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Influence of Message Theme on Consumer Perceptions of Lab Grown Meat

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Influence of Message Theme on Consumer Perceptions of Lab Grown Meat

Abstract

Lab grown meat is a new technology being developed as a potential alternative protein source. Although some research has been done about public perception of lab grown meat, no studies to date have observed the effects of message themes on public perception of lab grown meat. The study sought to better understand measures of uncertainty and risk and benefit perceptions after viewing a themed blog post about lab grown meat. Participants were randomly assigned one of three themed blog posts - against lab grown meat, neutral, or support lab grown meat. Perception questions were asked after viewing the blog post, and a total of 238 responses were collected. Results indicated the message theme had a statistically significant effect on risk perception, benefit perception, and intention to consume, but not on message evaluation or measures of uncertainty. Further discussion as well as suggestions for future research are included.

Keywords

Risk and benefit perceptions, Lab grown meat, Meltwater, Uncertainty perceptions

Cover Page Footnote/Acknowledgements

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Authors

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Introduction

In the upcoming years, the world population is expected to grow and as it does, the demand for meat as a protein source is expected to grow with it (Lee, 2018). In the United States alone, meat consumption rose 5% in 2015 (Wilks & Phillips, 2017). Scientists are looking outside the realm of traditional agriculture to solve the higher demand for animal protein sources while simultaneously lowering the environmental impacts present in agricultural production (Shapiro, 2018). Lab-grown meat, an innovation in cellular agriculture and food biotechnology, has been proposed as an alternative protein source. No single name has been settled upon for this new technology with a variety of descriptors used in the media and literature: cultured meat, *in vitro* meat, lab-grown meat, synthetic meat, artificial meat, and factory grown meat (Verbeke et al., 2015). For consistency and lack of confusion, *lab-grown meat* will be the term used throughout this study.

In their review of the literature surrounding public perceptions of lab-grown meat, Verbeke et al. (2015) found providing additional information about the benefits of lab-grown meat resulted in a greater willingness to try lab-grown meat as well as willingness to purchase lab-grown meat. Although the study indicated only a small number of consumers completely rejected the idea of trying lab-grown meat, there is no proof of how likely consumers will be to repeatedly buy or replace traditional meat (Verbeke et al., 2015). In a cross-country survey of consumer's perception of plant and lab-grown meat, consumers in India and China were more willing to consume lab-grown meat than consumer counterparts in the United States (Bryant et al., 2019). Of the consumers in all three surveyed countries, meat-eaters and omnivores were more likely to purchase lab-grown meat than pescatarians, vegetarians, or vegans. In the United States, political leaning to the left and those more familiar with lab-grown meat showed a higher intent to purchase given the scenario that it was on grocery store shelves (Bryant et al., 2019).

While new food technologies enable innovation, they are not always readily accepted by the public (Siegrist, 2008). Consumers often view new food technology with scrutiny due to the significance and essential nature of food in daily life (Lucht, 2015). Due to the importance of consumer acceptance on the success of new food products, consumer attitudes – including risk and benefit perceptions – should be evaluated at an early stage in the process of developing a new food technology (Siegrist, 2008). Several factors − price, environmental effect, and animal welfare – play into the public's perception of lab-grown meat. It remains unclear how consumers will accept this new technology (Verbeke et al., 2015) and there is a need to explore how messaging might influence perceptions of lab-grown meat.

Blogs as a scientific messaging source are viewed as a highly credible online medium after adjusting for politics and demographics (Johnson & Kaye, 2004). Kang (2009) suggested "credibility of a medium" has a strong association with future behavioral changes and outcomes (p. 22). Although there has been an influx of social media websites to provide a science dissemination role, Jarreau and Porter (2018) stated "science blogs remain an established source" of niche and specialty science information. (p. 163).

Conceptual Framework

The conceptual framework for this study was built on the concepts of risk and benefit perceptions and scientific uncertainty. We also acknowledge framing theory and how it can be used to develop message themes.

Risk and Benefit Perceptions

Risk is assessed by the formula that states risk is equal to hazard multiplied by exposure (Juanillo, 2001). Assessment of risk is essentially the process of answering the question: What is safe? In the context of risk communication, exposure – the amount of time and frequency exposed to a message – and the actual content of messages may impact risk perception (Binder et al., 2011). Binder et al. found increased exposure to a message amplified both benefit and risk perceptions. Discussion of the issue was shown to amplify risk, benefit, or neutrality positions rather than sway people closer to one side of the issue (Binder et al., 2011). The results of this study are significant because preexisting attitudes, whether a person assesses something as positive or negative, have been shown to affect behavior toward a new issue (Kim et al., 2014).

In regard to food technologies, consumers often see them as risky (Cavaliere & Ventura, 2017). This is magnified in the eyes of consumers as marketers portray the exact opposite of food technology with the label *all-natural* emphasized as the healthiest, most beneficial option when it comes to food (Biltekoff, 2010). Despite technology's role in keeping food safe and plentiful, there is an underlying connotation that things of nature or all-natural are inherently pure (Biltekoff, 2010).

In a literature review of risk and benefit perceptions of new food technologies, Ueland et al. (2011) found risks and benefits were inversely correlated; when benefit perception is high, risk tends to be low. Consumers tend to be more cautious rather than adventurous toward new food. Foods considered to be traditional and well-known tend to align with perceptions of benefits, while new or highly processed food tends to be associated with higher risk perception (Ueland et al., 2011).

Scientific Uncertainty

Scientific uncertainty is an element of incompleteness in regard to something in nature or something resulting in a dissonance regarding a scientific claim (Zehr, 2000). This is not always a negative thing, as it is often what pushes scientists to continue researching in order to address the uncertainty. However, this could pose an issue between the public and scientists as uncertainty can lead to mistrust of scientists among the public (Zehr, 2000).

Communicating scientific uncertainty is essential because all aspects of science contain some uncertainty (Fischhoff & Davis, 2014). If uncertainty is not communicated effectively, someone may put too much or too little faith into a technology and make an inaccurate decision regarding it. Scientific communication should uncover uncertainties and simplify uncertainties to a point where people can identify the best choice about a scientific innovation for themselves.

Uncertainty is present in risk information and may affect the impact risk information has when it reaches the public (Han et al., 2008). Han and colleagues found some people associated uncertainty with a greater risk perception, but some did not associate uncertainty with any heightened risk. Han et al. concluded uncertainty does matter to people, even if it has different effects on different people.

Framing Theory

The concept of framing in communication research was introduced in 1972, defined as "spatial and temporary bounding of set of interactive messages" (Bateson, 1972, p. 197). A frame is a central organizing theme that provides context and meaning to events (Gamson & Modigliani, 1987). Entman (1993) described framing as the processes of selecting and focusing on details of a topic and consistently communicating those aspects so that causations, judgements, and solutions for the described issue can be established. Previous studies (Bryant & Barnett, 2019; Bryant & Dillard, 2019; Sexton et al., 2019) have utilized framing similar to how themes are used in the current study.

Purpose/Research Questions

The purpose of this study was to examine the influence of themed messages on public perceptions of lab-grown meat. The following research questions guided the study.

1. What influence does the message theme of a blog post have on message evaluation and intention to share content about lab-grown meat?
2. What influence does the message theme of a blog post have on risk and benefit perceptions of lab-grown meat?
3. What influence does the message theme of a blog post have on perceptions of uncertainty regarding lab-grown meat?
4. What influence does the message theme of a blog post have on intention to consume?

Methods

In order to address the research questions of this study, a between-subjects experimental research design was used. The message stimuli evaluated in the experiment were in the form of blog posts, which were embedded in an online instrument. [University]'s Institutional Review Board approved the study prior to data collection.

Message Stimuli and Message Testing

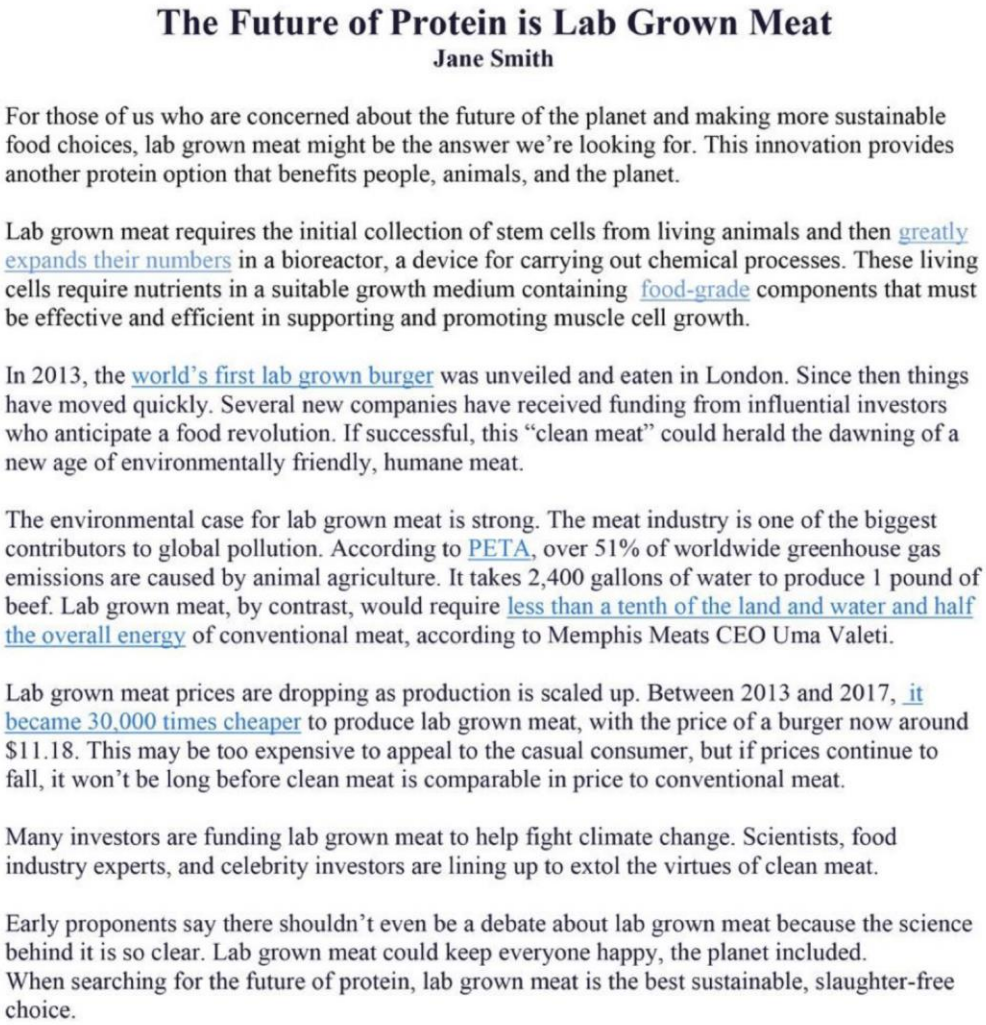
Three blog posts served as the message stimuli and were developed from online content found through Meltwater sentiment analysis and existing blog posts (Boykin et al., 2019). The three researcher-developed blog posts were designed to reflect the message themes toward lab-grown meat: *opposition, neutral,* and *support.* The blog post in support of lab-grown meat was adapted from Bloch (2019) and GrantTree (2018) and was edited to ensure a positive outlook. The neutral blog post was developed from Rabie's (2019) blog post and edited to ensure a neutral viewpoint of lab-grown meat. The blog post in opposition of lab-grown meat was adapted from Van Eenennaam (2018) and Condon's (2018) blog posts. Blog post stimuli all had the same credited author, and each had around 400 words.

Before launching the questionnaire with a nationally distributed sample, message testing was conducted to ensure the developed blog posts were distinct and reflected the desired message themes. Twenty-nine graduate students studying agricultural education and agricultural communications were sent a Qualtrics questionnaire with the blog posts. Participants were asked to read each randomly presented blog post and indicate if the overall message was in opposition,

neutral, or support lab-grown meat or whether they were unsure. Results indicated the themes of opposition and support were both identified easily. However, there was inconsistency in identifying the neutral theme. A sentence was added at the beginning of the neutral theme for clarity, and a smaller group of graduate students were presented the message again and deemed it appropriate for subsequent testing. Stimuli are shown in Figure 1, Figure 2, and Figure 3.

Figure 1

Blog Post Example Stimuli of Support Theme



The Future of Protein is Lab Grown Meat

Jane Smith

For those of us who are concerned about the future of the planet and making more sustainable food choices, lab grown meat might be the answer we're looking for. This innovation provides another protein option that benefits people, animals, and the planet.

Lab grown meat requires the initial collection of stem cells from living animals and then greatly expands their numbers in a bioreactor, a device for carrying out chemical processes. These living cells require nutrients in a suitable growth medium containing food-grade components that must be effective and efficient in supporting and promoting muscle cell growth.

In 2013, the world's first lab grown burger was unveiled and eaten in London. Since then things have moved quickly. Several new companies have received funding from influential investors who anticipate a food revolution. If successful, this "clean meat" could herald the dawning of a new age of environmentally friendly, humane meat.

The environmental case for lab grown meat is strong. The meat industry is one of the biggest contributors to global pollution. According to PETA, over 51% of worldwide greenhouse gas emissions are caused by animal agriculture. It takes 2,400 gallons of water to produce 1 pound of beef. Lab grown meat, by contrast, would require less than a tenth of the land and water and half the overall energy of conventional meat, according to Memphis Meats CEO Uma Valeti.

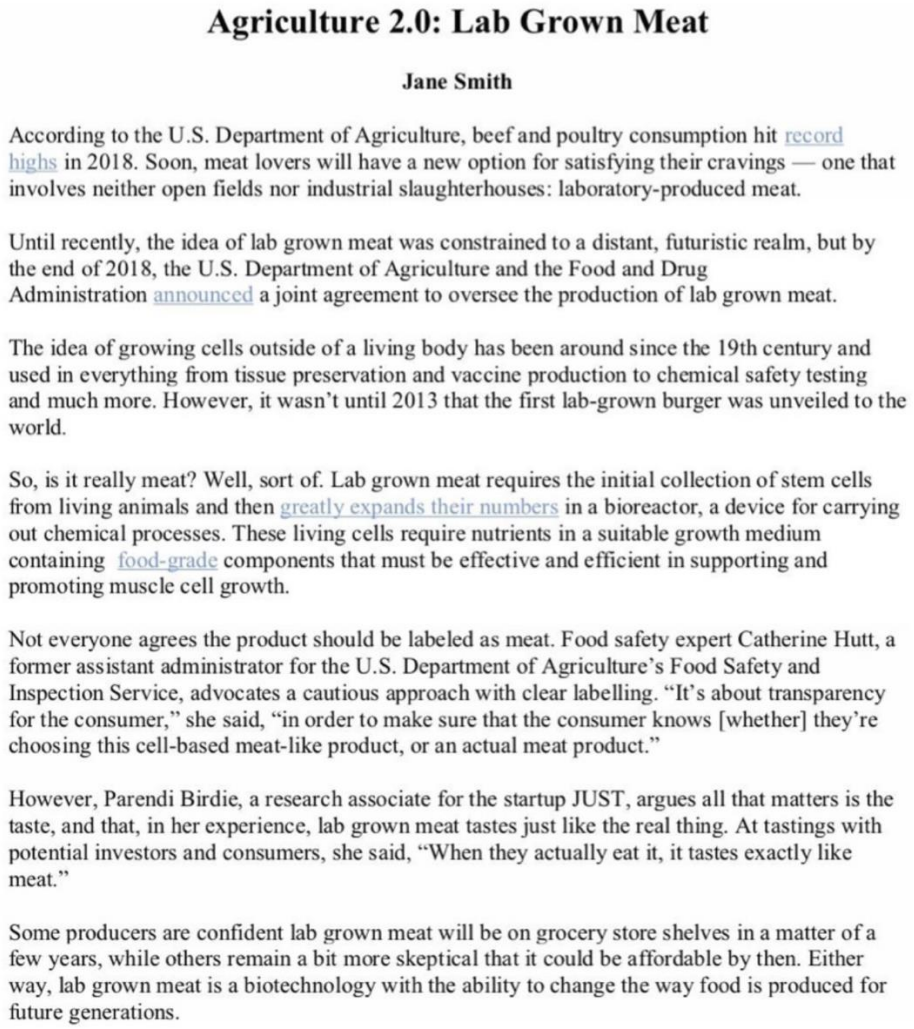
Lab grown meat prices are dropping as production is scaled up. Between 2013 and 2017, it became 30,000 times cheaper to produce lab grown meat, with the price of a burger now around $11.18. This may be too expensive to appeal to the casual consumer, but if prices continue to fall, it won't be long before clean meat is comparable in price to conventional meat.

Many investors are funding lab grown meat to help fight climate change. Scientists, food industry experts, and celebrity investors are lining up to extol the virtues of clean meat.

Early proponents say there shouldn't even be a debate about lab grown meat because the science behind it is so clear. Lab grown meat could keep everyone happy, the planet included.
When searching for the future of protein, lab grown meat is the best sustainable, slaughter-free choice.

Figure 2

Blog Post Example Stimuli of Neutral Theme



Agriculture 2.0: Lab Grown Meat

Jane Smith

According to the U.S. Department of Agriculture, beef and poultry consumption hit record highs in 2018. Soon, meat lovers will have a new option for satisfying their cravings — one that involves neither open fields nor industrial slaughterhouses: laboratory-produced meat.

Until recently, the idea of lab grown meat was constrained to a distant, futuristic realm, but by the end of 2018, the U.S. Department of Agriculture and the Food and Drug Administration announced a joint agreement to oversee the production of lab grown meat.

The idea of growing cells outside of a living body has been around since the 19th century and used in everything from tissue preservation and vaccine production to chemical safety testing and much more. However, it wasn't until 2013 that the first lab-grown burger was unveiled to the world.

So, is it really meat? Well, sort of. Lab grown meat requires the initial collection of stem cells from living animals and then greatly expands their numbers in a bioreactor, a device for carrying out chemical processes. These living cells require nutrients in a suitable growth medium containing food-grade components that must be effective and efficient in supporting and promoting muscle cell growth.

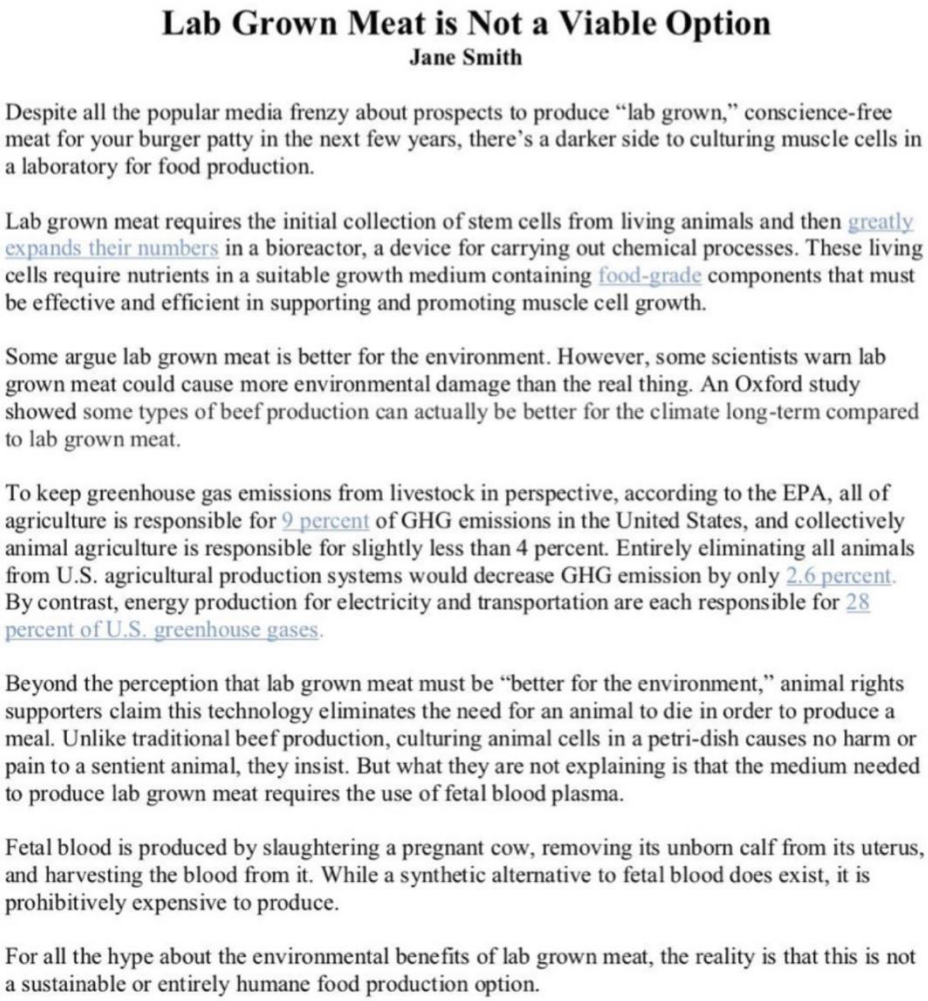
Not everyone agrees the product should be labeled as meat. Food safety expert Catherine Hutt, a former assistant administrator for the U.S. Department of Agriculture's Food Safety and Inspection Service, advocates a cautious approach with clear labelling. "It's about transparency for the consumer," she said, "in order to make sure that the consumer knows [whether] they're choosing this cell-based meat-like product, or an actual meat product."

However, Parendi Birdie, a research associate for the startup JUST, argues all that matters is the taste, and that, in her experience, lab grown meat tastes just like the real thing. At tastings with potential investors and consumers, she said, "When they actually eat it, it tastes exactly like meat."

Some producers are confident lab grown meat will be on grocery store shelves in a matter of a few years, while others remain a bit more skeptical that it could be affordable by then. Either way, lab grown meat is a biotechnology with the ability to change the way food is produced for future generations.

Figure 3

Blog Post Example Stimuli of Opposition Theme



Lab Grown Meat is Not a Viable Option

Jane Smith

Despite all the popular media frenzy about prospects to produce "lab grown," conscience-free meat for your burger patty in the next few years, there's a darker side to culturing muscle cells in a laboratory for food production.

Lab grown meat requires the initial collection of stem cells from living animals and then greatly expands their numbers in a bioreactor, a device for carrying out chemical processes. These living cells require nutrients in a suitable growth medium containing food-grade components that must be effective and efficient in supporting and promoting muscle cell growth.

Some argue lab grown meat is better for the environment. However, some scientists warn lab grown meat could cause more environmental damage than the real thing. An Oxford study showed some types of beef production can actually be better for the climate long-term compared to lab grown meat.

To keep greenhouse gas emissions from livestock in perspective, according to the EPA, all of agriculture is responsible for 9 percent of GHG emissions in the United States, and collectively animal agriculture is responsible for slightly less than 4 percent. Entirely eliminating all animals from U.S. agricultural production systems would decrease GHG emission by only 2.6 percent. By contrast, energy production for electricity and transportation are each responsible for 28 percent of U.S. greenhouse gases.

Beyond the perception that lab grown meat must be "better for the environment," animal rights supporters claim this technology eliminates the need for an animal to die in order to produce a meal. Unlike traditional beef production, culturing animal cells in a petri-dish causes no harm or pain to a sentient animal, they insist. But what they are not explaining is that the medium needed to produce lab grown meat requires the use of fetal blood plasma.

Fetal blood is produced by slaughtering a pregnant cow, removing its unborn calf from its uterus, and harvesting the blood from it. While a synthetic alternative to fetal blood does exist, it is prohibitively expensive to produce.

For all the hype about the environmental benefits of lab grown meat, the reality is that this is not a sustainable or entirely humane food production option.

Questionnaire

The instrument was constructed in Qualtrics. The data reported in this manuscript are a portion of the larger dataset; the constructs explored in this manuscript are described below.

Message Evaluation

After viewing the randomly assigned stimulus, participants provided their evaluation of the message by answering eight questions using a seven-point Likert-type scale (1 = *Strongly disagree*, 7 = *Strongly agree*). These measures were adopted from Steede's (2018) study of trust of messages about animal antibiotics. A sample statement from the measure was, "This blog post

is reliable." Steede et al. reported Cronbach's $\alpha = .839$. In the current study, post hoc reliability was calculated with Cronbach's $\alpha = .885$.

Intention to Share Content

Intention to seek information about lab-grown meat and share the viewed blog post on social media were asked in a three-question item adopted from Steede (2018). Responses were reported on a seven-point Likert-type scale from (1 = *Strongly disagree*, 7 = *Strongly agree*). Respondents were asked to respond to statements such as, "This blog post is something I would share on social media." A post hoc reliability analysis was calculated with Cronbach's $\alpha = .853$.

Risk Perception

Risk perception was measured with three questions using a five-point Likert-type scale (1 = *Very unlikely*, 5 = *Very likely*). An example question in the measure was, "How likely is it that lab-grown meat presents a serious health hazard?" These questions were adopted from both Binder et al. (2011) and Kim et. al (2014). Binder et al. reported a Cronbach's $\alpha = .86$ and Kim et al. reported a Cronbach's $\alpha = .91$. Post hoc reliability was calculated on the three measures with a result of Cronbach's $\alpha = .925$.

Benefit perception

Benefit perception was measured using three questions with a seven-point Likert-type scale (1 = *Strongly disagree*, 7 = *Strongly agree*). Participants were prompted to rate the following statements: "I believe lab-grown meat is good for the environment," "I believe lab-grown meat is good for animals," and, "I believe lab-grown meat is good for future generations of people." These statements were adapted from Kim et al. (2014) who reported a Cronbach's $\alpha = .91$. Reliability calculated post hoc resulted Cronbach's $\alpha = .878$.

Uncertainty

To measure uncertainty, three questions were adopted from Li and Brossard (2012). Participants were asked their level of agreement with response options presented on a seven-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*). Post hoc reliability was calculated at Cronbach's $\alpha = .733$.

Intention to Consume

A three-item question set was asked to measure a consumer's intention to consume lab-grown meat. The questions were adopted from Wilks and Phillips' (2017) survey of attitudes toward lab-grown meat. Respondents were asked questions such as, "How likely are you to try lab-grown meat at least once?" The response options were presented on a five-point Likert-type scale (1 = *Not at all likely*, 5 = *Extremely likely*) with a reliability calculated post hoc with Cronbach's $\alpha = .853$.

Demographics

Respondents were asked to report gender, age, education level, income, political view, and political party.

Data Collection

Participants in the study were recruited using Marketing Systems Group (MSG). MSG is an information systems company used to distribute online instruments, compensate participants, and collect data. Because the current study was an experimental design with a nationally distributed sample, 30 responses per message stimuli was the minimum number of responses needed according to Roscoe (1975). In order to increase statistical power and account for potential errors, 300 complete responses were requested. For completing the instrument, MSG compensated participants with points, which are redeemable for Amazon gift cards.

Two attention checks were embedded within the instrument. If both attention check questions were answered incorrectly, the response was removed from the data set. Sixty-one responses were removed leaving a total of 239 viable responses. One additional response was removed due to not meeting the minimum age requirement of 18 years of age, resulting in the 238 usable responses.

Data Analysis

Data analysis was carried out using IBM® SPSS® Statistics version 25. Data from MSG was received as an Excel file and non-qualifying responses were extracted before importing into SPSS. Descriptive statistics were used for nominal and scale data. Measures of central tendency, including means and modes, were calculated as well as measures of variability, (i.e., frequencies, standard deviations, and ranges). ANOVAs were used to compare the stimuli's influence on message evaluation, intentions to share content, risk and benefit perceptions, measures of uncertainty, and intentions to consume lab-grown meat.

Description of Participants

Of the 238 participations, nearly three-quarters were female (n = 182, 76.2%). The age of respondents varied from 18-80 years old with the mean age of respondents being 45.7 years old. Participants in the study were recruited using Marketing Systems Group (MSG). Most respondents had an undergraduate degree (n = 83, 42.7%) while 33.5% (n = 80) had completed high school as their highest level of education. The majority of respondents were meat-eating individuals (n = 184, 77.3%), 4.2% of respondents were vegetarian (n = 10), 4.2% reported being pescatarian (n = 10), and only two respondents (0.8%) reported being vegan.

The income level of respondents was primarily $20,000–$39,999 (n = 55, 23.1%) and less than $20,000 ($n$ = 53, 22.3%). Nearly a third of participants responded they were moderate in their political views (n = 78, 32.8%). While 21 participants (8.8%) chose not to answer, 39.1% (n = 93) of participants identified their political party as Democrat. The remaining responses were split with 66 respondents (27.7%) being Republican and 58 respondents (24.4%) identifying as an Independent.

Each participant was randomly assigned a themed blog post. Due to 61 responses being removed because they did not meet the quality check questions, slightly more participants (n = 88, 36.8%) saw the positive stimuli. The remaining participants saw either the negatively themed blog (n = 74, 31.0%) or the neutral themed blog (n = 77, 32.2%).

Findings

RQ 1: What influence does the message theme of a blog post have on message evaluation and intention to share content about lab-grown meat?

Message Evaluation

A one-way ANOVA was conducted for message evaluation and intention to share, shown in Table 1. No significant difference was found between the message themes – opposition, neutral, and support – and message evaluation (F = .59, p = .55). The group means showed those who viewed the neutral theme reported slightly more agreement regarding message evaluation (M = 4.67, SD = 1.09), but this was not statistically significant when compared to the evaluation of the other message themes.

Table 1

*One-Way ANOVA for Message Theme Effects on Evaluation and Intention to Share (*N = *238)*

	Support		Neutral		Opposition			
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2, 235)	*p*
Message Evaluation	4.50	1.59	4.67	1.09	2.68	1.19	1.46	.23
Intention to Share	2.64	1.27	2.56	1.41	2.03	1.21	5.02	.01*

*p < .05

Intention to Share Content

Another one-way ANOVA, shown in Table 1, reported significant differences between message theme and intention to share content (F = 5.02, p = .01). The group means showed those who viewed the opposition theme had less intention to share content (M = 2.03, SD = 1.21).

Between Groups. A post hoc analysis using Bonferroni comparison was calculated to understand where the significance occurred between the message themes on intention to share content. A significant difference was found between support and opposition (p = .01) and opposition and neutral themes (p = .04). There was no significant difference found between support and neutral themes (p = 1.00).

RQ 2: What influence does the message theme of a blog post have on risk and benefit perceptions of lab-grown meat?

Risk Perception

Two one-way ANOVA calculations were completed, the first comparing the message theme and risk perception. Table 2 displays a significant difference in risk perception was found between the three message themes ($F = 3.44$, $p = .03$). The group means showed those who viewed the opposition theme were more likely to perceive risk ($M = 3.58$, $SD = 1.07$) than those who viewed the neutral ($M = 3.19$, $SD = 1.20$) or support theme ($M = 3.13$, $SD = 1.12$).

Table 2

*One-Way ANOVA for Message Theme Effects on Risk and Benefit Perception (*N *= 238)*

	Support		Neutral		Opposition			
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2, 235)	*p*
Risk Perception	3.13	1.12	3.19	1.20	3.58	1.07	3.44	.03*
Benefit Perception	4.14	1.57	4.06	1.56	3.28	1.60	7.08	< .001*

*$p < .05$

Between Groups. In order to identify where the significance existed between the message themes on risk perception, a Bonferroni comparison was calculated. The comparison found a statistically significant difference existed between the support and opposition themes ($p = .045$).

Benefit Perception

Table 2 shows the one-way ANOVA calculated to compare the message theme on benefit perception showed a significant difference between the two variables ($F = 7.08$, $p < .001$). The group means revealed participants who viewed the opposition theme somewhat disagreed with the statements of benefits perception ($M = 3.28$, $SD = 1.60$). However, those who viewed the support theme on average neither agreed nor disagreed with statements about benefit perception ($M = 4.14$, $SD = 1.57$)

Between Groups. In order to shed light on where the significant difference existed between the message themes on benefit perception, a post hoc Bonferroni comparison was run. The comparison showed a significant difference between opposition and support themes ($p = .002$) and between opposition and neutral themes ($p = .007$).

RQ 3: What influence does the message theme of a blog post have on perceptions of uncertainty regarding lab-grown meat?

A one-way ANOVA was calculated to assess the interaction between the message theme and perceptions of uncertainty toward lab-grown meat. As shown in Table 3, no significant

difference between message themes and measures of uncertainty were observed (F = 1.46, p = .23). The group means showed those who viewed the opposition theme (M = 2.68, SD = 1.19) more strongly disagreed with statements of certainty than those who viewed the other message themes.

Table 3

*One-Way ANOVA for Message Effects on Uncertainty (*N *= 238)*

	Support		Neutral		Opposition			
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2, 235)	*p*
Uncertainty	2.97	.95	2.81	1.09	2.68	1.19	1.46	.23

*$p < .05$

RQ 4: What influence does the message theme of a blog post have on intention to consume?

The interaction between message theme and intention to consume lab-grown meat was measured with a one-way ANOVA. Table 4 shows there was a significant difference between message themes and intention to consume (F = 5.02, p = .007). A calculation of the group means indicated those who viewed the opposition theme (M = 2.03, SD = 1.21) more strongly disagreed with intention to consume than the other two message themes.

Table 4

*One-Way ANOVA for Message Effects on Intention to Consume (*N *= 238)*

	Support		Neutral		Opposition			
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*(2, 235)	*p*
Intention to Consume	2.64	1.27	2.55	1.41	2.03	1.21	5.02	.007*

*$p < .05$

Between Groups. A Bonferroni post hoc analysis showed significant differences existed between opposition and neutral themes (p = .04) and between opposition and support themes (p = .01).

Conclusions/Discussions/Implications

This study sought to examine the influence of themed messages on public perceptions of lab-grown meat. The blog posts were designed to each feature a distinctive theme: opposition, neutral, and support. No statistical difference was found between message evaluation and the message themes viewed. This indicates, regardless of the stimuli assigned to a participant, each blog post was evaluated similarly. This shows the blog posts were written in a way that was equally credible despite the difference in message frame. Aligned with Kang's (2009) suggestion that the "credibility of a medium" (p. 22) has a strong association with future behavioral changes

and outcomes, no statistical significance in credibility regardless of message frame sets a strong foundation for this study and its implications.

Regarding intention to share content about lab-grown meat, we found a significant difference between the three themed message conditions. Those who viewed opposition theme were less likely to share lab-grown meat content. This aligns with findings from Majmundar et al. (2018) who found one of the four main reasons people retweet or share content on social media is to show approval or agree with the content.

Risk perception was found to be influenced by the message theme used in the blog post. A Bonferroni post hoc comparison found a significant difference between opposition and support themes. The mean scores indicated those who viewed the opposition theme were more likely to perceive risk than those in the other two themes. This result is intuitive; seeing a negatively themed message causes people to be more wary of an issue. This also aligns with Cobb's (2005) framing study where he found negative framed messages increased risk perception and decreased benefit perceptions.

In regard to message theme and benefit perception, there was a significant difference found in perceptions related to the blog post theme. The mean scores revealed those who viewed the opposition theme indicated a higher level of disagreement with benefit perception. The Bonferroni post hoc comparison found significant differences between opposition and support themes as well as opposition and neutral. Similar to the results of risk perception, this also aligns with Cobb's (2005) findings that a negative frame would decrease benefit perceptions.

Unlike risk and benefit perceptions, the theme of the blog post did not have a significant effect on participants' uncertainty toward lab-grown meat. However, on average, participants were more likely to disagree with statements of certainty after viewing the opposition theme. While risk and uncertainty are often tied closely together in literature (Han et al., 2008), the uncertainty associated with lab-grown meat is much more ambiguous than risk. Risk can be calculated with a formula, but uncertainty is an element of incompleteness within a scientific claim (Zehr, 2000). Han et al. found uncertainty affects different people in different ways which could explain the statistical inconsistency between the message theme and perceptions of risk and uncertainty.

Similar to risk and benefit perceptions, the blog post theme had a significant effect on a person's intentions to consume lab-grown meat. Those who viewed the opposition theme more strongly disagreed on intention to consume lab-grown meat than those who viewed the other blog themes. Again, this demonstrates the influence negatively themed information can have in heightening risk perceptions, which would decrease interest in consuming lab-grown meat.

Recommendations

The results of this study add to previous literature regarding how the public may perceive and eventually accept lab-grown meat as an alternative protein source after viewing neutral, support, or opposition themed blog posts. Other message themes may arise as the public forms opinions and more information about lab-grown meat is exposed to the public. These message themes should be explored regarding measures of uncertainty, intention to share content, intention to consume lab-grown meat, message evaluation, and risk and benefit perceptions.

As this was an exploratory study with researcher-developed message stimuli, we hesitated to describe the messages as "framed." As more research is completed regarding the message elements used in discourse about lab-grown meat, we recommend applying framing

theory in subsequent studies. Future research should utilize this theoretical framework in the development, refinement, and testing of message stimuli. Framing theory in conjunction with scientific certainty and risk and benefit perceptions could be utilized in future research with different audiences, agricultural topics, and industries.

To decrease uncertainty, the general public needs to clearly understand the terms referring to lab-grown meat (Fischhoff & Davis, 2014). By examining future research about the public's understanding of the terms used to describe lab-grown meat, one term should be decided upon and used consistently throughout marketing, literature, and news to refer to this technology.

In addition to the unknown consumer acceptance of lab-grown meat, it is also not clear what impact this new technology could have on beef production and ranchers worldwide. The livestock industry – breed organizations, feedlots, ranchers, and seedstock operations – should be aware of the public's perceived risks and benefits associated with lab-grown meat. Although there are still barriers to overcome before this technology is a direct competitor for traditional livestock production, it is essential that livestock producers and breed organizations be aware of what may come. With this knowledge and insight, they can be better prepared to answer consumer questions and inform the development of policies regarding how lab-grown meat is labeled, regulated, and marketed.

Because this product is not yet available to consumers, the livestock industry should begin to develop communication strategies that clearly outline what lab-grown meat is. Those who viewed the opposition theme were more likely to perceive this new food technology as risky and indicated lower benefit perceptions and a greater level of uncertainty. This implies providing consumers with these aspects may lead them to be less willing to accept this alternative to traditional protein sources.

A better understanding of public perception can give the livestock industry a head-start in responding to this technology and be more effective when marketing their own product alongside this alternative protein source. South Carolina and Missouri have already put laws into place regarding the labeling of lab-grown meat. Knowledge of public perception may influence other states to create their own legislation regarding labeling and marketing aspects of lab-grown meat.

For those developing lab-grown meat, understanding public perception can be beneficial to startup companies as they attempt to market their product to the public. Marketers should be aware of risks in order to address them and understand what influences benefit perceptions in an effort to highlight benefits. As communication practitioners go forward to create messaging to educate or market lab-grown meat, they should be aware of how an emphasis on different aspects of a message may influence consumer opinions and purchasing habits.

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