Predicting Consumer Willingness to Eat Cultivated Meat: A Protection Motivation Theory Approach

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Abstract

Cultivated meat is emerging as a sustainable alternative to conventional livestock production, yet consumer acceptance remains uncertain due to concerns about food safety, unnaturalness, and ethical unease. Guided by Protection Motivation Theory (PMT), this study examined psychological and demographic predictors of willingness to eat cultivated meat. A cross-sectional online survey of 770 Indiana residents was conducted in September 2024. Logistic regression models assessed the effects of perceived risk, perceived concerns, perceived benefits, and willingness to learn, alongside demographic controls. Results showed that 39% of respondents expressed willingness to consume cultivated meat. Willingness to learn emerged as the strongest predictor (OR = 14.91, $p < .001$), indicating that individuals open to learning were substantially more likely to try cultivated meat. Perceived benefits were positively associated with acceptance (OR = 2.40, $p < .001$), while perceived risk significantly reduced willingness (OR = 0.53, $p < .001$). Perceived concerns were not significant in the models. Among demographics, only gender mattered, with females less likely to accept cultivated meat. Findings highlight the importance of communication strategies that emphasize benefits, reduce risk perceptions, and foster curiosity, offering practical implications for advancing sustainable food innovations.

Introduction / Relevant Literature

Cultivated meat, also referred to as cell-based, lab-grown, cultured meat, or in-vitro meat, is an innovative breakthrough to mitigate the environmental, ethical, and health concerns associated with conventional livestock production in the global food system. By growing animal cells in controlled conditions without slaughter, cultivated meat promises to reduce greenhouse gas emissions, land and water use, and animal welfare challenges (Pakseresht et al., 2022). With global meat demand projected to increase by over 70% by 2050 (FAO, 2020), this technology is positioned as a sustainable solution to future protein needs.

Despite its technological feasibility, consumer perceptions of food safety, unnaturalness, and sensory appeal often present significant barriers to acceptance. Prior research indicates that unfamiliar food technologies may trigger cognitive dissonance, leading to negative risk perceptions and resistance (Verbeke et al., 2015; Siegrist & Hartmann, 2020). Therefore, understanding the factors that shape consumer acceptance is critical not only for commercial success but also to inform technological development, guide public engagement efforts, and support the broader transition to sustainable food systems. To explore these dynamics, the present study employed a behavioral science lens informed by Protection Motivation Theory (PMT) to examine factors that predict consumer willingness to eat cultivated meat.

Conceptual Framework

Protection Motivation Theory (PMT), developed by Rogers (1983), provides a comprehensive framework for understanding how individuals assess innovations that pose both potential risks and opportunities. The theory comprises two key components: threat appraisal and coping appraisal. Threat appraisal includes perceived severity and vulnerability (e.g., concerns related to food safety or industrial control), while coping appraisal encompasses self-efficacy, response efficacy, and cost efficacy. PMT has been widely applied in consumer behavior research, such as insect consumption (Vastola et al., 2024), food waste reduction (Jang & Lee, 2022), and pandemic-related food safety behaviors (Soon et al., 2022).

In this study, we adapted the PMT framework to the specific behavioral context of cultivated meat consumption. The standard PMT construct of cost efficacy (e.g., time, money, or social discomfort associated with protective behavior) was excluded due to its conceptual underdevelopment in the context of cultivated meat. Similarly, self-efficacy, typically defined as an individual's confidence in performing a recommended behavior, was redefined to better reflect the early-stage nature of consumer interaction with cultivated meat. Here, it was operationalized as willingness to learn about cultivated meat, capturing the idea that informational openness is a necessary precursor to behavioral engagement with unfamiliar food technologies.

Therefore, our model focuses on four psychological concepts that are particularly crucial for understanding consumer behavior around this food innovation:

- Threat Appraisal
    - *Perceived Risk*: Concerns about the potential health risks of cultivated meat, including perceived unnaturalness, long-term safety, and unintended consequences.
    - *Perceived Concerns*: Affective and moral discomforts, such as disapproval of lab-grown foods or mistrust of technological products in the food system.
- Coping Appraisal
    - *Perceived Benefits*: Beliefs that cultivated meat contributes positively to environmental sustainability, human health, nutrition, food security, or animal

welfare. These beliefs may increase openness to trying the product.
- *Willingness to Learn*: An individual's openness to explore new information and perspectives about cultivated meat. This construct serves as a substitute for traditional self-efficacy, reflecting a learning mindset critical to early adoption of novel food technologies.

By streamlining the PMT framework in this manner, our model focuses on the psychological factors that are most relevant to understanding consumer willingness to try cultivated meat.

Research Questions

This study investigates the following:

RQ1. To what extent do psychological factors - perceived risk, perceived concerns, perceived benefits, and willingness to learn - predict Indiana residents' willingness to eat cultivated meat?

RQ2. How do demographic characteristics of Indiana residents' such as gender, age, education, income, political affiliation, and community type, influence willingness to eat cultivated meat after accounting for PMT-based predictors?

Methods / Procedures

A third-party panel provider was used to recruit respondents. The questionnaire was created utilizing best practices for survey design, which include balanced scales, attention checks, and randomized item ordering as suggested by Dillman et al. (2014) in the Tailored Design Method. A cross-sectional online survey of 770 residents in Indiana was used to gather data in September 2024 upon IRB approval (*IRB-2023-585*).

Willingness to consume cultured meat was the main outcome variable, and it was binary (1 = yes, 0 = no). The focal independent variables included multi-item Likert scales measuring perceived risk (2 items), perceived concerns (10 items), and perceived benefits (6 items), along with a binary indicator representing willingness to learn.

Cronbach's alpha was used to assess the internal consistency of the multi-item constructs, and all of them were greater than 0.70, suggesting strong reliability of the instrument. Gender, age, education, household income, political affiliation, and community type were among the demographic factors.

Stata was used for analyzing data via binary logistic regression. Two models were estimated: a full model that included both psychological and demographic variables, and a focal model that only included modified PMT-based psychological predictions. Marginal effects were calculated, and interaction terms between important factors were investigated to improve interpretability. Likelihood ratio tests and pseudo-R2 values were used to assess the model's performance. Multicollinearity diagnostics were applied using VIFs, and education was re-coded to reduce collinearity across categories

Findings / Results

Descriptive statistics revealed that approximately 39.09% of respondents reported a willingness to eat cultivated meat, indicating a modest level of acceptance within the Indiana sample. Among the psychological predictors, the mean score for Perceived Benefits was 2.92 (SD = 0.81, range: 1–5), reflecting moderate agreement with the societal value of cultivated meat. Perceived Concerns had a higher mean of 3.89 (SD = 0.75), indicating generally elevated levels of discomfort or ethical unease. Perceived Risk averaged 3.42 (SD = 1.23), showing moderate to high concern about potential health or safety implications. Willingness to Learn was represented by 52.08% of respondents, suggesting notable openness to informational outreach. The sample was demographically diverse, with a mean age of approximately 48.3 years, capturing a wide cross-section of Indiana adults.

The focal model (*in Table 1*) demonstrated a good explanatory power in predicting consumer willingness to eat cultivated meats (Pseudo $R^2 = .41$; Log Likelihood $\chi^2(4) = 424.74$, $p < 0.001$). Among all the independent variables, Willingness to learn emerged as the strongest predictor (OR = 14.03, $p < .001$), with respondents who are willing to learn more about cultivated meat being 14 times more likely to express willingness to eat it, highlighting the importance of communicational strategies. Perceived benefits were also positively associated (OR = 2.59, $p < .001$), indicating that each unit increase in perceived benefits was associated with a 159% increase in odds of accepting cultivated meat, highlighting the importance of communicating advantages such as environmental sustainability, adaptability for human health needs, or animal welfare. In contrast, perceived risk significantly reduced the willingness (OR = 0.54, $p < .001$), supporting the threat appraisal aspect of PMT. Perceived concerns, while conceptually related, were not significant in the model.

The full model (Pseudo $R^2 = .44$), which included demographic controls, retained the significance and direction of psychological predictors. Among demographic variables, gender was the only statistically significant factor, unveiling that females were 57% less likely than males to try cultivated meats (OR = 0.43, $p < .001$). Other variables, including age, education, income, and community type, were not statistically significant.

Table 1: Logistic Regression Odds Ratio outputs representing the factors that predict Willingness to Eat

**p<0.05, **p<0.01, ***p<0.001; Note: Model 1 is the Focal Model and Model 2 is the Full Model*

	Model 1	**Model 2**
Willingness to Eat		
Perceived Risk	0.541***	0.526***
Perceived Concerns	0.815	0.860
Perceived Benefits	2.593***	2.395***
Willingness to Learn	14.030***	14.911***
Age		0.990
Female (ref: Male)		0.428***
Education (ref: Low)		
Medium (or 2-year College degree)		1.277
High (or Undergraduate & above level)		1.243
Income (ref: <$25k)		
$25k – $50k		1.025
$50k – $75k		0.825
>$75k		1.167
Community type (ref: Primarily Urban)		
Primarily Sub-urban		1.179
Primarily Rural (not on a farm)		1.702
Primarily Rural (on a farm)		0.231
Constant	0.112*	-0.196
Observations	770	770
Pseudo R2	0.4122	0.4425

Moreover, on average, after keeping all the variables at their observed values in the full model, there is a 0.39 probability of favoring the consumption of cultivated meats over avoiding it ($p < 0.05$)

The interaction plot in *Figure 1* revealed that the perceived risk of eating cultivated meats had a more pronounced negative effect among females than males. Predicted probabilities showed that as risk perception increased, female respondents' likelihood of willingness declined more sharply than that of male respondents. The interaction between perceived benefits and willingness to learn (*in Figure 2*) showed that high benefit perceptions translated into much higher acceptance rates among individuals open to learning, suggesting a synergistic relationship between knowledge-seeking behavior and acceptance of cultivated meats.

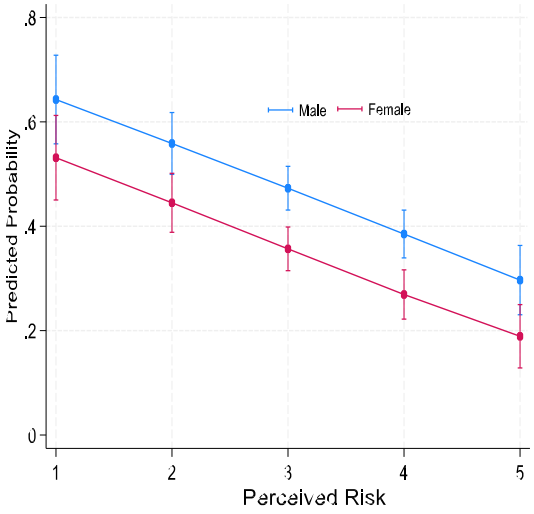

Figure 1

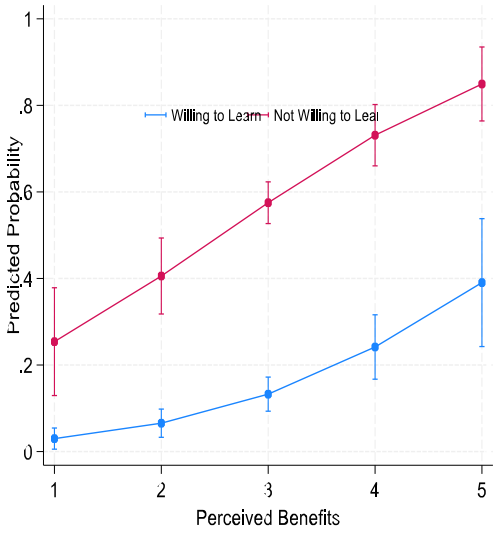

Figure 2

Conclusions, Recommendations & Implications

This study highlights that psychological factors are crucial determinants of consumer willingness to try cultivated meats. Strategic communication efforts should emphasize the environmental, health, and animal welfare benefits of cultivated meats, while also addressing common misconceptions. Education campaigns may be particularly effective when designed to foster curiosity and reduce ambiguity around the technology.

Willingness to learn functions as both a standalone predictor and an amplifier of benefit perceptions, underscoring its value as a key target for intervention. Given the observed gender differences, risk communication strategies should be tailored to address safety concerns more prominently among women than men. These insights can help policymakers, agricultural communicators, and alternative protein advocates segment audiences and design more effective, targeted outreach strategies.

The study also advances theoretical understanding by reinforcing the role of PMT constructs in understanding consumer acceptance of food innovations. Future studies should incorporate additional PMT variables, such as response cost and self-efficacy, for deeper insights.

Limitations of this study include its cross-sectional design, lack of longitudinal or experimental measurements, and limited generalizability due to the geographically restricted state sample. However, the findings have practical implications for improving communication strategies regarding cultivated meat and other emerging agricultural technologies.

Furthermore, as psychological readiness is more critical in shaping consumer openness to cultivated meats than their demographic characteristics, framing the benefits effectively and fostering the interest among stakeholders can help bridge the gap between innovation and public acceptance in the evolving food system.

References:

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). Internet, phone, mail, and mixed-mode surveys: The tailored design method. *Indianapolis, Indiana*.

FAO (2020). OECD-FAO Agricultural Outlook, 2020–2029. *Outlook, 2020*.

Jang, H. W., & Lee, S. B. (2022). Protection motivation and food waste reduction strategies. *Sustainability*, *14*(3), 1861. https://doi.org/10.3390/su14031861

Pakseresht, A., Kaliji, S. A., & Canavari, M. (2022). Review of factors affecting consumer acceptance of cultured meat. *Appetite*, *170*, 105829. https://doi.org/10.1016/j.appet.2021.105829

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. *Social psychology: A source book*, 153-176.

Siegrist, M., & Hartmann, C. (2020). Consumer acceptance of novel food technologies. *Nature Food*, *1*(6), 343-350.

Soon, J. M., Vanany, I., Wahab, I. R. A., Sani, N. A., Hamdan, R. H., & Jamaludin, M. H. (2022). Protection Motivation Theory and consumers' food safety behaviour in response to COVID-19. *Food Control*, *138*, 109029. https://doi.org/10.1016/j.foodcont.2022.109029

Vastola, A., Romano, S., Cozzi, M., & Viccaro, M. (2024). Are Consumers Ready to Consider Insect-Based Foods as a Sustainable Food Choice? An Application of the Extended Protection Motivation Theory to Italian Consumers. *Agriculture*, *14*(12), 2232. https://doi.org/10.3390/agriculture14122232

Verbeke, W., Sans, P., & Van Loo, E. J. (2015). Challenges and prospects for consumer acceptance of cultured meat. *Journal of Integrative Agriculture*, *14*(2), 285-294. https://doi.org/10.1016/S2095-3119(14)60884-4