall; 50 neither dry nor juicy/neither tough nor tender, neither like nor dislike texture/overall flavor/beef flavor/overall; 100 = extremely juicy/tender, like texture/overall flavor/beef flavor/overall
[3]Standard error (largest) of the least square means.
[4]Consumers were served samples seasoned with a taco seasoning blend on a flour tortilla with an option to add cheese, lettuce, and tomato to their taco samples.
[5]If price were not a factor, likelihood of purchase; 1 = Not Likely, 100 = Extremely Likely.
[6]Price, in U.S. dollars, willing to be paid at foodservice for comparable product.

Table 2. Least squares means for the percentage of ground beef and plant-based ground beef alternatives (GBA)[1] taco samples rated acceptable for each palatability trait by consumers (n = 120)

Trait	Ground beef	Foodservice GBA	Retail GBA	Traditional GBA	SEM[2]	P-value
Taco panels[3]						
Juiciness	94.1[a]	91.8[a]	90.3[a]	63.4[b]	5.4	< 0.01
Tenderness	98.0[a]	96.7[a]	96.7[a]	84.7[b]	4.2	< 0.01
Texture	94.6[a]	83.2[b]	76.5[bc]	67.7[c]	5.8	< 0.01
Overall flavor	94.2[a]	73.1[b]	62.6[b]	39.2[c]	5.6	< 0.01
Beef flavor	93.4[a]	71.2[b]	58.0[c]	41.9[d]	5.7	< 0.01
Overall liking	93.5[a]	71.5[b]	61.7[b]	46.4[c]	5.9	< 0.01

[abcd]Least squares means in the same row without a common superscript differ ($P < 0.05$).
[1]Foodservice GBA = plant-based ground beef alternative most commonly sold in foodservice establishments (restaurants).
Retail GBA = plant-based ground beef alternative most commonly sold in retail markets (grocery stores, supermarkets).
Traditional GBA = plant-based ground beef alternative most indicative of a traditional soy-based product.
[2]Standard error (largest) of the least square means.
[3]Consumers were served samples seasoned with a taco seasoning blend on a flour tortilla with an option to add cheese, lettuce, and tomato to their taco samples.