

2023

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

L. A. Egger

Kansas State University, lane11@ksu.edu

K. J. Farmer

Kansas State University, kjfarmer@ksu.edu

E. S. Beyer

Kansas State University, erbeyer@ksu.edu

See next page for additional authors

Follow this and additional works at: <https://newprairiepress.org/kaesrr>



Part of the [Beef Science Commons](#), and the [Meat Science Commons](#)

Recommended Citation

Egger, L. A.; Farmer, K. J.; Beyer, E. S.; Lybarger, K. R.; Vipham, J. L.; Zumbaugh, M. D.; Chao, M. D.; and O'Quinn, T. G. (2023) "Consumer Sensory Evaluation of Ground Beef and Plant-Based Ground Beef Alternatives Used in a Hamburger Application," *Kansas Agricultural Experiment Station Research Reports*: Vol. 9: Iss. 1. <https://doi.org/10.4148/2378-5977.8425>

This report is brought to you for free and open access by New Prairie Press. It has been accepted for inclusion in Kansas Agricultural Experiment Station Research Reports by an authorized administrator of New Prairie Press. Copyright 2023 Kansas State University Agricultural Experiment Station and Cooperative Extension Service. Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. K-State Research and Extension is an equal opportunity provider and employer.



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

Abstract

Objective: The objective of this study was to evaluate the palatability traits and consumer acceptance of three plant-based ground beef alternatives in comparison to ground beef in a foodservice-like hamburger application.

Study Description: Three popular plant-based ground beef alternatives (GBA) and 80% lean, 20% fat composition ground beef chubs (n = 20) were selected for consumer analysis. Samples were cooked to an internal temperature of 160°F, plated on a bun and served to consumers with the opportunity to apply ketchup, mustard, cheese, lettuce, and pickles. Consumers evaluated the differences in palatability traits and purchase intent for the samples identified as: Ground Beef, Foodservice GBA, Retail GBA, and Traditional GBA.

The Bottom Line: This research indicates the use of ground beef and ground beef alternatives provide different eating experiences when consumed as a complete hamburger and should be marketed as such by the foodservice and retail sectors.

Keywords

ground beef, ground beef alternatives, plant-based

Creative Commons License



This work is licensed under a [Creative Commons Attribution 4.0 License](https://creativecommons.org/licenses/by/4.0/).

Authors

L. A. Egger, K. J. Farmer, E. S. Beyer, K. R. Lybarger, J. L. Vipham, M. D. Zumbaugh, M. D. Chao, and T. G. O'Quinn

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

*L.A. Egger, K.J. Farmer, E.S. Beyer, K.R. Lybarger, J.L. Vipham,
M.D. Zumbaugh, M.D. Chao, and T.G. O'Quinn*

Abstract

The objective of this study was to evaluate the palatability traits and consumer acceptance of three plant-based ground beef alternatives in comparison to ground beef in a foodservice-like hamburger application. One ground beef (80% lean/20% fat; 1 lb chubs) and three commercially available plant-based ground beef alternative (GBA) treatments ($n = 20$ production lots/treatment) were formed into 2.5 oz patties to be served to consumers on a bun with an opportunity to apply ketchup, mustard, cheese, lettuce, and pickles to samples. The GBAs were selected as representatives of GBAs well-known to be sold at foodservice (FGBA) and retail (RGBA). In addition, a popular “traditional” soy-based patty (TGBA) on the market was selected for use. Consumers ($n = 120$) evaluated samples for juiciness, tenderness, texture, flavor liking, beef-like flavor intensity, overall liking, and willingness to purchase. Panelists rated each of the samples as acceptable or unacceptable for these sensory traits. Furthermore, panelists assigned a purchase price they would be willing to pay for each sample if purchasing a similar product at foodservice. Overall, GB was preferred by consumers compared to all three GBAs. The GB treatment rated higher ($P < 0.05$) for juiciness and texture compared to all GBAs. The GB, FGBA, and RGBA tenderness ratings were similar ($P > 0.05$), but all three rated higher ($P < 0.05$) than the TGBA. Consumer ratings for overall flavor liking, beef-like flavor intensity, and overall liking showed GB was higher ($P < 0.05$) compared to all three GBAs. However, GB and FGBA were similar ($P > 0.05$) for the percentage of samples rated acceptable by consumers for juiciness and texture, but both had a higher ($P < 0.05$) percentage rated acceptable for these traits than RGBA and TGBA. Similar to the consumer ratings, the percentage of samples rated acceptable for tenderness for GB, FGBA, and RGBA were similar ($P > 0.05$), but all three had a higher ($P < 0.05$) percentage rated acceptable than the TGBA. The GB treatment had a higher ($P < 0.05$) percentage of samples rated acceptable for 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 more than 50% higher ($P < 0.05$) for the GB than all the GBAs. Subsequently, this research shows the use of ground beef and ground beef alternatives provide different eating experiences when consumed as a complete hamburger and should be marketed as such by the foodservice and retail sectors.

Introduction

During the past decade, modern plant-based ground beef alternatives have grown in market share in food markets. A push for healthy, environmentally friendly food production has sparked consumer interest in the trend to use plant-based meat alternatives. While research has been completed comparing ground beef alternatives and ground beef directly, the research of these products in at-home or a foodservice environment is minimal (Davis et al., 2021). The addition of toppings is commonplace for American consumers in hamburger consumption and can affect palatability preferences among consumers. Thus, the objective of this study was to evaluate the palatability traits and consumer acceptance of three plant-based ground beef alternatives in comparison to ground beef in a foodservice-like hamburger application.

Experimental Procedures

One ground beef (80% lean, 20% fat; 1.0 lb chubs) and 3 commercially available plant-based ground beef alternative (GBA) treatments ($n = 20$ production lots/treatment) were purchased from five supermarkets in the Manhattan, KS, area over a 5-month period. The plant-based GBAs were selected as representatives of GBAs well-known to be sold at foodservice (FGBA) and retail (RGBA). In addition, a popular "traditional" soy-based patty (TGBA) on the market was selected for use. Ground beef (GB) and the 3 GBA packages were stored frozen at the Kansas State University Meat Laboratory in Manhattan, KS, for no more than 4 months prior to patty fabrication. All lots were formed into 2.5 oz patties to be served to consumers on a bun with an opportunity to apply ketchup, mustard, cheese, lettuce, and pickles to samples.

A total of 20 sensory panels were conducted at the Kansas State University Meat Science Sensory Lab. Consumers ($n = 120$) evaluated samples for juiciness, tenderness, texture, flavor liking, beef-like flavor intensity, and overall liking on 100-point continuous line scales anchored on both ends with descriptive terms. Panelists rated each of the samples as acceptable or unacceptable for each of the sensory traits. Furthermore, panelists rated each sample on their willingness to purchase on a 100-point continuous line scale, and assigned a purchase price they would be willing to pay for each sample if purchasing a similar product at foodservice.

Results and Discussion

Overall, GB was preferred by consumers compared to all three GBAs (Table 1). The GB treatment rated higher ($P < 0.05$) for juiciness and texture compared to all GBAs. The GB, FGBA, and RGBA tenderness ratings were similar ($P > 0.05$), but all three rated higher ($P < 0.05$) than the TGBA. Consumer ratings for overall flavor liking, beef-like flavor intensity, and overall liking showed GB was higher ($P < 0.05$) compared to all three GBAs. However, GB and FGBA were similar ($P > 0.05$) for the percentage of samples rated acceptable by consumers for juiciness and texture, but both had a higher ($P < 0.05$) percentage rated acceptable for these traits than RGBA and TGBA (Table 2). Similar to the consumer ratings, the percentage of samples rated acceptable for tenderness for GB, FGBA, and RGBA were similar ($P > 0.05$), but all three had a higher ($P < 0.05$) percentage rated acceptable than the TGBA. The GB treatment had a higher ($P < 0.05$) percentage of samples rated acceptable for 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 more than 50% higher ($P < 0.05$) for the GB than all the GBAs (Table 1).

Implications

This research indicates that when ground beef and ground beef alternatives are used as an ingredient to make products such as a hamburger patty, ground beef provided a different eating experience preferred by consumers. Therefore, the use of ground beef and ground beef alternatives provide different eating experiences when consumed as a complete hamburger and should be marketed as such by the foodservice and retail sectors.

References

Davis, S. G., K. M. Harr, K. J. Farmer, E. S. Beyer, S. B. Bigger, M. D. Chao, A. J. Tarpoff, D. U. Thomson, J. L. Vipham, M. D. Zumbaugh, and T. G. O'Quinn. 2021. Quality of Plant-Based Ground Beef Alternatives in Comparison with Ground Beef of Various Fat Levels. *Meat and Muscle Biology* 5(1): 38, p.1–15.

Table 1. Least squares means for consumer (n = 120) panel ratings for hamburgers 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
Hamburger panels ⁴						
Juiciness	66.4 ^a	55.3 ^b	53.5 ^b	39.1 ^c	2.2	< 0.01
Tenderness	64.7 ^a	61.4 ^a	62.6 ^a	48.8 ^b	2.1	< 0.01
Texture	64.6 ^a	55.0 ^b	50.0 ^b	40.5 ^c	2.3	< 0.01
Overall flavor	67.7 ^a	48.6 ^b	43.4 ^{bc}	37.4 ^c	2.5	< 0.01
Beef flavor	66.1 ^a	47.2 ^b	41.0 ^c	36.8 ^c	2.7	< 0.01
Overall liking	67.5 ^a	49.6 ^b	42.3 ^b	34.1 ^c	2.6	< 0.01
Purchase intent ⁵	63.3 ^a	42.2 ^b	34.5 ^c	28.3 ^c	2.7	< 0.01
Purchase price ⁶	4.8 ^a	3.2 ^b	2.7 ^{bc}	2.1 ^c	0.2	< 0.01

^{abc}Least squares means in the same row without a common superscript differ ($P < 0.05$).

¹Foodservice 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.

²Sensory 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.

³Standard error of the mean (largest) of the least square means.

⁴Consumers were served a hamburger patty on a white bun with an option to add cheese, ketchup, lettuce, mustard, and pickle to their hamburger samples.

⁵If price were not a factor, likelihood of purchase; 1 = Not Likely, 100 = Extremely Likely.

⁶Price, in US 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 hamburger samples rated acceptable for each palatability trait by consumers (n = 120)

Trait	Ground beef	Foodservice GBA	Retail GBA	Traditional GBA	SEM ²	P-value
Hamburger panels ³						
Juiciness	89.7 ^a	81.5 ^{ab}	79.0 ^b	50.0 ^c	5.1	< 0.01
Tenderness	93.4 ^a	92.5 ^a	86.7 ^a	70.1 ^b	4.3	< 0.01
Texture	86.7 ^a	82.5 ^{ab}	72.5 ^b	55.0 ^c	4.5	< 0.01
Overall flavor	90.9 ^a	67.6 ^b	50.8 ^c	45.0 ^c	4.6	< 0.01
Beef flavor	89.4 ^a	61.8 ^b	52.5 ^{bc}	39.9 ^c	4.8	< 0.01
Overall liking	90.2 ^a	69.4 ^b	49.2 ^c	49.9 ^c	4.8	< 0.01

^{abcd}Least squares means in the same row without a common superscript differ ($P < 0.05$).

¹Foodservice 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.

²Standard error of the means (largest) of the least square means.

³Consumers were served a hamburger patty on a white bun with an option to add cheese, ketchup, lettuce, mustard, and pickle to their hamburger samples.